JUNIA
HEI·ISEN·ISA

Graduate school
of science
and engineering

2022.23

Course guide

English-Taught Courses

JUNIA.COM

Junia (formerly Yncréa Hauts-de-France) is a French grande école graduate school of engineering delivering Masters of Science and Engineering degrees and offering a wide range of specializations. All of Junia's programmes are nationally and internationally accredited and fully recognised by the French government and the CTI, the French commission of engineering degrees.

VISIT JUNIA.COM TO LEARN MORE

Our graduate programs are taught in French, English or a combination of both languages. Students must have a minimum B2-level in the language of instruction. All programs are open to exchange students from our partner universities. Exchange students pursuing a Bachelor's degree in their home university may be eligible to take Master level courses according to their prerequisite courses. Access to a course is at the discretion of the academic coordinator and professor.

Junia has united the efforts of three engineering schools HEI, ISA and ISEN, working closely together to educate tomorrow's leaders in engineering innovation. Each programme maintains its own specialisations and unique offer. This guide gives all the details of English-taught courses available in each of our programmes: ISA, ISEN and HEI. Please visit each programme's dedicated webpage to learn more.

For more information on our academic offer, please contact international.cooperation@junia.com

contents

MASTER

MASTER

MASTER

MASTER

MASTER

MASTER

MASTER

General Information

Master of Science and Engineering Program

Junia HEI trains well-rounded executive engineers with strong foundational skills in general engineering as well as expertise in one of 13 different specialisations, such as:

- Building and Civil Engineering,
- Mechanical,
- Computer Science and Information Technology,
- Biomedical Engineering,
- Industrial Operations Management and Logistics,
- Chemical Innovation and Ecological
- Transition Technologies,
- Innovation, and International Textile Management
- Mechatronics and Robotics,
- Energy, Electrical, and Control Systems.

JUNIA HEI curently offers 1 Master programme 100% taught in English:
Smart Cities

The courses below are common to all Junia HEI Master programmes.

LEARN MORE AT HEI.FR

Return to Table of Contents

JUNIA HEI

smart cities

Master of Science and Engineering Program

Cities are in constant transformation. New technological, social, and economic challenges present themselves constantly. Numerous trends are formed in the conception of modern cities, from optimist technological vision to ecological resilience.

Junia HEI's Master of Science and Engineering Smart Cities programme, 100% taught in English, offers students the aptitude and skills necessary to succeed as engineering leaders in this context.

LEARN MORE AT HEI.FR

MASTER 1 - FALL SEMESTER	ECTS
Principles and Future Trends in Urbanism	2,5
Transport and Mobility Issues	2,5
Architecture, Construction & Sustainable Design	2,5
Fundamentals of Energy and Renewable Energies	2,5
Means of Expression	2
Innovation and Collaborative Project	3
Workshop 1	3

MASTER 1 - SPRING SEMESTER	ECTS
Urban Project Management	1,5
Environmental Law	1,5
Ubiquity and Internet of Things	2
Dynamic Thermal Simulation and HVAC	2,5
Building Management Systems and Home Automation	2,5
BIM	2,5
Introduction Lecture to Major Urban Challenges	1
Future Cities: Smart, Inclusive, Sustainable	2
Workshop 2	3

MASTER 2 - FALL SEMESTER	ECTS
Emergent Economy in the City	1,5
Green Building Certification and Environmental Footprint	3
Learning Expedition	2,5
Smart Grid and Energy Management at Building Scale	2,5
Sociopolitical Approach of the City	1,5
Sustainable Refurbishment	1
Urban Environment Principles	2
Water Management, Landscaping and Green Spaces	2
Workshop 3	4

Return to Table of Contents

principles and future trends in urbanism

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 1	Semester 1	25h	2,5	Vedrana Ikalovic, Ana Ruiz-Bowen	English	■ 60% Continous Assessment ■ 25% Project ■ 15% Exam

This course is part of a module and must be taken in conjuction with Transport and Mobility Issues.

COURSE OBJECTIVES	■ Introduce main principles of part and contemporary urbanism ■ Be able to identify efficient eco-neighborhood
LEARNING OUTCOMES	■ Explain the links between sustainable development and its application to a district ■ Quote some eco-neighborhoods of reference (Freiburg-in-Brisgau, Eva Lanxmeer, Bedzed) ■ Understand the Life Cycle Analysis principles, as far as a city is concerned
CONTENT	The course begins asking two questions: “What is your favorite neighborhood?” and “What is your hated neighborhood?” Then, essential concepts are provided (e.g. sustainable development applied in a city or a district) and students prepare case studies presentations, with facts and figures and a SWOT Analysis. The course ends with a final project. For a chosen eco-neighborhood, you will play the role of a city advisor and you have to: ■ Propose 12 indicators (4 on economic aspects, 4 on social/cultural aspects, 4 on environmental aspects). Propose definition, calculation method and unit. They have to be suitable to the econeighborhood context. The aim is to assess, over time, the performance of the neighborhood, as far as Sustainable development is concerned. ■ Propose a survey helping the city to improve the life quality, the resilience, and the relationships with the other parts of the town. This survey should be designed for inhabitants and could be filled by the users in 30 minutes.

transport and mobility issues

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 1	Semester 1	30h	2,5	Philippe Tostain, Aurélie Montigny	English	■ 40% Continous Assessment ■ 60% Project

This course is part of a module and must be taken in conjuction with Principles and Future Trends in Urbanism.

COURSE OBJECTIVES	■ Propose a general reflection about transport economy, policies and engineering ■ Present principal concepts and analysis tools ■ Propose approaches to illustrate the subject: - Passengers rather than freight - Urban and not rural - Historical - France and Europe, opening to the world ■ Present different legislative and administrative frames of sustainable urban mobility planning (SUMP) in the EU and EU SUMP guidelines ■ Present SUMPs support tool “JASPERS“, operated by EIB ■ Assess France’s PDUs ■ Present main streams of digital development in urban mobility ■ Zoom on information systems and applications to enhance passenger mobility and inter-modality ■ Present potentials of an interchange hub for urban development ■ Imagine such an interchange hub in Lille
LEARNING OUTCOMES	■ Present the historical trend of transport and some of its impacts, particularly on urban structure ■ Quote basic figures of personal urban mobility ■ Quote planning French urban mobility tools and stakeholders ■ Analyze data and stakeholders of mobility issues and set up recommendations for proper functioning on a small scale area ■ Identify outlines of several European SUMPs ■ Quote indicators monitored by support tool “JASPERS“ ■ Quote French PDUs’ strengths and weaknesses ■ Quote and organize several passenger mobility apps ■ Identify team organization main features ■ Analyze urban context, data and stakeholders of mobility, set up recommendations for proper operation and new development of an interchange hub, design corresponding layout
CONTENT	■ Issues 1: Transport in the economy: evolution and demand ■ Issues 2: positive and negative impacts of transport ■ Demand and supply: measurement, forecast, engineering, modelling and planning ■ Transport policies: stakeholders, planning, financing ■ Transport infrastructure ■ From transport to mobility ■ Study of accessibility of a company headquarters (e.g.: Castorama, located in the business park of Templemars, south-east of Lille, 9 km from Junia HEI campus) ■ Lecture on sustainable urban mobility plans (SUMP): EU guidelines, national reality ■ Lecture on digital technology and mobility, data and apps, incumbent operators and new players ■ Interchange hub workshop: case study of “Porte des Postes”: - Definition of interchange hubs and reference developments - Methodology, presentation of site and sources - Project statement, team organization - Tutorial course - Presentation

architecture, construction and sustainable design

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 1	Semester 1	30h	2,5	Oliver Page, Ana Ruiz Bowen	English	■ 50% Continous Assessment ■ 30% Project ■ 20% Exam

This course is part of a module and must be taken in conjuction with Fundamentals of Energy and Renewable Energies.

COURSE OBJECTIVES	■ Introduction to architecture and construction approaches ■ Understand the project context (multidisciplinary, complexity) ■ Present fundamental environmental issues in sustainable architecture
LEARNING OUTCOMES	■ Present full building analysis, taking into account architectural, technical and environmental issues ■ Make thermal calculations ■ Know the bioclimatic architecture through vernacular responses ■ Understand the different technical and technological issues (thermal, ambiances, energy...) but also architectural and urban issue at facet scale ■ Design of the building envelope (climatic analysis, thermal environmental, carbon balance) ■ Integrate multicriteria analysis into the design study ■ Understand the importance of the morphology of a building: compactness and bioclimatic form
CONTENT	■ Overview of several architectural projects, architectural approaches ■ Environment site analysis ■ Engineering approaches and structure ■ Visit ■ Architecture overview through history ■ Construction stakeholders ■ Building skins and envelope

fundamentals of energy and renewable energies

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 1	Semester 1	30h	2,5	Dhaker Abbes	English	■ 50% Continous Assessment ■ 25% Practical Courses ■ 25% Exam

This course is part of a module and must be taken in conjuction with Architecture, Construction and Sustainable Design.

COURSE OBJECTIVES	■ Be aware about the context of energy transition and renewable energy systems from a social, ecologic and economic point of view. ■ Make the difference between renewable and no renewable sources of energy ■ Acquire the knowledge, necessary for modeling, simulation, control and design of standalone or a grid connected renewable energy systems.
LEARNING OUTCOMES	■ Assess renewable sources potentials. ■ Evaluate the load of a building or a city. ■ Choose the adequate source of energy according to the situation and to the load. ■ Model, simulate, control and correctly connect an assembly of a wind turbine chain or a photovoltaic chain. ■ Design of a standalone or a grid connected renewable energy system. ■ Being able to tackle the issues related to renewable energy systems. ■ Being able to make the difference between solar thermal energy and solar photovoltaic energy. ■ Being able to make a technological survey and to innovate. ■ To read and analyze the technical manual of a photovoltaic panel or a wind turbine. ■ Use of simulation tools: Matlab/Simulink and HOMER energy.
CONTENT	■ Chapter 1 : Fundamentals of Energy (Dhaker) ■ Chapter 2 : Renewable Energy Sources (Stéphane) ■ Chapter 3 : Photovoltaic installation (Dhaker) ■ Chapter 4 : Solar Thermal Energy Systems (Dhaker) ■ Chapter 5 : Wind Energy Systems (Dhaker) ■ TP1 : Modeling and simulation of a grid-connected photovoltaic system under Matlab/Simulink/Simpower ■ TP2 : Dimensioning of a hybrid system Photovoltaic-Wind Turbine, Connected to the Network with the HOMER software ■ Site visit (3h)
BIBLIOGRAPHY	■ Le Manifeste négaWatt “En route pour la transition énergétique !” Coédition Actes Sud/ Association négaWatt - Collection : Babel. ■ L’autonomie énergétique : Une nouvelle politique pour les énergies renouvelables- Hermann Scheer – Actes sud. ■ “déchiffrer l’énergie” - Benjamin Dessus – Edition Belin ■ Robyns, B., François, B., Davigny, A., Sprooten, J., & Henneton, A, Electricity production from renewables energies. Book, Wiley, 2012. ■ Dhaker Abbes, Gérard Champenois, André Martinez, Benoit Robyns, Modeling and simulation of a photovoltaic system: An advanced synthetic study, Research paper, 3d International Conference on Systems and Control (ICSC13), 29 to October 31, 2013, in Algiers, Algeria. ■ ABBES, Dhaker, MARTINEZ, André, et CHAMPENOIS, Gérard. Life cycle cost, embodied energy and loss of power supply probability for the optimal design of hybrid power systems. Mathematics and Computers in Simulation, 2014, vol. 98, p. 46-62. ■ Messenger, Roger, and Amir Abtahi. Photovoltaic systems engineering. CRC press, 2017. ■ ABBES, Dhaker. Contribution au dimensionnement et à l’optimisation des systèmes hybrides éoliens-photovoltaïques avec batteries pour l’habitat résidentiel autonome. 2012. Thèse de doctorat. Ph. D. thesis, Université de Poitiers. ■ Ewald F. Fuchs I Mohammad A.S. Masoum, Power Conversion of Renewable Energy Systems, Book, ISBN 978-1-4419-7978-0 e-ISBN 978-1-4419-7979-7, DOI 10.1007/978-1-4419-7979-7, Springer New York Dordrecht Heidelberg London

means of expression

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 1	Semester 1	20h	2	Ana Ruiz Bowen, Vedrana Ikalovic	English	■ 60% Continous Assessment ■ 40% Project

This course is part of a module and must be taken in conjuction with Innovation and Collaborative Projects.

COURSE OBJECTIVES	To encourage the students to take a broader theoretical and practical approach to the notion of the 'city' through the direct experience and documentation of aspects of Lille.
LEARNING OUTCOMES	■ Have a greater contextual understanding of the way in which cities have been used by architects, artists and writers. ■ Research and document the city through drawing and 3D model making ■ Develop and interrogate the potential of basic materials such as card, paper, balsa wood, markmaking materials ■ Interpret and evaluate information and ideas from primary and secondary resources
CONTENT	The workshops which takes place over three days will draw inspiration from the context of how other creatives have worked with the City as well as developing the students own individual responses the environment of the City. The workshop will include a presentation which provides the context for the project. There will be a series of practical tasks which involve a visual analysis of the city through moving around the city drawing and mark making. This visual resource will become the starting point for three dimensional work. Practical work with drawing, mark-making, 3D model making. Materials needed for the workshop are paper for drawing, pencils, black wax crayon, black ink, white and black paint. Masking tape, dressmaking pins (with a plain head), cardboard, Stanley knife (craft knife) and foam board.

innovation and collaborative project

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 1	Semester 1	30h	3	Ana Ruiz Bowen	English	■ 40% Continous Assessment ■ 30% Practical Courses ■ 30% Project

This course is part of a module and must be taken in conjuction with Means of Expression.

COURSE OBJECTIVES	■ Discover the challenges of managing innovation in organizations ■ Practice creativity, divergence / convergence exercises in the context of Codesign sessions ■ Use collective intelligence in an innovation / design process. ■ Have tools adapted to collaborative project management (Agile Method, Learning Networks) ■ Know how to mobilize the collective intelligence in project management ■ Discover co designs spaces and reflex in innovation ecosystems ■ Introduction to urban scale and innovation topics in the city
LEARNING OUTCOMES	■ Analyze the bases of technical, social and architectural innovation ■ Know the strengths and limitations of «classic» project management processes. ■ Know the organization and management of innovative organizations ■ Put into practice the collaborative project management and practice feedback (capitalization). ■ Get use to design thinking methods
CONTENT	■ Through collaborative practice, students have an overview of the smart cities context. ■ Students will produce models and documents related to the urban environment. ■ Students will practice several activities in order to experiment new ways of innovative management. ■ They will visit new creative companies and perform a benchmark of social, architectural and technical innovation.

workshop 1

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 1	Semester 1	48h	3	Ana Ruiz Bowen	English	■ 40% Continous Assessment ■ 30% Project ■ 30% Exam

COURSE OBJECTIVES	The subject of Workshop 1 is to reflect and design an urban program proposition, taking into account the urban scale, the environment issues and the social aspects.
LEARNING OUTCOMES	■ Design skills: Understand the importance of the site analysis: environmental, social, historic, economic aspects. Engage a research of references. ■ Management skills: organizing a project team, using collaborative project tool ■ Critical skills: understanding the project in the wider context of an engineering education and practice. ■ Discover and deepen a thorough knowledge of ecological urban problems ■ Begin to propose a sustainable urban space
CONTENT	■ This studio is based on a real site. First, students will visit the site and meet the stakeholders. A functional roadmap will be provided (or compose with students). ■ Secondly, a succession of workshops will allow exchange between professors and students. Students will provide technical and architectural documentations. They will engage deep reflection and research in their propositions. ■ Finally, a panel will provide advises and critics on their projects.

urban project management

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 1	Semester 2	15h	1,5	François Laurent Touzain	English	■ 70% Continous Assessment ■ 30% Project

This course is part of a module and must be taken in conjuction with Environmental Law and Ubiquity and the Internet of Things.

COURSE OBJECTIVES	Provide a general overview and a toolkit about urban transformation management
LEARNING OUTCOMES	■ Analyze : a framework to understand any urban situation ■ Model: tools to decide and manage (governance, technical issues, risks, economics, acceptance, informational system) ■ Lead the transformation: systemic approach for efficiency
CONTENT	■ Case study 1: Use of the toolkit (analysis, model, lead), governance and value chain in city operations ■ Case study 2: Planning and technical issues ■ Case study 3: Consultation and communication ■ Case study 4: Informational system for decision and action

environmental law

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 1	Semester 2	15h	1,5	Syrine Ismaili-Bastien	English	■ 70% Continous Assessment ■ 30% Project

This course is part of a module and must be taken in conjuction with Urban Project Management and Ubiquity and the Internet of Things.

COURSE OBJECTIVES	Give students a basic legal culture on environmental obligations protection
LEARNING OUTCOMES	■ Have an understanding of environmental concepts ■ Be aware of the basics of urban planning law ■ Know legal obligations and prohibitions on environmental protection ■ Assess the feasibility of a project from a legal point of view
CONTENT	■ The course contains the definition of the legal language necessary for its comprehension. ■ It sets out the rights and limits to be respected. ■ The legislation studied is mainly French, European and international. Examples of other legislations are also given.

ubiquity and internet of things

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 1	Semester 2	20h	2	Jad Nassar	English	■ 60% Continous Assessment ■ 40% Exam

This course is part of a module and must be taken in conjuction with Urban Project Management and Environmental Law.

	COURSE OBJECTIVES	Have a general knowledge about IoT technologies in a smart cities context
	LEARNING OUTCOMES	■ Understand the concept of connected object and associated technologies ■ Know the communication technologies related to ubiquity network ■ Know how to use and associate these technologies
CONTENT	**Introduction**	■ Introduction
	From smart object to connected object	■ Smart object or sensor ■ The Arduino phenomenon ■ Transition toward ARM architecture : the Rapsberry example ■ Connected object = Smart object + Communication solution
	Ubiquitous network: from PAN to WAN	■ Wire networks (xDSL, Fibre, Ethernet) ■ Wireless networks (3g/4g, femtocell, Wifi, Bluetooth) ■ Machine 2 Machine (Zwave, Zigbee, LORA / SIGFOX) or sensor networks ■ Vehicular application (V2V and V2I) ■ Contactless technologies (RFID et NFC)
	Cloud computing	■ Datacenter ■ Cloud providers : Amazon, Microsoft, Google ■ Virtualization : PAAS, SAAS, IAAS
	Development and value-creation	■ Analysis (Big data) et Visualization ■ Example of big data for cities
	Inhibitors of deployment	■ Standardization, interoperability, data management, safety, organization, acceptability

dynamic thermal simulation and hvac

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 1	Semester 2	30h	2,5	Makram Abdellatif	English	■ 40% Continous Assessment ■ 30% Project ■ 30% Exam

This course is part of a module and must be taken in conjuction with Building Management Systems and Home Automation.

COURSE OBJECTIVES	■ Introduction to architectural science and thermal performance of buildings ■ Basic calculation for HVAC systems design ■ Utilization of dynamic thermal simulation software
LEARNING OUTCOMES	■ Understand the French thermal regulation for new and existing buildings ■ Calculate heating and cooling loads of a simple building ■ Calculate the main parameters of a ventilation and air conditioning system ■ Perform a full dynamic thermal simulation using relevant software
CONTENT	■ First, the course starts with an overview of the requirements included within the French thermal regulation for new and existing buildings. HVAC systems are introduced in relation to building envelope and thermal comfort. Simple methods to calculate heating loads, cooling loads and some HVAC systems parameters will be presented. ■ Second, practical courses related to dynamic thermal simulation software are scheduled. Students will take part of a project that aims to perform a full dynamic thermal simulation for a small building or a part of a complex building.

building management systems and home automation

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 1	Semester 2	25h	2,5	Laurent Peyrodie	English	■ 60% Continous Assessment ■ 40% Project

This course is part of a module and must be taken in conjuction with Dynamic Thermal Simulation and HVAC.

COURSE OBJECTIVES	■ Introduce Building Management Systems (BMS) ■ Understand the design and the implementation of Information and ■ Communication Technologies (ICT) for the domestic, tertiary or medical buildings ■ Know the basics of technical maintenance
LEARNING OUTCOMES	■ Understand the equipment positioning within complex projects ■ Understand an energy management policy at building scale ■ Be able to model and control technical equipment.
CONTENT	■ Energy and environmental issues: public policies, financial tools, regulation context ■ Energy management policies at building scale: energy efficiency approach, measurement and trouble-shooting, continuous improvement ■ Energy costs: contract and pricing system, quality of energy. ■ Energy consumption: lighting, building automation, electronic variation speed, communication, visualization ■ Case study: Each case study underlines the energy and financial benefits actually reached, including payback time estimation. ■ Practical work with Intouch software

bim

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 1	Semester 2	30h	2,5	Simone Aragno	English	■ 50% Continous Assessment ■ 50% Project

This course is part of a module and must be taken in conjuction with Introduction Lecture to Major Urban Challenges and Future Cities: Smart, Inclusive, and Sustainable.

COURSE OBJECTIVES	■ Introduction to parametric environmental design ■ Introduction to the BIM concepts ■ Presentation of the collaborative approaches available for the BIM
LEARNING OUTCOMES	■ Understand the benefits of a collaborative project in BIM ■ Understand principles on parametric design ■ Building 3D model and do simulation with Rhino grasshopper/Revit Dynamo ■ Conduct result analysis and compare different design strategies ■ Apply simulation skill on design optimization project
CONTENT	■ Introduction about simulation tools and parametric environmental design. ■ Exercise and tutorial about simple parametric geometry (Rhino grasshopper or Revit Dynamo). ■ Lecture on simulation tools and data analysis (Ladybug tools &/OR GHCitySim) ■ Simple case study and data analysis (urban design optimization) ■ Assignment tutorial and final remarks ■ Project presentation

introduction lecture to major urban challenges

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 1	Semester 2	10h	1	Ana Ruiz Bowen	English	■ 85% Continous Assessment ■ 15% Practical courses

This course is part of a module and must be taken in conjuction with BIM and Future Cities: Smart, Inclusive, and Sustainable.

COURSE OBJECTIVES	■ Aware students to key urban challenges that cities and urban environment in general will have to face in the coming decades ■ Develop scientific argumentation, scientific point of view and ethical approach in technology
LEARNING OUTCOMES	■ Develop critical eye on the “Smart Cities” concept ■ Be able to discuss the main urban challenges that are coming next ■ Organize a conference or an event on the Smart Cities topic
CONTENT	Student will organize conferences with professionals, academics or citizens for the school audience on different topics such as circular economy, low tech/high tech design, gentrification, cities and climate change, etc.

future cities: smart, inclusive and sustainable

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 1	Semester 2	20h	2	Montserrat Pareja-Eastaway	English	■ 65% Continous Assessment ■ 35% Project

This course is part of a module and must be taken in conjuction with BIM and Introduction Lecture to Major Urban Challenges.

COURSE OBJECTIVES	■ Improve methodological knowledge (qualitative, quantitative, case studies, etc.) ■ Identify current urban discourses and challenges in Europe ■ Approach best practices in dealing with current urban problems ■ Know in depth specific case studies.
LEARNING OUTCOMES	■ Students will be able to review and understand the characteristics of the cultural / creative / smart economy and indicate why it is sensitive to local embedding. Local capacity building and the particularities of the cultural economy represent a productive strategy towards improving urban attractiveness and performance. ■ Students will be able to critically analyze current policies and practices in the smart city ■ Students will be familiar with the three pillars of urban sustainability (environmental, social and economic)
CONTENT	The aim of this topic is to cover the broad range of theories and models related to the competitiveness of cities in a global world. From traditional theories to advanced reflections, these lectures are entitled to provide a framework of analysis of urban developments and strategies to improve cities' competitiveness. Cities are increasingly competing in a globalized world. The decline in manufacturing and economic restructuring means that urban performance progressively depends on certain sectors, which include knowledge and creative industries as their main source of added value. Attracting these sectors has become a key element of urban competitiveness and hence in the local political agenda. Urban regeneration processes linked to the creation of residential and business districts usually involve strategies oriented towards enhancing the economic performance of the city. ■ Global world and urban contexts. The effects of globalization in local thinking. Challenges and projects around the global urban competitiveness. ■ Economic structure and urbanization: from the post-fordist city to the post-modern city. Relationship between systems of economic reproduction with systems of social reproduction and the diversity of the urban form. Questioning the effect of IoT in the local arena. ■ Localization factors and urban context: Hard factors, soft factors, clusters and networks. From traditional location factors to the new requirements of the creative city. How does the local environment react to the new demands? ■ Pathways and the built environment: urban regeneration as a practice to enhance territorial development. From flagship projects to arts factories. ■ Attractiveness and the city: conflicts and successes in the shared use of space.

workshop 2

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 1	Semester 2	48h	3	Ana Ruiz Bowen	English	■ 100% Project

COURSE OBJECTIVES	Workshop 2 follows Workshop 1 and allows to deepen the technical aspects of the proposals. The scale of study can go towards precise aspects of dimensioning of construction elements and techniques. The focus is on the building scale.
LEARNING OUTCOMES	■ Design skills: Using dimensioning skills to confirm the chosen project. Use the technical concepts learned in the thematic courses. Find appropriate techniques to optimize your projects. ■ Critical skills: Be able to present and defend a project. Accept the critics and answer appropriately to a jury. ■ Discover and deepen a thorough knowledge of ecological building problems ■ Begin to propose a sustainable and viable buildingm
CONTENT	Workshop 2 is based on the same area as in Workshop 1. During the first semester, an urban proposal has been presented. The students will continue working on the same scheme but choosing a building of the proposals. They will deepen all the technical aspects of this construction. The development of this semester work can impact the first proposal. In fact, the process will be cyclical and recurrent between the building scale and the urban scale. At the end of the semester, a presentation will be made to a professional academic panel.

emergent economy in the city

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 2	Semester 1	15h	1,5	Montserrat Pareja-Eastaway	English	■ 60% Continous Assessment ■ 40% Project

COURSE OBJECTIVES	■ Understand key economic concepts ■ Approach the relationship between economy and the local development ■ Learn the functionalities of Business Models
LEARNING OUTCOMES	■ Understand economic elements needed in the planning of a city ■ Identify new practices associated with the emergent economy ■ Understand, produce and reinterpret a Business Canvas Model.
CONTENT	These lectures will expand of policy interventions and practices in the territory, paying particular attention to new collaborative models developed among creative and knowledge sectors in the city. From networks to governance issues, “Emergent Economy in the City” will focus on identifying innovative practices in companies, sectors, institutions and citizenship issues that aim to counteract the traditional norms and behaviors of urban actors. Particular attention will be paid to the ‘smart specialization’ approach that combines industrial, educational and innovation policies to suggest that countries or regions identify and select a limited number of priority areas for knowledgebased investments, focusing on their strengths and comparative advantages. In addition, students will visualize how the triple helix (university, companies and institutions) is articulated in particular evidence-based monitoring and evaluation systems and cases. ■ ‘Project ecologies’ and the city: the ability to create ‘atmospheres’ for networking and collaboration: the case of the video games sector ■ The emergence of innovative ecosystems: the case of districts of innovation’ as tools for urban development ■ New cultural centers of production: the case of factories of creativity in Bilbao and Barcelona ■ Smart cities and technology: the case of ‘co-working spaces, living labs, fab labs and innovative incubators’ ■ Urban tourism and attractiveness: the case of gastronomy (from foodies to high cuisine) and fine arts (galleries and festivals) ■ Social innovation and urban developments: the case of citizens participation and involvement in the re-use of urban space

green building certification and environmental footprint

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 1	Semester 2	30h	3	Elodie Chebassier	English	■ 40% Continous Assessment ■ 60% Project

COURSE OBJECTIVES	The global aim is to take green building dimension in account for a smart city design
LEARNING OUTCOMES	■ Know the different green building frameworks ■ Explain the different phases of a certification ■ Make the connection between technical requirements and environmental footprint.
CONTENT	The course is organized with lectures and students workshops and oral presentations. First, the students discover by themselves the different green building certifications: Breeam, HQE, LEED, Minergie, Casbee. They have to present them by group and also present the implementation for a building of their choice. Then a lecture deals with the importance of the reasons why such frameworks are applied, with an overview of the different stakeholders (project owner, building firms, city). After those two steps, a case study is launched: a program and several competing teams : ■ in 2017-2018, teams worked on an international high school planned in the Citadel of Lille) ■ in 2018-2019, they worked on the same program but in a different place (Humanicités) The delivery takes modern forms like videos. This case study obliges the students to read and to understand the precise technical requirements (e.g. energy consumption or green roofs). The last lecture focuses on Life Cycle Assessment approach and deals with the different HQE targets (the cerway framework is used, as it is in English language).
BIBLIOGRAPHY	■ http://www.breeam.com ■ https://www.cerway.com

learning expedition

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 2	Semester 1	27h	2,5	Ana Ruiz Bowen	English	■ 40% Continous Assessment ■ 60% Project

COURSE OBJECTIVES	■ Be aware of the up-to-date development of sustainable cities in European countries in government policy, urban infrastructure, and green buildings. ■ Case study and site survey in awarded and well known projects in some of the leading smart cities in the world. ■ Establish collaboration with overseas universities and industries
LEARNING OUTCOMES	■ Knowledge in good practice and policy support and economic aspects in successful smart cities and communities. ■ Adapting skills of site survey, data collection, and case based project analysis. ■ Application of sustainable planning and design in local and international context.
CONTENT	This module will take place in the form of site visit, case study, and seminar. Through the learning activities, students will expand knowledge in government policy and real world practices in the subject, in particular innovation and cutting-edge technology and design method in planning and designing smart cities in Europe and worldwide. Apart from professional skill building such as environmental assessment and site survey in the selected smart projects, students will also compare different smart approaches applied in France and overseas. Transforming basic planning principle and adaptation in different context will also be discussed. ■ Urban policy, master planning and infrastructure in smart cities ■ Smart grids, optimization and synergic technology in community and neighborhoods ■ Case studies of awarded smart/green buildings and technology ■ Seminar with local government departments and industry partners ■ Academic program with local universities ■ Knowledge transformation and adaptation in French cities.

smartgrid and energy management at building scale

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 2	Semester 1	30h	2,5	Benoit Durillon	English	■ 40% Continous Assessment ■ 60% Project

	COURSE OBJECTIVES	■ Provide to students a comprehensive understanding on fundamentals of power systems operation. ■ Acquire knowledge on smart grids working definitions, associated concepts and its application to electrical systems. ■ Acquire knowledge on the component of smart grids and their functions. ■ Introduce to the students the current state-of-the-art on architectures and operation of smart grids. ■ Get acquainted with the most commonly used communication protocols for smart grid applications.
	LEARNING OUTCOMES	■ Acquire in-depth understanding on the evolution of power systems. ■ Have knowledge about smart grid terminology and concepts. ■ Know about challenges and possibilities related to smart architectures. ■ Have knowledge about technology for micro grids and integration of renewable energy, energy storage and electrical mobility. ■ Learn the smart grid applications.
CONTENT	Course Content	■ Overview of power systems ■ Smart Grids: components and definition ■ Integration and management of distributed energy resources, energy storage systems and electrical mobility in smart grids ■ Demand Management, smart metering and AMR devices ■ New network architecture and communication protocols in smart grid. ■ Demonstration projects and deployment
	Practical work	■ Technical visits
	Project	■ Analysis of smart grid case studies from all over the world.
	BIBLIOGRAPHY	■ J. Momoh; Smart Grid: Fundamentals of Design and Analysis. Wiley-IEEE Press, March 2012. ■ Md Fakhrul Islam, Amanullah M. T. Oo, Shaheen Hasan Chowdhury, A B M Shawkat Ali Smart Grids: Opportunities, Developments, and Trends. Springer-Verlag London, 201. ■ A. Beaulieu, J. de Wilde, J. M.A. Scherpen. Smart Grids from a Global Perspective: Bridging Old and New Energy Systems. Springer, 2016
	USEFUL LINKS	■ www.cre.fr; ■ www.iea.org; ■ www.ieee.org/portal/site/pes/; ■ www.rte-france.com/en/eco2mix/eco2mix; ■ www.ec.europa.eu; ■ www.eia.doe.gov/oiaf/kyoto/kyotorpt.html; ■ www.energy.gov; ■ www.eere.energy.gov; ■ http://www2.epri.com ■ IEC Standards: 62357, 61970, 61850, 61968, 62351, 62056, 61508

socio-political approach of the city

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 2	Semester 1	15h	1,5	Colette Saba Touzain	English	■ 60% Continous Assessment ■ 40% Project

	COURSE OBJECTIVES	To give students the tools for a critical lecture about the elusive concept of smart cities.
	LEARNING OUTCOMES	■ Understand how the concept is born, developed and used by several entities (IO, specialists, multinationals, population). ■ Have an overview of a wide range of smart cities in the world (developed and developing countries). ■ Have tools for interpretation and critical evaluation of the concept, its development and its use.
CONTENT	**S1 (3 hours): what is a "smart city"**	■ Emergence of the concept of smart city (UNESCO, A journey through smart cities), ■ Presentation of the multitude of definitions of smart city (Council definition, specialists, administrators...), ■ What is the popular understanding of a smart city (examples based on studies), ■ Explication of cases studies that students will conduct and who aims to prove or not the needs to establish a smart city and its efficiency for the citizen's wellness.
	S2 (3 hours): What is a smart city approach for developed and developing country cities	■ Different understanding and perception of the concept of smart city between developed and developing countries (The World Bank, Smart City in Developing Countries), ■ Presentation of 4 cases studies, 2 in developed countries and 2 in developing countries (20 minutes for each presentation and 10 minutes debate).
	S3 (3 hours): Do we need smart cities?	■ Presentation of various points of view, for example the critical view of smart cities raising questions about the commercial interest of large multinational companies (Elke Rauth). ■ Presentation of 4 cases studies on ancient and new intelligent practices in "non smart cities" developed by societies in order to facilitate their daily life (20 minutes for each presentation and 10 minutes debate).
	S4 (3 hours): Smart city or smart society? The case of Beirut	■ Presentation (1 hour) of the emergence of the smart city in Beirut: society's initiatives and their limits to achieve the large public. The role of the government in supporting those initiatives. ■ Presentation of 4 cases studies on emerging smart cities (20 minutes for each presentation and 10 minutes debate).
	S5 (3 hours): Conclusion	■ Elaboration of a summary report on the different notions of smart city, the work will be based on the students' reflexion.

sustainable refurbishment

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 2	Semester 1	15h	1	Stéphane Baly	English	■ 60% Continous Assessment ■ 40% Project

PREREQUISITES	■ Thermal transfer ■ Architecture, construction and sustainable design ■ Dynamical thermal simulation and HVAC
COURSE OBJECTIVES	■ Introduction to building refurbishment specificities in comparison to new buildings ■ Presentation of sustainable refurbishment approaches and realizations
LEARNING OUTCOMES	■ Present the building refurbishment specificities ■ Propose refurbishment strategies with a sustainable approach ■ Building simulation and data analyses
CONTENT	The course is organized between lectures and field visits. Regarding the material presented within the previous courses (cf. prerequisites), lectures will provide supplementary elements dedicated to refurbishment projects. Case studies with building simulation will be conducted to analyze and criticize sustainable refurbishment approaches.

urban environment principles

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 2	Semester 1	30h	2	Dragan Milosevic	English	■ 50% Continous Assessment ■ 50% Project

PREREQUISITES	■ Thermal transfer ■ Architecture, construction and sustainable design ■ Principle and future trends in urbanism ■ Future cities: smart, inclusive and sustainable
COURSE OBJECTIVES	■ Introduction of urban environment topics: urban climate, outdoor air quality, adaptation to climate change in cities ■ Presentation of microclimate simulation ■ Introduction to research activities toward engineering students
LEARNING OUTCOMES	■ Understand key urban environment topics ■ Use the basic tools of a climate simulation software ■ Identify the local climate of a neighborhood ■ To learn up-to-date knowledge about ArcGIS
CONTENT	■ First, introduction lectures will provide key elements to understand urban environment, in relation to major current issues including climate change. ■ Second, students will take part of a research project focusing on uran microclimate modeling will be introduced during this practical course.
BIBLIOGRAPHY	■ Oke, T., Mills, G., Christen, A., & Voogt, J. (2017). Urban Climates. Cambridge: Cambridge University Press. doi:10.1017/9781139016476

water management, landscaping and green spaces

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 2	Semester 1	30h	2	Didier Larue	English	■ 65% Continous Assessment ■ 35% Project

COURSE OBJECTIVES	■ Introduction to the management of storm water with an ecological approach. ■ Understanding the importance of site analysis. ■ How to design a master plan which fits to the site and combines an integrated rainwater management. ■ Understanding of the relationships between open space network, water management and ecological hydrological continuity. ■ Presentation of examples of innovative solutions to manage rainwater in the urban water cycle.
LEARNING OUTCOMES	■ Understand the way storm water can be managed into a master plan. ■ Be able to manage solutions favoring the re-infiltration of water into the subsoil.
CONTENT	■ First, the course starts with an overview of storm water management illustrated by a lot of examples, and outstanding “eco-quartier” in Europe. ■ Second, the course focuses on an existing project located in Lille which is a relevant example of ecological water management. ■ Third, students will take part of a project that aims to perform a master plan located on an existing site. They will have to set up buildings, an integrated water management solution using swales, ponds, percolation and infiltration trenches.

workshop 3

Level	Period	Hours	ECTS Credits	Teacher Coordinator	Language	Assessment
MASTER 2	Semester 1	48h	4	Ana Ruiz Bowen	English	■ 65% Continous Assessment ■ 35% Project

PREREQUISITES	■ Workshop 1 ■ Workshop 2
COURSE OBJECTIVES	The subject of Workshop 3 is the built environment: conception, design, and performance. The main objective to develop knowledge and understanding of this field.
LEARNING OUTCOMES	■ Have a thorough knowledge of today's urban problems ■ Show his/her capacity of proposing persuasive future sustainable urban spaces in practical terms ■ Design skills: urban design, construction, write a report, run participatory events and workshops, make presentations and exhibitions. ■ Management skills: organize a project team, manage client communication, deliver work on time. ■ Critical skills: understand the project in the wider context of an engineering education and practice.
CONTENT	Workshop 3 is based on a real site. ■ First, students will visit the site and meet the stakeholders. A functional roadmap will be provided (or compose with students). ■ Secondly, a succession of workshops will allow exchange between professors and students. Students will provide model technical and architectural documentations. They will engage deep reflection and research in their propositions. ■ Finally, a panel will provide advises and critics on their projects.

JUNIA ISA

general information

Master of Science and Engineering Program

Junia ISA (Institut Supérieur d'Agriculture), since 1963, provides life science expertise related to agriculture, agrifood, environmental science, agricultural economics, and landscape.

The key to Junia ISA's pedagogical approach is activating students' ability to connect their theoretical knowledge with real world applications. Through project-based, hands-on learning, Junia ISA graduates grasp the big picture as well as the technical details.

Students pursuing a Master's degree choose from one areas of four specializations:

- Agricultural Science,
- Environmental Science,
- Food Science, or
- Agricultural Economics, Marketing and Management.

The below courses are common to all Master's programs at Junia ISA.

LEARN MORE AT ISA-LILLE.FR

MASTER 1 - FALL SEMESTER	ECTS
Welcome Session	6
French as a Foreign Language	3

MASTER 1 - SPRING SEMESTER	ECTS
French as a Foreign Language	3
Summer Internship	6

MASTER 2 - SPRING SEMESTER	ECTS
Final Internship	30
Six-month Professional Experience	
Written Report and Oral Defense	

Return to Table of Contents

welcome session

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	6	Sophie Dupont Wargniez	English

This welcome session is a mandatory course for ALL degree-seeking AND exchange students joining the first semester of Master 1 at Junia ISA.

	OBJECTIVES AND SKILLS DEVELOPED	This session is an introductory course to the teaching at Junia ISA (scientific skills, communication skills, knowledge on agriculture and food chain). The objectives of the welcome session are to: ■ Get used to the pedagogic methods, expectations and type of evaluations at Junia ISA ■ Introduce the lectures from the 4th year in agriculture and food chains ■ Give reminders on scientific writing and communication methods ■ Get to know each other and prepare to meet future colleagues from 4th year.
CONTENT	**LECTURES - WORKSHOPS GROUP WORK** **Scientific communication (33% of the credits)**	■ Prepare for future scientific work through a written and oral assignment on scientific topics ■ 8h lectures on the methodology for a literature review/ 22h of work in small groups ■ Evaluation: Individual literature review + Group oral presentation of a press review
	Food chain (33% of the credits)	■ How are the food chain organized in the European context? ■ 17h of lectures on food chain organizations / analysis of some specific food chains ■ Evaluation: Individual exam
	Intercultural communication and interpersonal skills (17% OF THE CREDITS)	■ Get a glimpse at how cultural differences interact in our relationship and communication with others, and how communication between people works... ■ 15h + 12h of workshop + 12 ■ Evaluation: exercises during the workshops + short individual report + participation in the workshops

NOTE: Non French-speaking students will also take 15h of French as Foreign Language course

french as a foreign language

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1 & 2	3	Vira Wannepain	French

This French as a Foreign Language course is mandatory course for all non-French-speaking, degree-seeking students in the Master program. Students are placed according to their French level, as assessed using the Common European Framework.

OBJECTIVES AND SKILLS DEVELOPED	Develop French language skills in a social context, both written and oral, in order to improve communication: Listening, Reading, Speaking, Writing
CONTENT AND ORGANIZATION	■ Written and oral reception activities ■ Conceptualization of linguistic content ■ Training exercises in the classroom and at home ■ Written and oral production: simulation, role-playing, playful activities ■ Final Tasks mobilizing all the skills of a didactic unit
EVALUATION	■ Continuous assesment, oral presentations, final exam

summer internship

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	6	Sophie Dupont Wargniez	French or english

All degree-seeking students at Junia ISA must carry out an “assistant engineer internship” (SAI) at the end of the bachelor-level program or Master 1 year.

OBJECTIVES AND SKILLS DEVELOPED	The main purpose of this internship, lasting for at least eight weeks (forty days), is to provide an immersion in the professional world in a field of the student’s choice. This process of discovery helps to guide students in their future development and build career plans. It gives them the technical and interpersonal skills and knowledge of the business world that are essential for any engineer. The SAI enables students to immerse themselves in a company/sector that interests them, or to assist an executive (not necessarily an engineer) occupying a role they themselves would like to fill. The interns are given one or more missions relevant to the curriculum defined by Junia ISA and approved by the host organization.
CONTENT AND ORGANIZATION	The knowledge and skills to be acquired/developed through the internship may include: ■ Scientific, technical, economic and/or regulatory knowledge about a subject ■ Carrying out an analysis or consultancy mission with the appropriate tools ■ Collecting and processing information and data and suggesting appropriate solutions ■ Reporting information in a relevant way ■ Working as part of a team ■ Using interpersonal skills, adapting to the workplace and demonstrating professional ethics ■ Demonstrating an ability to analyse and summarise ■ Demonstrating initiative and independence ■ Using creativity, ability to anticipate, imagination and a proactive approach ■ The ability to question one’s judgement
EVALUATION	The internship will be evaluated based on the following: ■ The internship mentor’s assessment ■ Internship report ■ Validation interview with a referring teacher The internship counts for 6 ECTS points (European credits) of the 60 ECTS points awarded for the fourth year of the engineering course.

JUNIA ISA

department of agricultural science

Master of Science and Engineering Program

Junia ISA's Agricultural Science program aims to give students:

- an international view of the issue of agriculture, highlighting certain national and/or regional specificities,
- the necessary tools to manage crop and livestock production, as well as agricultural processes, from ruminant nutrition to distribution channels
- a practical view of site management, thanks to lectures and seminars by experts in the field;
- the methods to manage projects within an international context, with multicultural staff.

LEARN MORE AT ISA-LILLE.FR

MASTER 1 - FALL SEMESTER	ECTS
Welcome Session	6
Project: Food Chains 2 and Initiation to Project Management	6
Ruminant Nutrition and Roughage Systems or Urban Farming	3
Plant Biotechnologies	6
Plant Breeding and Genetics or Precision Livestock Farming	3
Crop Modeling	3
French as a Foreign Language	3

MASTER 1 - SPRING SEMESTER	ECTS
Animal Welfare: From Consumer Demand to Farm Auditing	3
Biocontrol for Sustainable Crop Mangement	3
Livestock Housing and Building Conception	3
Project in Agriculture	6
Agriculture and Climate Change	3
Global Food Politics	3
Applied Agricultural Sciences to Specialized Crops	3
Livestock Production Systems	6
French as a Foreign Language	3
Summer Internship	6

MASTER 2 - FALL SEMESTER	ECTS
Sustainable Agriculture and Smart Farming	30

MASTER 2 - SPRING SEMESTER	ECTS
Final Internship	30
Six-month Professional Experience	
Written Report and Oral Defense	

contact

Hélène Leruste, Academic Advisor
helene.leruste@junia.com

project: food chains 2 and initiation to project management

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	6	Hélène Leruste	English

MAIN OBJECTIVES	This program is specific to international students (or french students who did not follow the bachelor program at Junia ISA) joining the master program in agriculture or agribusiness. The objectives are to: ■ Discover some agricultural production specific to French or European agriculture (in line with the lecture on food chains included in the welcome session). ■ Study a project in the farming sector. Meet the expectations of the sponsor, with a solution in relation with the demand.
SKILLS DEVELOPED	Understand and analyze a problem. ■ Define objectives. ■ Manage a group project (project schedule, anticipation of risks, evaluation of the resources, distribution of tasks, take into account of the constraints) ■ Develop relationships in a multicultural context (in the group, with the partners, with the teachers)
CONTENT	■ Self-learning on the main animal and plant productions in France (e-learning platform) - 24h ■ 1 workshop on project management - 4h ■ 1 intensive week on a project in agriculture in subgroups - 5 days
EVALUATION	Evaluation of knowledge on animal and plant production (on-line quiz) ■ Group oral evaluation + report on the project in agriculture

ruminant nutrition and roughage systems

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	Joop Lensink Valérie Jacquerie	English

MAIN OBJECTIVES	■ Train future animal nutrition managers (formulation, R & D, sales) and breeding advisors ■ Enhance knowledge on ruminant feed and roughage systems
SKILLS DEVELOPED	■ Identify problems related to feed-imbalanced diets (health, product quality, sustainability...) ■ Develop a systematic and systemic approach regarding ruminant farms
CONTENT	■ Roughage (fodder) systems and grazing management ■ Pasture management and plant variety use ■ Ruminant (feed) systems and sustainability approach ■ Metabolic diseases related to rumination ■ International feed and animal diet evaluation systems
EVALUATION	■ Written individual exam
PROGRAM	■ Introduction: Ruminant production systems ■ Roughage and conservation methods ■ Pasture and grass management / Productivity of grass / Different species in grasslands ■ Roughage systems ■ Ruminant-specific metabolic diseases ■ Rationing and feed systems (in France and abroad): technical and economic analysis

urban farming

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	Pénélope Cheval	English

MAIN OBJECTIVES	■ This course is based on the definition of urban agriculture, its context, its typology, its issues and the questions it raises.
SKILLS DEVELOPED	This class will help you understand the issues and the context in which urban agriculture is taking place. It will also give you an initial overview of the projects carried out and underway in France and around the world and will enable you to understand the setting up of a project in urban agriculture and the associated issues (environmental, social and economic issues, etc.). The questions raised by urban agriculture will also be discussed and will help you understand the research objectives on this theme.
CONTENT	The following points will be treated: ■ Definition ■ History, ■ Context, ■ Issues, ■ Objectives ■ UF functions, ■ Forms of UF, ■ Projects developed in UF and diversity of actors, ■ UF in France and in the world ■ Project editing in UF ■ Economic aspects, ■ UF and environment, ■ Smart Farming and UF ■ Research in UF
EVALUATION	■ Student project + Final Exam at the end of the course
PROGRAM	The course will be structured around theoretical lessons, interventions by professionals from the field, visits of projects in urban agriculture, a student project and a final exam at the end of the session.

plant biotechnologies

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	Pénélope Cheval	English

MAIN OBJECTIVES	■ Improve knowledge on techniques and applications of biotechnologies in crop production ■ Investigate the presence of Septoria leaf blotch resistance genes on different varieties of wheat
SKILLS DEVELOPED	■ To have a general outlook on plant biotechnology principals and application ■ Implementation of experiments integrating biotechnology techniques ■ Management of a mini-project in plant biotechnology (research, bibliography, presentation)
CONTENT	Lectures, practicals, visits ■ Biotechnology application in micropropagation ■ Biotechnology applications to regenerate plants virus-free and in plant breeding (Protoplaste production, Androgyny, embryos culture) ■ Realizing a mini-project
EVALUATION	■ Reports, oral defense in group

plant breeding and genetics

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	Ali Siah	English

MAIN OBJECTIVES	■ Acquire a background in the area of plant breeding and plant genetic selection (actors, organization, challenges, progresses, etc.) ■ Understand the strategies and techniques of quantitative genetics applied for plant improvement ■ Tools of biotechnology applied for plant breeding such as marker assisted selection and genomic selection
SKILLS DEVELOPED	■ Analyze constraints, technical and economic challenges of genetic improvement of various plant species.
CONTENT	Lessons/conferences, company visits ■ Organization of plant breeding sector ■ Methods of plant breeding ■ Quantitative genetics applied for plant breeding ■ Marker assisted selection and genomic selection ■ Breeding specificities of different plant species ■ Seed production and regulation
EVALUATION	■ Individual exam - Synthesis report and oral defense on a subject not developed during the courses.

precision livestock farming

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	Hernaina Andriamandroso	English

MAIN OBJECTIVES	This course sequence, taught in English, will propose to students an introduction to the new technologies used today in the agricultural sector, on the field.
SKILLS DEVELOPED	■ Knowledge about new aspects and technologies regarding the agricultural techniques. ■ Data analysis : work on huge data sets coming from sensors ■ Self-learning through the case study work.
CONTENT	■ The lectures will approach techniques coming from the crop and animal productions. ■ These illustrated techniques will go from environmental or crop and animal health sensors to new mechanization technologies (ie robots). Some information and help decision tools will also be illustrated.
EVALUATION	■ This short course sequence will be evaluated through a case study on which students will work. About 10 hours will be dedicated to this part.

crop modeling

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	Sitraka Andrianarisoa	English

MAIN OBJECTIVES	■ Integrate different steps of crop models design ■ Understand formalities used to model different mechanisms occurring in the soil/plant/atmosphere system ■ Use crop models to simulate the functioning of agroecosystems ■ Discover some instances of the use of modeling by farmers
SKILLS DEVELOPED	■ To be able to interact during the different steps of crop model design: conceptualization, formalization, parameterization, calibration and validation ■ To be able to think about the modeling of multiple processes involved in crop production (soil/plant/atmosphere) ■ To be able to use some models applied to crop management at farm scale.
CONTENT	Lectures and concrete cases (36 hours) **Topic:** ■ Definition, designing, parameterization, calibration and validation of crop model (8h) ■ Use of some crop models: simulation of agro-environmental performance of different crop management systems (e.g., variation in fertilizer inputs or in crop rotation/association, effect of climate change or soil type in crop production) (8h) ■ Models for weeds management, crop protection and fertilization (10h) ■ Examples of applied models: used in automatic robot, used in farm management (10h)
EVALUATION	■ Individual work to simulate some situations of crop systems ■ Individual evaluation: written exam as multiple choice questions

animal welfare: from consumer demand to farm auditing

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Vanessa Guesdon Hélène Leruste	English

MAIN OBJECTIVES	■ Define what is animal welfare and what influences people's perception of animal welfare ■ Discuss major factors influencing animal welfare with a specific focus on housing, nutrition and management practices (inducing pain) ■ Determine how to evaluate animal welfare on a farm level, set-up and perform a simple audit, and analyze the results ■ Know how (European) legislation in animal welfare is constructed and what are the main aims of legislation ■ Realize what is the market situation in terms of animal welfare-friendly products and the ways to increase the market ■ Discuss future evolution in terms of legislation, situation for farmers and global markets
SKILLS DEVELOPED	■ Set-up (simple but valid) animal welfare scoring protocols ■ Analyze results of a farm audit ■ Capacity to anticipate future evolution
CONTENT	■ Welfare definitions ■ Factors influencing animal welfare ■ Legislation and future evolution
EVALUATION	■ Oral presentations in group, Final exam

biocontrol for crop protection

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Jérôme Muchembled Ali Siah	English

MAIN OBJECTIVES	■ Understand the modes of action of biocontrol products. ■ Integration of biocontrol products in cropping systems and agronomic advice. ■ Know the organization and different actors of biocontrol area.
SKILLS DEVELOPED	■ Identify different categories of biocontrol and understand the sector ■ Identify available biocontrol products for plant protection and crop production (arable crops and specialized crops) ■ Understand how a biocontrol product operates in the environment
CONTENT	■ Biocontrol area and the current context of crop protection in relationship with sustainable agriculture and agroecology. ■ Description of the different categories of biocontrol products (macro-organisms, micro-organisms, semiochemicals and natural substances). ■ The biocontrol sector (Research & Development process, companies, marketing process, regulation, field use, etc).
EVALUATION	■ Individual exam on the different course content. ■ Synthesis report and oral defense on a subject not developed during the courses.

livestock housing and building conception

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Joop Lensink	English

	MAIN OBJECTIVES	■ Gain knowledge and analyze the different aspects related to livestock housing influencing the animals' performances ■ Go through all steps of a project by the realization of dairy barn building project for a farmer ■ Advise farmers on building aspects and project ■ Realize a building quality audit
	SKILLS DEVELOPED	■ Conceptualize a cattle building project ■ Advise farmers on building aspects and project ■ Realize a building quality audit
	CONTENT	■ Knowledge on animal needs, human constraints, administrative and legislative aspects, environmental regulations related to livestock building ■ Future evolution in this area specifically in terms of innovation ■ A major part of the knowledge on the topic of this module will be gained through the farm building project. The first visit will concern a dairy farmer that has a construction project; either a complete new building or an extension of an existing one. Students will have to identify the wishes of the farmer, the environmental, legislative and administrative constraints and realize finally building plans and budget plans for the project. The work will be evaluated through an "advisory" report and oral defense in front of the farm and an expert from the "farm building service" of the Chamber of Agriculture.
	EVALUATION	■ Case study analysis with synthetic note to be written (20%) ■ Report on the building construction project (60%) ■ Oral presentation (45 min) by the groups of on their building project
PROGRAM	Session 1	■ Lecture: Introduction to livestock housing, animal behavior, basis of housing (4h)
	Session 2	■ Visit: dairy farm with construction project (4h)
	Session 3	■ Lecture: resting, feeding and thermal requirements (8h)
	Session 4	
	Session 5	■ Free session: construction project (4h)
	Session 6	■ Lecture: environmental legislation, storage capacities of manure (4h)
	Session 7	■ Lecture: building concepts and automatization (4h)
	Session 8	■ Lecture: dairy calves housing and innovation (4h)
	Session 9	■ Visit: building concepts in several species (4h)
	Session 10	■ Lecture: ventilation and climate control (4h)

project in agriculture

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	6	Eric Taisne	English

MAIN OBJECTIVES	■ Study a project in the farming sector, in answer to the request of a partner (farmer or professional working in connection with farms) ■ Meet the expectations of the partner, with a solution in relation with the demand.
SKILLS DEVELOPED	■ Understand and analyze a problem. ■ Define objectives. ■ Manage a group project (project schedule, anticipation of risks, evaluation of the resources, distribution of tasks, take into account of the constraints) ■ Develop relationships in a multicultural context (in the group, with the partners, with the teachers)
CONTENT	■ 11 days dedicated to the study, including one whole week. ■ Projects presentation, choice of the groups and the affectation of the projects
EVALUATION	■ Intermediate evaluation after 3-4 workweeks ■ Final oral evaluation in the presence of the partner, written report

agriculture and climate change

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Hélène Desmyttère	English

MAIN OBJECTIVES	Agriculture is simultaneously co-responsible for climate change (emission of greenhouse gases etc) and a victim of climate change (variations, sometimes extreme, of temperature and rainfall, for example! Therefore, farming systems need to reduce their impacts and adapt themselves but can also become one of the major solutions for it! Based on these elements, the main objectives of this course will be to: ■ Understand climate change challenges regarding agriculture: agriculture's contribution, adaptation and mitigation. ■ Discover concrete and innovative projects or tools for monitoring the impact of farming systems (crops and livestock) to adapt/improve them.
SKILLS DEVELOPED	■ Understand environmental and sustainable development challenges ■ Use environmental analyses tools ■ Critical thinking (reconsideration) and curiosity
CONTENT	■ Fundamentals on climate change and understanding of the relationship with agriculture ■ Impacts and practices' assessments tools ■ Presentation of concrete research and development projects
EVALUATION	■ Individual written exam ■ Group oral presentation
PROGRAM	■ Lecture: Fundamentals on Climate Change ■ Lecture: What link between climate change and agriculture? ■ Lecture: Tools for carbon footprint calculation/diagnosis ■ Lecture: Diagnosis at the farm scale ■ Visit: Impact of climate change on crops ■ Lecture: Livestock farming adaptation ■ Lecture: Carbon sequestration ■ Lecture: Reducing emissions in farms ■ Visit: SOERE observatories

global food politics

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Eric Taisne Sabine Weiland (ESPOL)	English

MAIN OBJECTIVES	Food covers immense terrain. It is at the intersection of competing issues such as production, consumption, supply chains, trade, government and politics, science and technology, nutrition, public health, environment, ethics, culture, social justice and many more. In this array, it is particularly difficult to design food policy on various levels and among diverse actor groups and demands. In this course, we will explore the contemporary global food system, the past, and possible futures for food policy. We will cover a number of core problems, such as food policy and governance, food production and consumption, food security and safety, health and the environment, food behavior and culture, and food poverty and justice.
CONTENT	The course is taught through 12 lectures of 2 hours each. Each session contains also interactive elements, and students are encouraged to actively participate, ask questions and discuss issues of common interest. The lectures are designed to outline the topic in general, highlight illustrative examples and discuss some salient points. They are meant as an introduction to the topic at hand which enables the students of further self-study. You are required to read the basic literature (see “Basic reading” in session overview) in preparation of the sessions.
EVALUATION	■ Regular attendance of the sessions is a requirement. ■ Exams: 3 hours written exam (essay).
PROGRAM – Session 1	■ Introduction: The Geopolitics of Food
Session 2	■ Food as a Policy Field
Session 3	■ Food Governance
Session 4	■ Food Governance
Session 5	■ Food Production and the Global Food Chain
Session 6	■ Food Security
Session 7	■ Food and the Environment
Session 8	■ Food, Ethics and Culture
Session 9	■ Food, Poverty and Social Justice
Session 10	■ The Future of Global Food Politics

applied agricultural sciences to specialized crops

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Pauline Trapet	English

MAIN OBJECTIVES	■ Identify the specialized crops, the different production areas, the markets and the possible valorization of these plant productions (fruits and vegetables). ■ Know the biological and botanical characteristics of the French specialized crops. ■ Understand the importance of phenological stages in relation to the technical itinerary. ■ Understand and analyze a technical itinerary : varietal choice, soil and sowing; fertilization and piloting tools ; chemical and mechanical management of the main weeds; chemical and biological management of major diseases; chemical and biological management of major insects; decision support tools to manage bio-aggressors; harvest, quality and regulation.
SKILLS DEVELOPED	■ Understanding the quantitative and qualitative issues of specialized crops for food and health ■ Analysis of technical itineraries in relation to production methods and the regional pedo-climatic context ■ Identification of the main biotic and abiotic stresses of specialized crops
CONTENT	News, evolutions and innovations of technical itineraries applied to specialized crops : ■ Arboriculture (Apple orchards) ■ Grape vine ■ Vegetables production
EVALUATION	■ Individual assessment (50 or 100%) and/or oral presentations by groups (30 minutes) (50 or 100%)

livestock production systems

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	6	Valérie Jacquerie Hélène Leruste	English

MAIN OBJECTIVES	■ Enhance knowledge on cattle, sheep, pig and poultry farming techniques in France and abroad ■ Identify the actors in these sectors ■ Understand the issues and developments in the sector
SKILLS DEVELOPED	■ Production systems/markets (meat and milk) ■ Analysis of technical and economic results ■ Systemic approach to Livestock Production and Organization ■ Compare breeding methods in different European countries
CONTENT	■ Ten sessions: Courses/conferences, Visits + self-managed and personal work. Topics: Breeding of suckling cattle, pig breeding, breeding laying hens, sheep-goat farming ■ One Week: Study mission of 2-3 days, with preparation and restitution. Topic: Study of a theme according to destination (e.g. environment and competitiveness in the Netherlands).
EVALUATION	■ Oral defense in group – Written report.

specialization: sustainable agriculture and smart farming

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	30	Bertrand Vandoorne Herinaina Andriamandroso	English

MAIN OBJECTIVES & PROFESSIONAL SKILLS DEVELOPED		The main objectives of this specialization are to understand new issues in agriculture and develop a working method to accompany farmers and companies in their changing environment. ■ For the next year: to be operational in the support of farmers. ■ For the next 40 years: to be an actor of sustainable agriculture through diverse sectors and territories. This specialization will train students to: ■ Discover, understand and analyse innovative and sustainable agronomic methods in animal and plant production ■ Understand and manipulate the technologies of digital agriculture at the service of the sustainability of agricultural systems.
CONTENT		Different teaching modules (for 50 days) will be organised by the teachers of Junia ISA's Department of Agricultural Science with numerous professional guest lectures. The objective is to span the different environmental, technical and economic approaches in animal and plant production. A development and innovation project (for 40 days) will be assigned to students in partnership with a company or organization. This project corresponds to a real demand and the students (in groups) are in a situation of obligation of result. For some groups, according to the needs of the project, students from partner schools Junia HEI and/or ISEN will also be able to bring their skills to solve the problem.
TRAINING MODULES (main topics)	Tools for supporting farming and farmers:	■ Farm strategy, consulting and projects (10 days)
	Agriculture and society:	■ Societal issues around technology (5 days)
	Professional skills:	■ Agriculture and Water (5 days) ■ Agriculture and territories (3 days) ■ Innovative and sustainable cropping systems (10 days) ■ Precision Agriculture (20 days)
	Group project	■ 40 days

JUNIA ISA

department of environmental science

Master of Science and Engineering Program

Junia ISA's Environmental Science program aims to give students a general overview of:

- Prevention of soil pollution
- Water and air pollution
- Management and treatment of sites contaminated by human activities
- General assessment of pollution,
- Remediation/treatment of polluted sites (bioremediation, phytoremediation, biotechnology, and more)

LEARN MORE AT ISA-LILLE.FR

MASTER 1 - FALL SEMESTER	ECTS
Welcome Session	6
Field Study in Environment	6
Environmental Pollutants	3
Toxicology - Ecotoxicology	6
Pollutant Behavior in Abiotic Matrices	3
Waste Management	3
French as a Foreign Language	3

MASTER 1 - SPRING SEMESTER	ECTS
Geographical Information System(GIS) - Basic Knowledge	3
Soil Quality Investigation - Consultancy Tools	3
Field Study in Environment	6
Applied Statistics to Environment	3
Human Risk Assessment	3
Waste Water Management	3
Water and Sediment Management	6
Audit Practices	3
French as a Foreign Language	3
Summer Internship	6

MASTER 2 - FALL SEMESTER	ECTS
Sustainable Management of Pollution	30

MASTER 2 - SPRING SEMESTER	ECTS
Final Internship	30
Six-month Professional Experience	
Written Report and Oral Defense	

contact

Julien Castelin, Academic Advisor
julien.castelin@junia.com

field study in environment

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1 & 2	6	Nadège Oustrière	English

MAIN OBJECTIVES	Manage, in a collaborative work, a long study dealing with an environmental issue.
SKILLS DEVELOPED	■ Use project management tools; ■ Deliver your work in a strict and professional way; ■ Understand and respond to a company issue; ■ Technical skills, depending on the topic of the project.
CONTENT	■ Eleven (11) days dedicated to the study, including one whole week. ■ Project presentation, choice of the groups and the project assignment.
EVALUATION	■ Intermediate evaluation after 3-4 work weeks ■ Final oral evaluation in the presence of the partner, written report

environmental pollutants

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	Julien Castelin	English

It is highly recommended to take this course with Pollutant Behavior and Toxicology-Ecotoxicology

MAIN OBJECTIVES	■ Understand the main issues linked with contaminated areas and the main challenges to face ■ Know the major pollutants in the environment ■ Learn the main characteristics of such pollutants
SKILLS DEVELOPED	■ Be able to identify links between activities and pollution ■ Practice collaborative group work: work, oral presentation, written report
CONTENT	The physical environment of Western countries (air, water and soil) has been affected by a wide range of pollutants for centuries. Localized pollution from anthropogenic sources has been observed since the time of the Roman Empire. However, extensive pollution of the environment was a characteristic of the industrial revolution and major and widespread impacts have been observed throughout the nineteenth and twentieth centuries. Contaminated sites are the legacy of a long period of industrialization involving inconsiderate production and handling of hazardous substances and inadequate dumping of wastes. The expansion of industry and the increasing amount of industrial wastes have led to considerable environmental problems that apply in all industrialized countries. Nowadays, developing countries have to face the same problems. This course will provide basic knowledge on main pollutants and their sources. Focus on specific pollutants and specific issues worldwide will be addressed as well.
EVALUATION	Students will have to work both on a group project and an individual project: ■ Group Project: students will have to identify on their own pollution and pollutants associated with activities they will discover during on field visits. A written report will have to be realized. ■ Individual Project: students have to work individually on a specific project: - introducing the problem of soil and/or water pollution in their own country: students must focus on some typical pollution or areas with specific problems; - or exploring an existing management situation of a polluted area (case study) in their own country. Each student will have the opportunity to present his work in front of the class, based on a PowerPoint presentation. Finally, an individual written exam will be organized to verify acquisition of the essentials of the teaching unit.

toxicology - ecotoxicology

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	6	Nadège Oustrière	English

It is highly recommended to take this course with Environmental Pollutants and Pollutant Behavior

MAIN OBJECTIVES	■ Understand the fate of pollutants in biotic matrices (bacteria, plants, animals); Get the basis on toxicology and ecotoxicology; Integrate this knowledge in ecosystems. ■ Understand and use results from exposure and bioaccumulation experiments; results from ecotoxicological experiments with non-standard test species; results on the effects of chemicals on food-web.
SKILLS DEVELOPED	■ design in vivo bioassays to assess effects on behaviour of organisms; ■ interpret the results of chemical fate and ecological models; ■ interpret data from microcosm and mesocosm experiments; ■ perform an advanced data analysis on chemical and biological monitoring data; ■ perform advanced exposure, effect and risk assessments of chemicals in ecosystems
CONTENT	This course will first focus on the fate of toxic compounds and their effects on animals and plants from single individuals to populations and ecosystems. It is organized in lectures dealing with the: ■ main exposure routes (inhalation, ingestion, contact…); ■ mechanisms of bioconcentration, bioamplification and bioaccumulation; ■ main mechanisms of pollutant toxicity; ■ main mechanisms of pollutant detoxification; ■ effects on populations and ecosystems. Then, a focus will be done on Environmental risk assessment. ERA is a process for estimating the likelihood or probability of an adverse outcome or event due to pressures or changes in environmental conditions resulting from human activities.
EVALUATION	Individual written exam and oral group presentation

pollutant behaviour in abiotic matrices

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	Nadège Oustrière	English

It is highly recommended to take this course with Environmental Pollutants and Toxicology-Ecotoxicology

MAIN OBJECTIVES	■ Understand the main chemical reactions between pollutants and chemical species in the contaminated matrices (soil, sediment, water…) ■ Comprehend the complexity of chemical processes
SKILLS DEVELOPED	■ Read an analysis report and extract the most relevant information; ■ Discuss data on the analysis report (agronomic and physico-chemical properties); ■ Develop ideas to participate to the elaboration and set up of strategies to evaluate the environmental availability of metallic and organic pollutants. ■ Evaluate, analyze and, from a theoretical point of view, predict the behaviour of pollutants in soils and the main retention and depollution processes which are active in the soil-water system.
CONTENT	■ the main chemical reactions between pollutants and chemical species in the contaminated matrices (soil, sediment, water…) ■ the students will be able to link the behaviour of xenobiotics in the soil-water system to the physical and chemical characteristics of both pollutant and soil/sediment under investigation, to report on specific themes related to the fate of pollutants into soil and water, and to approach scientific reports dealing with the evaluation and assessment of pollution phenomena in the soil and water environment
EVALUATION	Individual written exam and written report

waste management

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	Johanne Géa	English

It is highly recommended to take this course with Environmental Pollutants and Toxicology-Ecotoxicology

MAIN OBJECTIVES	■ Acquire basic knowledge, and fundamental benchmarks in the area of waste management; ■ Knowing the context, environment, actors, and tools dedicated to waste management; ■ Get a "waste management" culture to be able to understand waste management study on company scale or for household waste management; ■ Integrate elements of understanding, related to the Circular Economy. This teaching unit is focusing on Waste management tools, on their complete cycle, from production to treatment facilities including the steps of pre-collection, collection, transfer and transport.
SKILLS DEVELOPED	■ Analyze equipment and results of waste management practices; ■ Set-up waste management solutions, technically, economically and in terms of communication; ■ Integrate elements of understanding, related to the Circular Economy.
CONTENT	The idea is: ■ to get used to the fundamentals (terminology, treatment types, regulations, technico-economic approach...) of household waste and waste of economic activities; ■ to develop a type of waste, or sector, or a treatment process, through a case study; ■ to visit a rather complete panel of processing plants (dumping sites, incinerators, recycling companies...)
EVALUATION	Written report in group ■ Group oral defense ■ Individual written exam

geographical information system (gis) - basic knowledge

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Sébastien Détriché	English

MAIN OBJECTIVES	■ The learning outcomes are to acquire basic skills on GIS by using the QGIS software (free and open source): ■ understanding different GIS fields of application; ■ mastering the basic tools of the QGIS software; ■ understanding data (vector and raster) and metadata, deal with spatial data; ■ making of thematic maps (with review of cartography rules); ■ knowing how and where acquiring data (data sources); ■ learning how to solve environmental problems and apply GIS solutions (polluted sites, soil science, agriculture, landscape management...)
SKILLS DEVELOPED	■ Know how to use a GIS software (QGIS) ■ Use GIS to deal with environmental issues
CONTENT	Guided step-by-step practical work on the software with exercises. Students will work with worldwide and regional (Nord-Pas de Calais) data. ■ What is a GIS? How to deal with spatial data? Fields of application, basic knowledge about GIS ■ The QGIS interface. Dealing with layers and their properties (graphic and attributary), coordinate systems ■ The table of contents, toolbars, definition queries ■ Symbology and labelling ■ Georeferencing, coordinate systems ■ Editing and layout (creating maps) ■ Making selections ■ Joining data (from the database to the GIS)
EVALUATION	Individual exam on the software

soil quality investigation consultancy tools

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Julien Castelin	English

	MAIN OBJECTIVES	■ To provide knowledge on soil quality investigation, through an exploration of general approaches in this field, and through a comparison of 2 specific approaches: the Dutch one and the French one. ■ Understand the main issues and goals linked with soil investigations; ■ Be aware of different kind of sampling methods and equipment; ■ Learn about conservation methods and about main analytical techniques.
	SKILLS DEVELOPED	■ Be able to build a financial and technical proposal for a classical pollution diagnosis case; ■ Be able to make interpretations and evaluations based on the analysis reports; ■ Technical skills in the field of soil quality investigation (sampling tools…) ■ Practice collaborative group work.
CONTENT	Lecture about French approach on soil quality investigation	■ This lecture will first give a definition of the goal of investigation in the French approach. The different kind of sampling strategies will be presented, and the way to choose the type and the number of chemical analyses that have to be done. A lot of real cases and examples will be brought to the students during this lecture in support.
	Lecture about Dutch approach on soil quality investigation	■ Those lectures will first propose an introduction to soil pollution problems in the Netherlands. ■ Then, the soil protection policy and legislation in the Netherlands will be highlighted. ■ Next, a definition of the goal of investigation in the Dutch approach will be given. ■ Then, the standard protocol for preliminary soil quality investigation will be detailed. The different kind of sampling strategies will be presented, and the way to choose the type and the number of chemical analyses that have to be done. ■ During the final part of this lecture the techniques for writing a summary report will be presented and the case study will be introduced.
	Case study – soil investigation "Garage de Vries"	■ Following those first lectures, students will have to work on a specific case study. Students will be split in different groups and will have to play the role of young engineers working in a consulting agency (One group of students = one consulting agency). Based on the same document introducing the site, each group will have to build the best proposal (from the technical and financial point) according to the customer needs. This proposal, presenting a sampling plan with the different drillings and chemical analysis proposed, will have to be justified and explained during a short oral presentation. There will be opportunities for class comments/feedback/discussion after each presentation. The exercise will have to be done using both the French and Dutch methodology. An open discussion about the main differences observed will then be done with the students.
	Lecture on soil quality standards and risk assessment & interpretation of the results of chemical analysis	■ During these last lectures within Dutch framework, the topics of soil quality standards and interpretation of results will be presented and discussed.
	Field visit: On-going soil investigations	■ Students will have the opportunity to visit a site where soil investigations are held. This will be a good opportunity to observe the way this is done and the drilling and sampling equipment.
	Study tour (to be confirmed)	■ Cooperation with AVANS Breda and TAMPERE Finland ■ The cooperation will consist of a two day project case, scheduled in January. ■ The detailed content will be updated in due time.
	EVALUATION	Group oral presentation and individual written exam based on the lectures.

applied statistics to environment

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Karin Sahmer	English

MAIN OBJECTIVES	■ Gain methods for the analysis of environmental data with the statistical software R. ■ Become autonomous in the management of environmental data acquired during an internship. ■ Understand how your statistical skills will deepen the understanding of your data..
SKILLS DEVELOPED	■ Learn how to use the R software. ■ Gain basic notions in inferential statistics. ■ Learn how to select the right statistical methods depending on your hypothesis. ■ Understand the limits and the conditions for applying those statistical methods. ■ Run statistical methods on data sets.
CONTENT	Lectures followed by practical work using computers The studied statistical analysis will be: ■ Analysis of variance (ANOVA) with 1 or 2 factors ■ Analysis of Covariance (ANCOVA) ■ Linear regression, simple and multiple ■ Principal component analysis
EVALUATION	■ Case study (40% of the global mark for this module): The students will have to work in small groups to write a report about the data they will analyze during class. ■ Individual exam (60% of the global mark for this module): 2 hours individual test with computer about the studied methods.

human risk assessment

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Aurélie Pelfrêne	English

MAIN OBJECTIVES	■ Know the difference in meaning of the terms “hazard” and “risk”, the purpose and the four steps of risk assessment, ■ Know the most common routes for absorption of substances into the body, ■ Have an understanding of integrating the results of hazard identification, hazard characterization, and exposure assessment, ■ Be familiar with the problems in extrapolating the results of studies of the harmful effects of substances from animals to humans and know what are the main sources of hazard information on commercially available substances, ■ Understand the principles of exposure assessment, ■ Know some of the common approaches to minimizing risk, ■ Know how to progress from risk assessment to risk management.
SKILLS DEVELOPED	■ Introduction to: human risk assessment concepts, risk calculation (from theory to practice), computerized models for assessment of contaminated land exposure
CONTENT	Human risk assessment concepts: ■ Definitions: hazard, exposure, risk, dose-response, risk perception, risk communication, risk characterization. ■ How to carry out risk assessment? Risk assessment process ■ Sources of uncertainty in risk assessment ■ From risk assessment to risk management
EVALUATION	■ Individual evaluation: written test about the lecture ■ Group evaluation: oral presentation (group project on a case study)
PROGRAM	■ Lecture ■ Examples: introduction to computerized models for human risk assessment ■ Practical (exercises on risk calculations) ■ Case study (group project of 3/4 students)

waste water management

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Julien Castelin	English

MAIN OBJECTIVES	Upon completion of this course students should be able to understand the big challenges that companies have to face in: ■ the reduction of the water use, ■ the management of the waste water, ■ the re-purposing of treatment by-products.
SKILLS DEVELOPED	Both technical skills and operational skills.
CONTENT	The course will be illustrated with short practical exercises, to be performed by students, and on-site visits (waste water treatment plant of municipality and company). The lectures will address the following topics: ■ Industrial water management; ■ Wastewater treatment: principles and implementation; ■ Water reuse, re-purposing of by products, and case studies; ■ Industrial wastewater specific treatment: principles and implementation.
EVALUATION	■ Individual written exam based on the lectures and case studies done

water and sediment management

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	6	Julien Castelin	English

	MAIN OBJECTIVES	Learning outcomes: ■ Understand the main issues and challenges about water and sediment pollution, in France and in Europe ■ Learn about the French and Dutch specific approaches on this topic.
	SKILLS DEVELOPED	■ Practice collaborative group work: work, oral presentation, written report… ■ Perform GW monitoring and sampling operations ■ Analyze survey reports, maps and data
CONTENT	**The course will include many different lectures about this topic, from different actors, showing different perspectives + a lot of field visits, in France and in the Netherlands.**	
	Water management	■ Specific cases of Water Management: - Example of Friesland region in The Netherlands (lecture from Friesland region water board + boat trip). - At the European Level: presentation of Integrated Management of Water Resources (lectures and serious game) ■ Sustainable Water Technology: visit of WETSUS center of excellence for water technology (Leeuwarden) + CEW (Center of Expertise Water Technology) ■ About Groundwater topic: field visit (groundwater sampling tools) + practical (groundwater quality) ■ Other field visits (visit of the biggest groundwater pumping facility of The Netherlands…)
	Sediment management	■ Specific approach of sediment management in The Netherlands: lectures and field visits (dredging work/deposit places/sludge treatment facility…) ■ Specific approach of sediment management in France: lectures and field visits.
	EVALUATION	Practical in lab, group assignments and individual written exam based on the lectures, visits.

audit practices

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Julien Castelin	English

MAIN OBJECTIVES	The learning outcomes of this teaching unit are to train students in audit practices and for them to understand the different types of audits (internal, external, follow-up, renewal etc...).
SKILLS DEVELOPED	The main skills developed are: ■ Organizational management of an audit: Planning, opening meeting, carrying out the audit, closing meeting, audit report... ■ Soft-skills learned during the audit: active listening, goodwill, advice ■ Analytical mind ■ Typology of deviations
CONTENT	■ The key steps for a successful audit will be introduced and discussed ■ The teaching unit will combine theoretical lectures, based on internal audit standard NF EN ISO 19011 and case studies. ■ The most popular ISO standards (Quality management, Environmental management...) will be used to train students. ■ Students will have the opportunity to lead their own audit.
EVALUATION	■ In groups, students will conduct an internal audit.

specialization: sustainable management of pollution

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	30	Julien Castelin	English

	OBJECTIVES & SKILLS DEVELOPED	The learning approach of the program is essentially multidisciplinary, dealing with the management of contaminated sites from the technical, scientific, economic and sociological angles. The specific objectives of this semester are to provide students with knowledge on: ■ Pollution treatment techniques (treatment of water, effluents); ■ The different remediation techniques (physico-chemical treatment, bioremediation, phytoremediation ...) ■ Social management of contaminated sites and selected management methods (social acceptance, socially positive use of the restored site, integration of the surrounding populations in the rehabilitation process...); ■ Economic evaluation of management methods (cost evaluation, choice of alternative uses for contaminated areas) ■ Possible rehabilitation methods (spatial planning, landscape management)
	CONTENT	The academic Semester (September to end of January) is composed of: ■ A two-week study tour with our partner university 'University of Chemistry and Technology' in Prague (September); ■ Multiple courses, case studies, group work, site visits, ■ Participation to professional and/or scientific conferences, in France or abroad, in which students will be able to meet the actors involved in management of polluted sites and soils, whether from the scientific or professional world and thus develop their network; ■ Self-directed time slots for the Semester project or the various projects included in different teaching units. The courses are mainly provided by specialists, professors or professional experts working in the different areas of interest of the program. The second semester of the program corresponds to the end-of-study internship (30 ECTS), which student can carry out in a company, consulting firm, research laboratory, in research and development, etc. in France or abroad.
	EVALUATION	Continuous assessment (individual & group) and individual written exams at the end of the semester For the Semester project: Oral defense, final written report and evaluation done by the "client"
TEACHING UNITS (5 modules)	Applied techniques of pollution remediation	■ Physical and chemical treatment techniques ■ Biological treatment technique ■ Phytoremediation
	Sustainable management of polluted areas	■ Alternative use of polluted sites & sustainable management of polluted areas ■ Ecological restoration & landscape management
	Applied Statistics	■ Computer and statistical tools
	Project Management	■ Professional semester-long project ■ Responsiblity: promotion/communication/sustainable projects
	Assistant Engineer Internship	■ credts allocated to the defense of the internship report

In addition, French as a foreign language courses are proposed to English-speaking students, as well as business English courses to French-speaking students through the whole academic semester spent at Junia ISA.

JUNIA ISA

department of food science

Master of Science and Engineering Program

Junia ISA's Food Science program aims to give students:

- an international view of food safety regulations and standards, highlighting local and international specificities,
- tools to assist food companies in setting up systems (HACCP, BRC, IFS, SQF, ISO 22000, FSSC 22000, ISO 14001 and ISO 9001) and performing audits (preparation for internal auditor certification exam),
- an overview of theories, concepts and methodologies of company resource planning systems,
- a practical view of food industry management, through lectures and seminars by professionals of the sector,
- methods to manage projects in an international context, with multicultural staff.

LEARN MORE AT ISA-LILLE.FR

MASTER 1 - FALL SEMESTER	ECTS
Welcome Session	6
Food Tech Project - Introduction	6
Quality Assurance and HACCP	3
Unit Operations	6
Data Analysis and Applied Statistics to Agrofood	3
Bioprocess	3
French as a Foreign Language	3

MASTER 1 - SPRING SEMESTER	ECTS
Agrofood Professional Project	3
Production Management	3
Product Formulation or Food Tech Project	6
Ingredients	3
Nutrition	3
Sensory Evaluation	3
Packaging and Ecodesign	3
Physical, Chemical, and Microbiological Characterization of Food Products	3
French as a Foreign Language	3
Summer Internship	6

MASTER 2 - FALL SEMESTER	ECTS
Two Specialization Options: ■ Sustainable Product Development: Ecodesign of Food Products ■ Quality Management Systems in the Agrofood Sector	30

MASTER 2 - SPRING SEMESTER	ECTS
Final Internship	30
Six-month Professional Experience	
Written Report and Oral Defense	

contact

Caroline Kaczmarek, Academic Advisor
caroline.kaczmarek@junia.com

food tech project - introduction

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	6	Vincent Dumortier Emmanuelle Martin	English

MAIN OBJECTIVES	■ Refresher course in biochemistry and food microbiology. Acquisition of laboratory techniques. ■ Mobilize knowledge and skills in food science to resolve a concrete technical issue presented in a professional setting. The project will be presented in the form of a problem arising in an industrial context (either an exterior sponsor or at Junia ISA with a link to an external study).
SKILLS DEVELOPED	■ Work in a team with colleagues and in collaboration with the school or partner firm and use project management tools. ■ Produce results in a rigorous and professional manner.
CONTENT	■ Around 100 hours dedicated to the projects ■ Microbiology: class, practicals, case study ■ Biochemistry: class, practicals, case study ■ One full week dedicated to a case study ■ Bibliographical study/latest developments on the project; proposition of an action plan and a methodology for addressing the issue; Experiment design; Critical analysis of results, summary report of work done.
EVALUATION	■ Intermediate evaluation (report and presentation of case study results): 75% ■ Final evaluation: Poster (s): 25%

quality assurance and haccp

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	Caroline Kaczmarek	English

MAIN OBJECTIVES	■ Understand the concept of quality, its added value and impact ■ Understand how to define quality in a particular context
SKILLS DEVELOPED	■ Identify links between food regulations and HACCP ■ Create a process diagram: description of the purpose and benefits of process mapping ■ Develop the HACCP methodology
CONTENT	The principles of quality and of the HACCP methodology. Lectures, tutorials and company visit. ■ What is quality, what are the principles of quality, how to develop a quality management system? ■ Focus on ISO 9001, quality standards, labels and strategies ■ Continuous improvement and problem solving tools ■ Presentation of the food hygiene package ■ Process mapping : SIPOC, Top Down, Functional Deployment approaches ■ Study of the prerequisite programs ■ HACCP : 12 steps for 7 principles.
EVALUATION	■ Written reports

unit operations

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	6	Alexandre Berth	English

MAIN OBJECTIVES	Unit Operations in Agri-Food Engineering deals with the design and selection of process equipment or process plants. Each piece of equipment that could be combined to make a “unit” in a process should have a clearly defined function. For example: mixing, separating solids and liquid, separating mixtures from fluids, size separation of solid particles, or transport of a fluid. The number of the most important and basic Unit Operations is not very large and are governed by the fundamental laws of mathematics, physics, chemistry, and mechanics, which provide an approximate description of the real processes. The ‘Unit Operations’ concept allows for the analysis of unit operations in terms of fundamental principles such as mass and energy balances, phase equilibria, and transport of momentum, energy and mass. In this course we examine a systematic way of approaching design and selection of process equipment.
SKILLS DEVELOPED	■ Name the main unitary operations used in the industry, give specific definitions of them and sort them into relevant categories. The operations evoked in the course are sterilization, frozen, filtration, drying, atomization (spray drying). ■ Name several precise examples of industrial applications for each unitary operation ■ Describe precisely the working principle of each unitary operation both at the macroscopic scale (in flow, out flow, energy flows) and at the microscopic level (particle, interface, molecule). This description will concern both the physical and chemical phenomena involved and the thermodynamic and kinetic constraints that dictate the separation. ■ Identify to operating parameters that determine the efficiency of each process ■ Calculate mass and energy balance for discontinuous, semi-continuous and continuous processes and dimensioning the facilities that allow to perform them ■ Re-write and interpret the main mathematical developments that lead to the useful equations for process dimensioning and remember at the same time what are all the simplifying hypotheses that must sometimes be used to establish models and dimensioning methods. ■ Apply empirical, analytical and graphical methods classically used for unitary operation dimensioning. ■ Gather information (field visits, literature search, interviews, etc.) on a unitary operation involved in an existing industrial process and elaborate a critical analysis of this step of the process, describing its interactions with previous and subsequent steps, evaluating if its operating conditions are optimal and providing recommendations for improvement (in addition to technical and economic criteria, the standards of ‘sustainable development’ will also be used as evaluation benchmarks).
CONTENT	Lectures, practical class, visits of food plant, project. Topics covered: ■ Thermal unit operations (evaporation-concentration, spray-drying, heat treatments). ■ Mechanical processes for physical separation: sedimentation, decantation, centrifugation, filtration, cycloning, membrane separation, solid-liquid extraction. ■ Drying processes: drying, lyophilisation, atomisation. ■ Diffusion, mass transfer and energy transfer between phases (diffusion theory, mass transfer coefficients, film theory). ■ Phase equilibrium.
EVALUATION	■ Written reports on practicals, written exam

data analysis and applied statistics to agrofood

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	Pierre Vandendriessche	English

MAIN OBJECTIVES	To take into account the multiple backgrounds, this course is designed to improve basic and advanced knowledge of statistics and probabilities
SKILLS DEVELOPED	■ Being able to master all relevant statistical tools related to statistical quality control, process control and R&D in Food Science.
CONTENT	Tutorial class essentially, interactive lecture, problems, real case studies ■ Basic Statistics: tables, charts ■ Numerical descriptive measures ■ Basic probabilities (events, Bayes, conditional) ■ Discrete distributions (Binomial, Poisson, Hypergeometric…) ■ Continuous Distributions (Normal, Fisher, Student…) ■ Sampling ■ Confidence Intervals (mean, proportion…) ■ Hypothesis Testing ■ Single and Multiple Sample tests (parametric and non parametric) ■ ANOVA (one way, two ways, randomized block design) ■ Post Hoc Tests (Tukey…) ■ PCA, CA, HAC, MCA
EVALUATION	Presentation of case study analyze in groups of 3 or 4 students. ■ 50% written presentation (Power point) ■ 50% oral presentation

bioprocess

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	Caroline Choma	English (french in semester 2)

	MAIN OBJECTIVES	Discoveries and uses of biotechnology and bioprocesses – agro-industry and agriculture applications. In this teaching unit, students will have a view on the complexity of bioprocesses: ■ Microbial biomass production; ■ Fermented foods production; ■ Biomolecules used in food industries, food products and agriculture
	SKILLS DEVELOPED	■ To comprehend the complexity of bioprocesses; ■ To better grasp the opportunity to participate in the development and implementation of strategies and action plans for a sustainable food industry; ■ To analyze and solve quality problems associated with fermented foods or compounds obtained thanks to the use of bioprocesses (from a scientific and technical point of view).
CONTENT	**Lectures/conferences; Visiting companies (Roquette, DSM, Lesaffre, etc); Tutorial work and/or Practical work (biomass production and yield of production calculation)**	
	Introduction	■ bioprocesses and biotechnology definitions
	Microorganisms potentialities	■ What are they? and their life dissection (nutrient requirements; biomass production & anabolism; growth phases)
	Various uses, industrial applications	■ What characteristic/specificity of a microorganism is used and for what application or which final industrial product? (Primary and secondary metabolites; Enzymes...).
	Processes and equipment/ how to manage bioprocesses	■ Biomass production; Equipment: and their control devices; Culture management.
	Optimization and perspectives	■ Optimization and perspectives
	EVALUATION	■ Written works

agrofood professional project

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Caroline Kaczmarek	English or French

MAIN OBJECTIVES	The student must be able to: ■ define his/her professional project ■ identify and illustrate his/her personal and technical skills ■ understand the concepts of the charter of written work and write the presentation of the company part
SKILLS DEVELOPED	■ Design a CV (personal and technical skills) ■ Definition of the professional project and of the internship research according to it ■ Development of the communication skills (presentation, general communication, interviews) ■ General understanding of the charter of written work ■ General understanding of the basics of an internship report
CONTENT	■ Skills and jobs in the food sector ■ CV and cover letter ■ Networking (LinkedIn) ■ Mock interviews ■ Written report workshops
EVALUATION	■ CV ■ Written report

production management

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Pierre Vandendriessche	English

MAIN OBJECTIVES	■ Discover and understand the typical organization of a food production company (business processes, departments, jobs and missions) ■ Discover and understand the various flows involved ■ Reflect on team management skills
SKILLS DEVELOPED	■ Discover and understand the key business processes involved in an industrial food production environment ■ Acquire the fundamental vocabulary related to industrial food production and supply chain ■ Understand the data required in how it is structured / managed ■ Understand the physical, data and financial flows ■ Discover the use of an ERP system ■ Understand the junior team manager's legal framework ■ IT skills: how to structure data and produce sensible KPIs ■ Running supply chain processes in an ERP system ■ Reflect on the knowledge and behavior of the junior team manager in a food factory ■ Adapt to social context
CONTENT	Lectures, tutorials, visit of food plant, serious game. ■ Industrial organization ■ Material handling ■ Demand and supply planning ■ Labor & HR ■ Specific software: ERP (SAP) and data visualization (Tableau)
EVALUATION	■ Exam, serious game results (ranking against other competing teams)

product formulation

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	6	Emmanuelle Martin	English

MAIN OBJECTIVES	Propose a methodology based on the benchmarking of a food product available on the market - to develop a prototype with physicochemical and sensory characteristics the closest as possible to the target.
SKILLS DEVELOPED	■ Design a food product. ■ Determine the appropriate microbiological and physicochemical analyses. ■ Understand ingredients-ingredients and ingredients-process interactions. ■ Carry out the sensory evaluation of a food product by using adapted methodology. ■ Analyze the results, propose clear recommendations and communicate them.
CONTENT	■ Project – group work. Use of laboratories (Microbiology, chemistry, sensory analysis). ■ Tools to help in the formulation and design of products ■ Project of bench marking of a food product ■ Rapid techniques of microbiological controls ■ Sensory evaluation: discriminative techniques
EVALUATION	■ Intermediate and final assessment

food tech project

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	6	Vincent Dumortier	English

MAIN OBJECTIVES	■ Mobilize knowledge and skills in food science to resolve a concrete technical issue presented in a professional setting. The project will be presented in the form of a problem arising in an industrial context (either an exterior sponsor or at Junia ISA with a link to an external study).
SKILLS DEVELOPED	■ Work in a team with colleagues and in collaboration with the school or partner firm and use project management tools. ■ Produce results in a rigorous and professional manner.
CONTENT	■ Group work - Learning by technical case study - A project is completed successfully by a group of 3-4 students, supervised by a permanent teacher. Five main topics on food could be proposed: Analytic - Method - Raw Materials or Ingredients - Microbiology or Sensory ■ The overall work period for a project is approximately 150 hours linked with 12 full project days during the semester. As a general rule, every Tuesday for 8 weeks, plus one full week reserved especially for projects. ■ After a session for presenting the projects and training in project management, the work is completed autonomously (conception of experiments) with technical supervision (pilot food plant or laboratory). ■ Bibliographical study/latest developments on the project; proposition of an action plan and a methodology for addressing the issue; Experiment design; Critical analysis of results, summary report of work done ■ Examples of project: Limit of the Brix Method for the determination of dry material - Dosage of sugar by HPLC - Enzyomes and fruit juice - Reserve osmosis - Feasibility study of putting into kegs - Candying - Egg whites/ Meringue - Tomato sauce: effects of texturizers - Study of the Maillard reaction - Study on biofilms - Setting up a new sensory analysis test.
EVALUATION	■ Presentation and report or other deliverable for the partner firm

ingredients

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Emmanuelle Martin	English

MAIN OBJECTIVES	■ To have basis knowledge of ingredients to formulate food products. ■ Acquire knowledge to understand food formulation ■ Know functionalities and implementation of main ingredients and additives used in food industry ■ Food regulation
SKILLS DEVELOPED	■ Know how to propose a list of ingredients in adequation with desired formula
CONTENT	Lectures by professionals and practicals on: ■ food formulation ■ study of main ingredients, additives and processing aid (functionality, implementation, storage and preservation) ■ aromas ■ food regulation ■ practical with gelling agents and thickeners
EVALUATION	■ 70% individual written final exam ■ 30% Report or oral defense in a group

nutrition

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Lucile Gaberel	English

MAIN OBJECTIVES	■ Acquire fundamental notions of nutrition. ■ Understand the importance of nutrition in an agrifood company and its place in strategy, communication, new product development, etc. ■ Know the regulations about food and nutrition labeling. ■ Have an overview of nutrition issues and politics around the world.
SKILLS DEVELOPED	■ Calculation of a human food ration and of the nutritional values of a food product ■ Nutritional audit approach ■ Researches on official websites

CONTENT	■ Fundamentals in nutrition: nutritional needs for different groups of population, balanced diet, link between nutrition and health ■ Regulations about food and nutritional labeling ■ Nutrition approach in food companies, nutritional audit methodology ■ Nutrition situation and policies around the world ■ Visit of Danone Research Center
EVALUATION	■ Oral presentation 40% ■ Written exam 60%
PROGRAM	
1- Lecture	■ Nutrition basics ■ Balanced diet
2- Lecture	■ Balanced diet ■ Practical ■ Food ration calculation
3- Lecture	■ Specific populations nutritional needs ■ Health issues related to nutrition
4 & 5- Lecture + practical	■ Nutrition labeling ■ Self-directed time ■ Research for group project
6 & 7- Outing	■ Danone Research Center
8- Lecture + practical	■ Nutrition in an agrifood company ■ Nutritional audit approach
9- Oral presentation	■ Group project
10	■ Exam

sensory evaluation

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Laureen Simon	English

MAIN OBJECTIVES	■ This course is dedicated to students interested in Quality, R&D and Marketing departments of food companies. ■ Knowing the different categories of sensory tests, their methodology and their applications in food industry
SKILLS DEVELOPED	■ Conducting a sensory test from A-to-Z ■ Analyzing and interpreting sensory data with statistical tools ■ Reporting sensory results in a professional style
CONTENT	Sensory evaluation is a unique discipline, today integrated in the decision making of many food and non-food companies. It is used to study the consumers' preferences, to describe a market. The sensory characteristics of a product and/or its presentation need to be considered from its conception, and then followed during production to guarantee the quality and the success of the product. The knowledge of sensory properties is regarded as a major control key of the quality perceived by the consumers. Lectures, Practicals/Tutorials, Group project on: ■ Fundamental principles of sensory evaluation ■ Basics of sensory physiology ■ Setting up of sensory evaluation: sensory lab, assessors, sample presentation ■ Discriminative tests: triangular test, duo-trio, etc. ■ Descriptive tests: QDA profile, alternative methods (Flash, CATA, tri, etc.) ■ Consumer tests ■ Preference mapping
EVALUATION	■ Group written report ■ Group oral presentation ■ Individual exam

packaging and eco design

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Emanuelle Martin	English

MAIN OBJECTIVES	■ Give an overview of the various packaging materials and their properties ■ Understand all the chain of the packaging of the expectations of the marketing to the logistics of associated distribution. ■ Eco-design: know how to propose the best possible compromise ■ Co-design
SKILLS DEVELOPED	Know how to determine the nature of packaging, understand their roles according to their characteristics, know the associated logistics and estimate their environmental performance
CONTENT	**Courses and conferences** - to acquire the fundamental on packaging **Sessions of codesign** - to bring a practical answer to a problem packaging put by an industrialist ■ Presentation and definition of the packaging and the market ■ Raising sensitization to the analysis of the value on packaging materials ■ Functional analysis of packagings used in food-processing industry ■ Evolution of materials, permeability and interactions food / materials ■ The processes of packaging used in food industries ■ Regulations on packagings food ■ Chemistry of plastics ■ Context Stakes and method of ecoconception(ecodesign) of packaging ■ Study of project in sessions of codesign
EVALUATION	■ Oral defense in groups

physical, chemical, and microbiological characterization of food

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	6	Vincent Dumortier	English

MAIN OBJECTIVES	This option is intended for students interested in R & D services, Quality or Production in agro-food industries. It is a technical approach to food science. Food products will be studied through three analytical domains: ■ Physico-chemical ■ Rheology ■ Microbiology
SKILLS DEVELOPED	Contribution to knowledge of food composition through physico-chemical analysis ■ Technological characterization of food through rheological or colorimetric analysis ■ Microbiological characterization of foods ■ Improvement of the student technical skills through new technologies and procedures of chemical, and physical characterization of food ■ Acquisition of a critical mind towards analytical methods, procedures and their results
CONTENT	Lectures, practicals, visits ■ Biochemical and nutritional analysis (fats, proteins, carbohydrates, dry matter, minerals, vitamins...) ■ Physical analysis (rheology of solid, liquid, colorimetry of food...) ■ Interpretation of experimental data ■ Microbiological analysis of foods ■ Visit of a food analysis laboratory Practical cases of analytical characterization will be carried out on the food-products that it will be duplicated in Project in Food Sciences – Formulations.
EVALUATION	■ Written reports (practicals) ■ individual written exam

specialization: food quality and ecodesign

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	30	Caroline Kaczmarek	English

OBJECTIVES & SKILLS DEVELOPED	Nowdays the food supply chain must be managed through a strong quality culture and a sustainable approach. The consummers expectations on products are focused on safety and respect towards the environment. Skills developped : ■ The ability to develop an integrated management system dealing with safety risks, food fraud, food defense, environmental risks, security ■ To be able to identify relevant environmental aspects across a food product life cycle and promote strategies to integrate sustainability at each step of the activities (sourcing, innovation, production...) ■ The ability to develop a CSR strategie ■ The capacity to develop the right methodology and use scientific knowledges to solve problems ■ The ability to manage several projects in a sustainable way
CONTENT	General organization : lectures, tutorials, group projects, visits and testimonies. ■ Food safety (Food safety management systems, Food defense, Food fraud, Hygenic design of equipments) ■ Environnement, security and risk management (ISO 14001, Security, Switching towards organic certification) ■ Strategies (Ecodesign strategies (sourcing procurement decisions, food product design, environmental, impact of processes, packgings, logistic...), Decision making tools = life cycle analysis...) ■ CSR (Corporate Social Responsibility) concepts (Moving towards a CSR strategy, Communication) ■ YES project : multidisciplinary project for a company (project realized by a group of students)
EVALUATION	■ Continuous assesment ■ Oral presentations ■ Exams

specialization: Nutrition and Health

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	30	Lucile Gaberel	70 % English 30 % French

OBJECTIVES & SKILLS DEVELOPED	■ Integrate the nutrition and health dimension into product development => Acquire the fundamentals of R&D of food products and the specificities of formulation with a nutrition objective, the knowledge of the food / health links, the nutritional needs and expectations of the consumer, the health impacts of technical choices ■ Guide the strategy of the company => Be able to make strategic choices for the development of healthy foods, take into account public policies and regulations in the formulation of products, communicate on the nutritional advantages of products
CONTENT	General organization : lectures, tutorials, group projects, visits and testimonies. ■ Product formulation and developement ■ R&D strategy and tools ■ Challenges for food companies ■ Basics of nutrition and food sociology ■ Nutrition specificities per group of population and pathologies linked with nutrition ■ Strategies in nutrition and health ■ Decision making tools ■ YES project: multidisciplinary project for a company (project realized by a group of students)
EVALUATION	■ Continuous assessment ■ Oral presentations ■ Exams

JUNIA ISA

department of agricultural economics, marketing & management

master of science and engineering program

Junia ISA's Agricultural Economics, Marketing and Management program aims to give students:

- an international view of the issue of agricultural trade and finance, highlighting certain national and/or regional specificities
- the necessary tools to manage business development and communication
- the necessary tools to manage agricultural trade, from purchase and procurement to industrial marketing and consumer behavior
- a practical view of site management, thanks to lectures and seminars by experts in the field
- methods to manage projects within an international context, with multicultural staff.

LEARN MORE AT ISA-LILLE.FR

MASTER 1 - FALL SEMESTER	ECTS
Welcome Session	6
Introduction to Finance	3
Export	6
Decision Tools: Statistics and Market Research	3
Introduction to Marketing	3
French as a Foreign Language	3

MASTER 1 - SPRING SEMESTER	ECTS
Purchase and Procurement	3
Trade Negotiation	3
Business Development Project	6
Digital Business	3
B-to-B Marketing	3
Leadership Management	3
Management Control	3
Financial Analysis	6
Consumer Behavior	3
French as a Foreign Language	3
Summer Internship	6

MASTER 2 - FALL SEMESTER	ECTS
Management Option - Trade & Agribusiness	30

MASTER 2 - SPRING SEMESTER	ECTS
End-of-Study Internship	30
Six-month Professional Experience	
Written Report and Oral Defense	

contact

Sophie Gozdziaszek, Academic Advisor
sophie.gozdziaszek@junia.com

introduction to finance

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	Van Hong Vu	English

MAIN OBJECTIVES	■ Understand and master the technical skills to analyze financial statements. ■ Learn French accounting standards and how managerial decisions affect financial reports. ■ Be able to construct, read and analysis the three most common financial statement: the income statement, balance sheet and cash-flow statement. ■ Be able to make a cost accounting analysis.
SKILLS DEVELOPED	■ Be able to understand how firm decisions affect a financial report. ■ Be able to analyze firm financial health.
CONTENT	■ Generality about accounting ■ The Balance sheet and Income Statement: - How to construct them? - How to analyze them? ■ The Cash-flow statement: construction and analysis ■ Cost accounting analysis: from the raw material to the finished good, how much does it cost?
EVALUATION	■ Written exam and a firm financial analysis

export

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	6	Xavier Alix	English

MAIN OBJECTIVES	■ Have a comprehensive vision of the different aspects of the export function in a business; ■ Be ready to develop an export strategy; ■ Be aware of consequences and risks of an export strategy for the business
SKILLS DEVELOPED	Be able to assure the management of the export function in a food-processing company, an agricultural supplies business, or, more generally, any company that would like to develop an export business.
CONTENT	■ Diagnosis and strategy (Study and choice of markets, prospecting, organization and sales offer) ■ Tools and techniques (transportation of goods, customs, calculation of a sale price export, international sale contract) ■ Financing and risk management (reassurance of payments, documentary credit, cover (blanket) of the foreign exchange risk)
EVALUATION	■ Individual written work (30%) ■ Practical study in group (50%) ■ Oral group presentation of their export project (20%)
PROGRAM – Session 1	■ Lecture: Introduction; Important Trade milestones; Recent evolution of international Trade; Regional Trade agreements; Why do companies expand overseas? Why is export complex? How to target a market (4h)
Session 2	■ Lecture: Marketing; Marketing research; Marketing planning; Marketing segmentation; Marketing mix; Promotion; Business planning; Some tools (SMART, SWOT, PESTEL); Marketing plan; Case study; Data collection (4h)
Session 3	■ Lecture: Ensure the presence of products on the market; Entry strategies; Various ways to implant in the targeted country (licensing, foreign direct investment, etc.) (4h)
Session 4	■ Lecture: Building commercial policy; Exporting; Product; Exporting cost, pricing and sale; promotion; Countertrade, International contracts (4h)
Session 5	■ Lecture: WTO and regulation of international trade; Dispute settlement; world events and their consequences on business: how to prevent issues and adapt the business (4h)
Session 6	■ Lecture: Transport and logistics; Infrastructures; Terms of Trade = Incoterms, International ocean, air, land and multi-modal transportation; Packaging for export (4h)
Session 7	■ Lecture: International logistics security; Documentation and customs procedures; Custom clearance; Payment; Basic business finance; Finance for international Trade; Terms of payment (4h)
Session 8	■ Lecture: Currency of payment; Managing transaction risks; International commercial documents; International Insurance; Visit and comments of website on main international trade actors (International Chamber of Commerce, etc) (4h)
Session 9	■ Lecture: Using international logistics for competitive advantage; suppliers and support organization; exchange and questions about the full course; Preparation of the week-long project (4h)
Week-long project	■ Group work: the students will be asked to prepare a full project of export of a product overseas, with the description of all steps, from the decision to export to the delivery of the products and their payment, and with costs impact (35h)

decision tools: statistics and market research

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	Amar Djouak	English

MAIN OBJECTIVES	This unit aims to put knowledge acquired in the field of statistics and marketing at the service of a specified problem. The scope may apply to agriculture, agri-food, environment or landscape fields of study. This approach will enable students to put into practice the acquired knowledge to analyze and solve a given problem.
SKILLS DEVELOPED	To carry out a quantitative survey, for example in the context of a market study, from planning to statistical analysis and results synthesis.
CONTENT	■ Quantitative surveys: methodology and tools ■ Descriptive and inferential statistics ■ Putting into practice acquired notions by carrying out a case study (survey)
EVALUATION	■ Oral group exam

introduction to marketing

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	Julie Christiaen	English

	MAIN OBJECTIVES	To introduce students to strategic issues concerning international marketing, mains steps of the identification of a market, and marketing mix adaptation to an international and multicultural environment.
	SKILLS DEVELOPED	Based on the international environment context: ■ To analyze a foreign market and identify opportunities and threats ■ To recommend relevant marketing strategy for a company ■ To understand, create/adapt a marketing policy to international markets ■ To prepare a marketing plan and financial recommendations to be submitted to the management of a company or external financial investors ■ To communicate and make a professional business presentation in a multicultural environment
	CONTENT	■ **DISCOVER and LEARN** Theoretical approach to international marketing issues: strategic marketing, research marketing and operational marketing, financial decisions ■ **PRACTISE** Through a case study: multicultural marketing teams work on a product to be launched in a new country; based on a market study, give recommendations regarding marketing strategy, marketing policies and financial decisions.
	EVALUATION	■ Oral presentation on case study (80%) ■ Written recommendation to convince external financial investors (20%)
PROGRAM	Session 1 & 2	■ Lecture: International marketing strategy (8h)
	Session 3	■ Lecture: Market study in an international context (4h)
	Session 4	■ Lecture: Marketing policies (4h)
	Session 5	■ Lecture: Financial issues (4h)
	Session 6, 7 & 8	■ Case study: launch and coaching /Market study, marketing strategy and marketing policies (12h)
	Session 9	■ Case study: coaching / financial recommendations (4h)
	Evaluation session	■ Oral presentation (4h)

purchase and procurement

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Alain Millecamps	English

MAIN OBJECTIVES	Buying in the head of purchasing in retail or inside a major food supplier is not the same on a daily basis. This program integrates the different levers, constraints, methods and interactions of the purchasing process.
SKILLS DEVELOPED	■ Manage the “7-step supply” general process. ■ Purchasing negotiation skills. ■ Common focused practices and key differentiated processes following markets. (Retail, Industries, small companies, importation, distribution channels…)
CONTENT	■ A business case study focused on purchases enable the students to implement a purchasing plan. In detail, the focus is done by different professionals: ■ The strategic dimension of the function ■ The variables of the function ■ The marketing of purchasing and segmentation ■ Strategy implementation ■ Sourcing methods ■ RFI, RFQ, contracts ■ Negotiation skills ■ Supply chain ■ Supplier Relationship management ■ Sustainable purchasing
EVALUATION	■ Participation: 25% ■ Presentations: “Purchasing Game”: 75%

trade negotiation

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Alain Millecamps	English (french in another period of s2)

MAIN OBJECTIVES	To be able to negociate with professional buyers and to understand and plan the different steps of a structured selling appointement.
SKILLS DEVELOPED	■ Assume the sales function in the actual global market. ■ Differentiate between the selling act and the negotiation act ■ Manage the different steps of the selling process
CONTENT	Theory, practice, presentations. ■ The constraints of a commercial call in B to B ■ The sales function in the actual global market. ■ Differentiate between the selling act and the negotiation act as well as prospection and follow up ■ The different steps of the selling process, meaning : - telephone skills - professional preparation - introducing yourself - understand the customer's concept - doing the pitch and deal with the objections - negotiate with the relevant major tools - close the sales and contractualize - follow up ■ Understand the purchasing approach ■ Key Account Management process
EVALUATION	■ Continuous assessment

business development project

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	6	Alain Millecamps	English

MAIN OBJECTIVES	This module aims to provide complementary knowledge that will enable the students to build a business plan. This approach is useful to launch a product range, a new business unit or set up a company.
SKILLS DEVELOPED	The students will be able to: ■ run a structured market survey ■ challenge a concept towards a B to C or B to B target with the relevant marketing tools, for instance questionnaires or insights ■ build a marketing plan ■ design a virtual company structure able to support the activity ■ implement the concept through an income statement ■ write a business plan
CONTENT	■ general marketing skills ■ advanced marketing skills like market surveys and questionnaires ■ commercial skills, forecasts ■ general financial skills ■ advanced finance concepts like cost per unit, income statement ■ technical constraints ■ business model and business plan
EVALUATION	The integration of those concepts is implemented in a business case study, which is the final deliverable. ■ Project report: 50% ■ Final presentation: 50%

digital business

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Marc-antoine D'Hulst	English

	MAIN OBJECTIVES	■ Understand the digital world: changes and issues ■ Gain knowledge of how E-commerce and Digital Marketing work (levers and tools) ■ Perceive the importance of data, performance indicators and analysis tools ■ Understand the evolution of the customer relationship
	SKILLS DEVELOPED	■ Analysis of a digital and business strategy (tools, contents, UX Design and datas) ■ Master stages of digital business and understand the particular features ■ Successfully manage a targeted digital campaign ■ Optimize the reference traffic flows and the online sales
CONTENT	**The digital world**	■ Key figures, consumers behaviour, jobs and vocabulary
	On-line business	■ Trading practices, operating mode, tools and developments
	Digital Marketing	■ Strategies, issues, Inbound & Outbound Marketing, User eXperience (UX) Design, Social Networks and SMO (Social Media Optimization), content management, SEO (Search Engine Optimization) and SEA (Search Engine Advertising)
	Data	■ Data acquisition chain, Key Performance Indicators and reference traffic flows optimization
	Consumer service	■ New expectations, consumer supports and digital content, risks and benefits
	EVALUATION	■ Online multiple choice or true/false quizzes on best practices ■ Workshop and oral presentation on a digital strategy for launching an E-commerce website
	PROGRAM	■ For this program, the objective is to alternate theoretical knowledge and practical highlights

b-to-b marketing

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Ulku Tarhan	English

PREREQUISITES	■ Fundamental aspects of marketing – Concepts, methods, tools knowledge
MAIN OBJECTIVES	■ To introduce and train students to specific characteristics of BtoB marketing.
SKILLS DEVELOPED	■ To be able to figure out how to work through BtoB marketing issues, using relevant tools and methods.
CONTENT	■ Global view: BtoB marketing specificities ■ BtoB Market research ■ Strategic BtoB Marketing ■ Marketing policies applied to BtoB
EVALUATION	■ Individual assessment
PROGRAM	■ **Learn:** Theoretical courses ■ **Practice:** tutorials ■ **Discover:** Professional experience presentations

leadership management

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Simon Owen	English

New Course - details available soon

management control

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Van Hong Vu	English

	MAIN OBJECTIVES	■ Introduce the concept and role of controller in the management performance system ■ Help to understand the methods of measuring performance ■ Describe how to measure the organization performance by financial indicators and dashboards ■ Have a basic understanding of problems and difficulties related to management control ■ Be able to relate knowledge acquired in this course to knowledge acquired in other courses
	SKILLS DEVELOPED	■ Identify the control process and the performance measurements systems ■ Recognize the main financial indicators in measuring's organisation's performance ■ Differentiate between the performance management dashboard and panoramic dashboard and understand how to construct and analyse these dashboards critically (objectives and principles) ■ Identify the key stakeholders in management control process that enable to deal/interact with
	CONTENT	■ Introduction to management control ■ Defining the performance of an organisation; ■ Measuring an organisation's performance financial indicators ■ Objectives, general principles and building performance management dashboards; Coordinating a system of dashboards ■ Business planning for organization ■ Analysing results using the cost accounting approaches and dashboards ■ Key roles in the management control process ■ Case study
	EVALUATION	■ Final Exam: - Type performance: 20 - Grade ratio: 60 % ■ Final Assignment: - Type performance: 20 - Grade ratio: 35 % ■ Attendance - Participation - Homework - Type performance: 20 - Grade ratio: 5 %
PROGRAM	**REQUIRED TEXTBOOK AND MATERIALS**	■ Fundamentals of Management Control, (Françoise Giraud, Philippe Zarlowski, Olivier Saulpic, Marie-Anne Lorain, François Fourcade, Jeremy Morales (Pearson, 2011) ■ 2 PowerPoint Slides, exercises TD, Glossary ■ Calculator. The use of a programmable calculator, telephone portables or any electronic devices on the exams will not be allowed.
	BOOK READINGS AND HANDOUTS	■ To gain a complete understanding of the course material it is important to attend all lectures, sections, read assigned study objectives from the required text, complete all assigned homework plus work additional problems during the lecture as deemed necessary. ■ In addition, I recommend each student print and have the section PowerPoint slides available during lecture. The benefit of having the slides available during lecture is to reduce the need to take detailed notes taking lectur

Continued on next page

management control (suite)

PROGRAM	General introduction about the management control (2h)	■ The control process ■ Performance measurement systems ■ Management control in large corporations
	Defining the performance of an organization (2h)	■ Definitions of performance ■ The performance model of an organization ■ Managing the balance between stakeholders ■ Managing multi-dimensional organisational performance
	Measuring an organisation's performance financial indicators (4-6h)	■ Introduction the main financial indicators ■ Analyse the advantages and limitations of financial indicators ■ Introduction the measuring the performance of an organization's entities from financial approaches
	Dashboards in management control system (4-6h)	■ Introduction objectives and principles assigned to dashboards. ■ Building performance dashboard. ■ Building "panoramic" dashboards. ■ Coordinating a system of dashboards: the architecture and the applied methods
	Business Planning (4h)	■ The principles of planning: main purpose, basic functions, functions linked to organization ■ The operational implementation of business planning
	Analysing results (6h)	■ The objectives and principles of results analysis ■ Results monitoring using a cost accounting approach ■ Results monitoring with dashboards ■ Other methods of analysing results
	The key roles in management control (4h)	■ The stakeholders in the managements control process ■ The controllers and performance management dynamic
	The Environmental Services Case Study (4h)	Optional

Previous page

financial analysis

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	6	Sophie Gozdziaszek	English

MAIN OBJECTIVES	Analyze and understand the operation of a listed company
SKILLS DEVELOPED	Understand IFRS consolidated financial statements and conduct a financial analysis of a listed company.
CONTENT	■ Understand consolidated financial statements ■ Understand and analyze the IFRS financial information ■ Conduct a group financial analysis and analyze the impact of strategic decisions on financial results ■ Write a well-argued and well-balanced report on a listed company ■ Discover the basis of company valuation
EVALUATION	■ Individual assessment : (30%) ■ A final report (in pairs) : (70%) ■ Oral presentation (20%) ■ Written report (50%) Choose a listed company and analyze their IFRS Consolidated Financial Statements. Prepare a report on this company which should contain : A strategic analysis and a financial analysis of the group

consumer behavior

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Dr. Fatma Güneri	English

	MAIN OBJECTIVES	The aim of this course is to familiarize you with the fundamental concepts of consumer behaviour and the different methods and tools available in companies in order to facilitate the purchasing process. As consumers are hyper-connected, volatile and demanding, marketing must constantly evolve by adopting new methods of analysis and practice to strengthen their customer relationship and offer a convincing shopping experience that must be repeated. Points of sale, distribution channels have multiplied and customer appeal must always be innovative to recruit new consumers.
	SKILLS DEVELOPED	■ Discover the consumer trends and expectations of the 21st century consumer ■ Understand the concepts of consumer behaviour ■ Identify new experiences and cross-channel customer paths ■ Deciphering the marketing challenges and strategies of supermarkets, optimizing the use of digital technology to sell more effectively ■ To know the new types of consumers following technological developments (the effect of artificial intelligence)
CONTENT	**Global informations**	Attendance required at each session, which will be in two parts: ■ Part 1 : The instructor's presentation ■ Part 2 : The group exercise (to be graded by the instructor) Students are expected to: ■ complete assigned readings before each session ■ arrive on time: delays will be marked as absences ■ participate: courses will be very interactive
	DAY 1: Introduction, definition, consumer research and lifestyles - trends	■ Give a project to the students to lead ■ Course on consumer behaviour: definition of the consumer, the customer, the decision-making processes leading to the purchase ■ Trend definition, consumer typology ■ Importance of profiles, lifestyles (INSEE, CREDOC, IPSOS, KANTAR) ■ Customer knowledge: new tools to analyse consumer behaviour, needs and activities on the Internet ■ Focus on Food marketing: revalidation of achievements: market research - importance of the customer in B to C ■ Marketing of sustainable development ■ Project: identify all sites, institutions to be considered, reconstruct the trend tree
	DAY 2: Companies and brands	■ How to establish a lasting relationship with brands: what is a brand, what is its function, its value, what is its interaction with the customer... brand territory ■ Importance of the logo, the slogan, its positioning...importance of creativity ■ Rebuild trust with your customers: needs for explanations, transparency and proximity ■ Involvement of social networks and community managers, relational interfaces ■ The new means of communication: tablet, mobile and TV connected, see omnichannelal ■ Importance of emails in e-business ■ Visualising marketing ■ Project: propose a brand and study it: offer, service, relationship through hyperpersonalization

Continued on next page

consumer behavior (suite)

CONTENT	DAY 3: Creativity/Marketing Session	■ Propose a problem to students ■ Creativity session and idea generation ■ Work on user and empathy ■ Working on a usage scenario: storytelling
	DAY 4: Evolution of the customer /consumer relationship	■ Move from product service to product solution and customer experience to gamification ■ Marketing history and evolution of customer knowledge ■ Evolution of customer relations within the company: product - service - solution - experience - gamification - co-actor and ambassador ■ New approaches to customer relations: Gamification the new tool to solicit the customer ■ Understand the different types of games: interactive game, competition game, challenges ■ Transpose the game world into communication to create buzz and collect customer data ■ Facilitate customer loyalty and attract prospects to their website
	DAY 5: Digital marketing	■ Involvement of digital in marketing ■ How to understand Big Data data and build your marketing strategy ■ Who uses them and how they are used ■ What marketing strategies are in place to influence the potential customer ■ Good knowledge and use of data for more targeted communication
	DAY 6: Merchandising	■ Definition Merchandising: 'a set of studies and application techniques implemented, separately or jointly, by distributors or producers, with a view to increasing the profitability of the point of sale and the sale of products, by constantly adapting the assortment to market needs, and by the appropriate presentation of the goods'. It can also be defined as "all the methods of presentation and valuation of products in a book service sales space". ■ Merchandising content ■ How to set up a sales area ■ The interior and exterior environment of the store ■ Implementation of the product in the shelves ■ The communication ■ The increased reality in the act of purchase
	DAY 7:	■ Exam
	EVALUATION	■ 50% exam ■ 50% final project

Previous page

specialization: management option - trade & agribusiness

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	30	Julie Christiaen	English

	MAIN OBJECTIVES & SKILLS DEVELOPED	Agriculture businesses sell and market their products globally, regionally and locally, leading to many related positions at these businesses. Skills related to selling and marketing products linked to agriculture technical knowledge greatly enhance the success of executives in an agribusiness operation. The main objective of this major is to fit to those expectations, ie. develop essential knowledge and skills for marketing, commercial, retail or consulting duties, focused on Agribusiness sector. Students will develop dual skills necessary in many career opportunities in the Agribusiness sector, dealing with widely differing business environments : ■ Trade and management skills including data analysis, business intelligence, communication, finance, management, marketing and business soft skills. ■ Ability to understand and analyse trade and marketing issues in agribusiness sector through innovative and sustainable agronomic and digital agriculture.
	CONTENT	Agriculture modules will be led by AgriSmart (sustainable agriculture and smart farming) major, business students will then be able to practise and learn with Agriculture students, in a multidisciplinary approach. Different teaching modules and field visits will be organised by the teachers of the Department of Agroeconomics, the department of Agriculture, and professional interventions. The objective is to cross the business and technical approaches in Agribusiness sector. Lectures will be combined with case studies and business game, projects, and professional meetings. Business project will be led by students in partnership with a company or organization. This project corresponds to a real demand and the students (in groups) are in a situation of obligation of result.
	EVALUATION	Assessments will be used and equally distributed between : ■ Individual written assessments ■ Oral presentations ■ Written reports ■ Evaluation based on the participation and professional attitude
TRAINING MODULES	Modules linked to trade and management skills	■ Management toolbox including budgetary control, supply chain management, team management (1 week) ■ Marketing toolbox including brand policy, digital marketing, advertising, data analysis, business intelligence (2 weeks) ■ Trade toolbox including BtoB segmentation, key account management, salesforce management (1 week) ■ Business management case study (1 week)
	Modules linked to technical / agriculture skills	■ Sustainable and Innovative Cropping Systems (2 weeks) ■ Smart Farming (2 weeks) ■ Agriculture, territories and economics (1 week)
	Common modules, including both technical and business skills	■ Business project in agribusiness sector: practise (3 weeks) ■ Farm diagnosis: farm strategy, advices and project on the farm (2 weeks) ■ Agriculture & society: Sustainable and smart agriculture around the world (conference management (1 Week)

JUNIA ISEN

General Information

Master of Science and Engineering Program

Junia ISEN is Junia's Graduate School of electronics and digital technology.

Interested students must have a background in related scientific disciplines. Junia ISEN places students at the crossroads of technology, its applications, and societal issues. Junia ISEN allows each student to reach their full potential by helping reveal their talent through tailored programmes, global-mindedness and interaction with the professional world.

Students pursuing a Master's degree choose one of three specialisations:

- Big Data,
- Embedded Electronics, or
- Software Engineering.

The courses below are common to all Junia ISEN Master programmes.

LEARN MORE AT ISEN-LILLE.FR.FR

MASTER 1 - FALL SEMESTER	ECTS
Java 1	3
Technical Project S1	7
French as a Foreign Language	3

MASTER 1 - SPRING SEMESTER	ECTS
Technical Project S2	7
Three-month Internship	6

MASTER 2 - FALL SEMESTER	ECTS
French as a Foreign Language	2
Innovation Project	9

MASTER 2 - SPRING SEMESTER	ECTS
Final Industrial Internship	30
Six-month Professional Experience	
Written report and oral defense	

java 1

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	M. Morelle	English

PREREQUISITES	■ Basic algorithms and data structures in the computer software
LEARNING OUTCOMES	■ Understand the aims of JAVA programming language ■ Know how to carry out an application in JAVA. ■ Be able to implement the basic notions of the object-oriented programming: inheritance, encapsulation and polymorphism.
COURSE DESCRIPTION	■ General presentation of JAVA programming language ■ Simple objects construction ■ Composite objects construction ■ Inheritance ■ Exceptions ■ Out/Input ■ Threads ■ Introduction to graphical applications development

technical project

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1 & 2	7	JM Capron M. Morelle	English

LEARNING OUTCOMES

- Undertake a study to respond to the need of a company, a laboratory, or a professor. The area of study is unique to each subject; the objective is to apply concepts studied in class and also to enhance knowledge by personal research within the confines of outlined projects.
- Apply project stages in group work.
- Be able to present the work in an academic defense.
- Ensure the project outline is given, and turn in a detailed report that allows for use and follow up of the product developed.

COURSE DESCRIPTION

To begin with, students will choose a subject from a list suggested by instructors. Subjects describe situations where companies would like solutions to a given problem. The areas addressed will cover one or several of the disciplines taught at the university.

The work will be done in groups (of two or more), under the supervision of a teacher who will direct the work. Each group will have the freedom to organize themselves as they wish but must debrief the 'client' and/or supervisors on a regular basis.

In this way, project stages taught in course will be applied in practice. A collaborative website will be used so that each group member, student or supervisor, will be informed of the real working rate of project advancement and may have access to the various working documents.

For a majority of suggested subjects, the study will terminate with the production of a product (application or function).

three-month internship

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	10	E. Litton	English

COURSE DESCRIPTION	The internship is for a minimum period of three months. It is to be made between the first and second year of Major cycle and gives rise to the allocation of 10 ECTS credits without grading. This period is a technical skills application internship in a company or industry. The Board of Studies may permit an internship in a research laboratory on motivated request from the student. The internship is evaluated through a report and verification of skills acquired with the company.

innovation project

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1 & 2	9	D. Boulinguez	English

PREREQUISITES	■ None
LEARNING OUTCOMES	At the end of this study the student is able to: ■ analyse a complex system in the area of his scientific domain ■ conduct a literature study on a well-defined problem and determine the state of the art in the matter ■ propose a solution to a complex technical problem ■ evaluate the proposed solution in terms of performance, fulfillment of the requirements, delay and cost
COURSE DESCRIPTION	The case study's aim is to establish the feasability of a complex system from the specifications provided. The different activities are: ■ establish the state of the art in the area from a litterature study ■ determine the performances that could be expected and refine the specifications ■ propose an appropriate solution in terms of performance, delay and costs ■ evaluate in detail the proposed solution by means of modelling, simulation and in the need arises, the design of a prototype. Deliverable of this work are: ■ litterature study and refined specifications (to be approved by the advisor) ■ report on detailed feasability study ■ oral defence of the study to a Jury The study is done by a small group of students (2 to 4 students)

final industrial internship

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	30	E. Litton	English

COURSE DESCRIPTION

The internship of six months is placed at the end of the study.

It must be done in a company, except for students following a research master programme.

In this internship the student will perform missions equivalent to those of an engineer.

This internship is evaluated by a report, an oral presentation, and the verification of the acquisition of skills with the company.

Validation of the internship is mandatory for graduation, except for students who have completed a 3 month internship in a company and then a full year of studies abroad.

This internship gives rise to the allocation of 30 ECTS credits without grading

JUNIA ISEN

big data

Master of Science and Engineering Program

Big Data describes sets of data being so voluminous and complex that traditional data-processing application software is no longer able to manage the information.

Big Data presents one of the greatest IT challenges of our era and many experts have made Big Data their R&D priority.

- AIM
  Digital marketing, mobility, health, environment...
- JOB OPPORTUNITIES
  Chief data officer, business intelligence manager, data scientist, data analyst, data miner, master data manager, data protection officer...

LEARN MORE AT ISEN-LILLE.FR.FR

MASTER 1 - FALL SEMESTER	ECTS
Network & System Base	3
Java 1	3
Data Report, Communication and Visualisation	3
Advanced Statistical Analysis	3
Artificial Intelligence	3
Quantum Communication	2
French as a Foreign Language	3
Technical Project	7

MASTER 1 - SPRING SEMESTER	ECTS
Metaheuristics	3
Advanced Machine Learning	3
Data Base	3
Quantum Computing	2
Technical Project	7
Three-month Internship	10

MASTER 2 - FALL SEMESTER	ECTS
Cloud Computing and Architecture	3
Hadoop & Spark Ecosystem	3
IT Risk & Management	3
Secured Network Architectures	3
Urbanisation of IT Services	2
French as a Foreign Language	2
Innovation Project	9

MASTER 2 - SPRING SEMESTER	ECTS
Final Industrial Internship	30

contact

David Boulinguez, Campus Director
david.boulinguez@junia.com

network & system base

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	D. Delannoy H. Benhabiles	English

PREREQUISITES	■ To follow this module, the student must know the basics of local networks (Ethernet, IP, static IP routing, TCP-UDP, DHCP, DNS, usual web application protocols, mail, ...).
LEARNING OUTCOMES	Targeted skills : 32(322/323), 34(342/343), 43(431/432/433), 112(1122) This module is a first implementation of local networks and linux systems. It takes up the notions cited in the prerequisites in scenarios intended to master the protocols and to identify the interactions between them. New concepts concerning the use of virtualization of linux machines are discussed. The orientation is suitable for all engineering profiles in software development, big data, cyber security, connected objects domains. At the end of the course, the student will: ■ Know how to use a linux operating system in a virtualization environment ■ Be able to configure the network interface of a machine on linux or Windows ■ Know communication protocols and parameters ■ Know how to present the mechanisms of communication ■ Be able to define and implement experiments illustrating particular points of operation Be able to implement basic network equipment ■ Know how to use a network traffic analysis tool ■ Know how to reproduce and interpret the results of an experiment The “hands-on” approach requires the acquisition of technical and transversal skills such as autonomy in understanding and learning, communication and restitution.
COURSE DESCRIPTION	This module covers the following topics: ■ The use of a virtualization environment such as VMware ■ The functioning of the main network protocols ■ The detailed analysis of protocols Ethernet, IP, TCP, UDP, ARP ■ The implementation of IP routing and subnetting ■ The DHCP Services configuration ■ The network interface configuration ■ The Service and application filtering ■ The diagnosis of a malfunction with Wireshark

data report, communication and visualisation

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	F. Windal H. Benhabiles	English

PREREQUISITES	■ Bases in Probability & Statistics
LEARNING OUTCOMES	Target Skills : 34(342,343), 53(531,532), 54(541,542),55(551,552,553) 61(611,612,613), 62(621,622), 63(631,632,634,634), 110(1102) In the business around data, it is more than important to communicate, popularize the results and make the analysis aesthetic and synthetic for your customers and your contacts. ■ In this course, the objectives are several. We will first approach programming with the R language. Indeed, R is a language dedicated to the science of data. You will learn to deploy the environment to work with this language and to program functions and instructions from the most basic to the most complex. ■ In a second step, we will approach the libraries which allow very beautiful graphics, curves,... with ergonomic layouts, captivating colors which allow an efficient and dynamic reading of the results. ■ In a third section, we will explore the bookstores to produce report type documents (pdf, word), presentation type, or web page type to communicate with customers.
COURSE DESCRIPTION	■ Programming with R language ■ Libraries for data visualization (ggplot2, dyplr, tidyverse) ■ Shiny for dynamic web pages ■ Rmarkdown and Rbook for report, presentation

advanced statistical analysis

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	F. Windal	English

PREREQUISITES	■ Bases in Probability/statistics ■ Data Report, Communication and VisualIsation (S1M1)
LEARNING OUTCOMES	Target Skills : 31(311,312,313), 32(321,322,323), 33(331,332,333), 34 (341,342,343), 35(351,352,353), 52(521), 53(531,532), 54(541,542), 55 (551,552,553) 61(611,612,613), 62(321,322), 63(631, 632,633,634), 110(1101,1102) The science of statistics is a methodological corpus which makes it possible to establish crucial and important information indicators in different fields, such as, for example, business, humanities and health, politics, etc. The objective of the course is: ■ To give you a sufficiently deep understanding of the methods so that you can recognize the problem of a method in a questioning of the user and to properly assess the scope of the results that you obtain. ■ To expose you to a wide range of methods with great application potential. ■ To allow you to understand, use and explain statistical tools. Each chapter of the course will tackle a theoretical aspect followed by practice with the treatment of problems in R language of real life (business, human science…). For those who have not followed the Data Report, Communication and Visualization course, a document on the R language will be distributed to you and teacher support for the acquisition of the software and the first steps with R.
COURSE DESCRIPTION	■ Description of a digital series ■ Estimate-Confidence Interval ■ Comparison of two means ■ Comparison of two variances ■ 1-factor analysis of variance ■ Analysis of variance with 2 factors without repetitions ■ Tests based on the Chi2 criterion ■ Links between two quantitative variables ■ Simple regression ■ Multiple regression

artificial intelligence

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	N. Ihaddadene	English

PREREQUISITES	■ None
LEARNING OUTCOMES	■ Understand the application fields and basic concepts related to Artificial Intelligence (AI). ■ Learn how to model a problem and solve it with an AI approach. ■ Start using AI modeling, machine learning and development tools. ■ Browse recent advances in AI.
COURSE DESCRIPTION	■ Background, definitions and basic concepts. ■ Fields of application (Natural language processing, machine vision, robotics, ...). ■ Input concepts. ■ Modeling and problem solving. ■ Supervised learning. ■ Unsupervised learning. ■ Neural networks and Deep Learning.

quantum communication

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	2	I. Lefebvre, JF. Robillard	English

PREREQUISITES	This module is intended to be accessible to all and requires as a prerequisite only a knowledge of the concepts seen in the course of quantum mechanics
LEARNING OUTCOMES	This module must allow: ■ to better master the fundamental principles and phenomena of quantum mechanics such as the superposition of states or entanglement ■ acquire a state-of-the-art vision of the use of these principles and their use in telecommunications and the exchange of quantum keys for cryptography
COURSE DESCRIPTION	■ Notions (Polarized photon - Superposition - Measurement - Intricacy - Correlated states) ■ Implementation problems (Decoherence - Noise) ■ Equipment used (Laser - Bi-photon generator - Photon counter - Optical fiber - Beam Splitter) ■ Applications (Network, Quantum Key Distribution) Teaching modalities

metaheuristics

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	F. Windal H. Benhabiles	English

PREREQUISITES	Java programming
LEARNING OUTCOMES	Target Skills : 31(311,312,313), 32(321,322,323), 33(331,332,333), 34 (341,342,343), 35(351,352,353), 52(521), 53(531,532), 54(541,542), 55 (551,552,553) 61(611,612,613), 62(321,322), 63(631, 632,633,634), Engineers and decision-makers are confronted daily with problems of increasing complexity, which arise in very diverse technical fields such as in operational research, the design of mechanical and robotic systems, image processing, Artificial intelligence, electronics, etc. These problems to be solved are often expressed in the form of “difficult optimization problems” where a cost function to be optimized is defined and constraint data to be respected, otherwise the solutions proposed will not be feasible. The objective of this course is to familiarize you with a group of methods, called “metaheuristics” whose ambition is to best solve the problems called «difficult optimization».
COURSE DESCRIPTION	■ The simulated annealing method ■ Evolutionary algorithms ■ Artificial ants ■ Research with taboos

advanced machine learning

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	F. Windal H. Benhabiles	English

PREREQUISITES	None
LEARNING OUTCOMES	The objective of this course is to familiarize you with the very advanced concepts of Machine Learning. The main algorithms will be presented and illustrated in intuitive ways, with practical and concrete cases where we want to make predictions. In this course you will also: ■ Explore the field of machine learning with its models, algorithms and data training ■ Understand supervised and unsupervised machine learning algorithms. ■ Use monolayer and multilayer neural networks to calculate outputs ■ Discover the technological tools for understanding machine learning.
COURSE DESCRIPTION	■ Advanced neural networks ■ Random forests ■ Decision trees ■ Support vector machines.

data base

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	D. Delannoy	English

PREREQUISITES	To follow this module, the student must know the notions of databases (reading a Conceptual Data Model, SQL queries) and have implemented these notions.
LEARNING OUTCOMES	Targeted skills : 32(321/323), 34(342/343), 43(431/432), 56(561/562), 63(634), 110(1102) This module addresses the notions of data modeling based on the MERISE method and allows to understand the whole chain from conception to implementation in a relational database. The orientation is suitable for all engineering profiles in software development, big data, connected objects, engineer of business domains. At the end of the course, the student will: ■ Know the concept of Information System data modeling ■ Be able to model the data of a Small Information System ■ Know how to read a conceptual data model and transform it into tables ■ Know the process of creating a database under PostgresSQL ■ Know how to insert data into a database and select them according to different criteria ■ Know how to select data in a database according to different criteria
COURSE DESCRIPTION	This module covers the following topics: ■ The role of modeling ■ The relational principle of organization of information ■ The presentation of the MERISE method ■ The conceptual, logical and physical modeling ■ The implementation of relational databases ■ The principles of a Database Management System (DBMS) ■ The description language of the database (SQL) ■ The data manipulation language (SQL)

quantum computing

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	2	G. Chênevert, JF. Robillard	English

PREREQUISITES	This opening module is intended to be widely accessible to all and has no specific prerequisites apart from a general mastery of the useful concepts of the common core of the third year (quantum mechanics, probability, digital electronics, programming).
LEARNING OUTCOMES	Target Skills : 34 (342), 101 (1011), 144 (1441), 146 (1461), 62 (622) To allow the student to acquire a factual and critical vision of the state of the art and the material and software perspectives related to the manipulation of quantum information. Master the foundations and put into practice simple algorithms in simulation or on real architecture (IBM Q).
COURSE DESCRIPTION	■ Quantum information: states and measurement ■ Physical modalities of the qubit ■ Logic gates ■ Universal quantum computer ■ Quantum simulation ■ Main algorithms: Grover, Shor, ... ■ Programming and simulation

cloud computing and architecture

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	3	F. Windal, D. Delannoy	English

PREREQUISITES	■ Java Courses (M1, semester 1) ■ Network & Sys base (M1, semester 1) ■ Data bases (CSI3, CIR3, semester 2)
LEARNING OUTCOMES	Target skills : 34(342,343), 41(412, 413,414), 42(422), 53(531,532), 54(541,542), 61(611,612,613), 62(621,622), 63(632,634) **Cloud Computing** The objective of this part of the course is to introduce the fundamental concepts of Google Cloud for a company. This platform includes various cloud services for computing, storage, networking, Big Data, machine learning, Internet of things, security, cloud management and application development that are directly launched on Google's servers. **Architecture** The objective of this part of the course is to understand the concept behind the term "Big data", from a perspective: ■ Architectural: resource organization, servers for performance optimization ■ Technological: the software suite deployed ■ Business: understanding the client's needs for the implementation of decision support tools
COURSE DESCRIPTION	**Cloud Computing** ■ Introduction of the fundamental concepts of cloud computing, technical aspects (data center architecture, non-relational databases) and economic aspects (service and billing) ■ Development & deployment of a web application on the Goolge Cloud platform - PaaS service **Big data Architecture** Part 1: Deploying a Big Data Architecture ■ Understand the notions of performance in the deployment of a Big Data architecture ■ Acquire knowledge about data storage solutions ■ Discern the differences between databases (NoSQL, Elastic, Oracle, MongoDB...) ■ Understand the importance of file systems (HDFS) in a Big Data architecture ■ Example of the implementation of the "Crédit Agricole" datalake

hadoop and spark ecosystem

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	3	F. Windal, H. Behabiles	English

PREREQUISITES	■ Java, Cloud Computing and Big Data Architecture
LEARNING OUTCOMES	Targeted skills :33(331,332,333) 34(341,342,343), 35(351,352,353) For more than a decade now, companies have been confronted with new types of data, “semi structured”, “unstructured” and “big data”. The question of storage, power and speed of The processing of this new data is at the heart of the problems that companies must face. We are also witnessing a new architecture to organize this big data (data lake) and new technologies to simplify processing. The objective of the course is to introduce you to specific big data technologies like the Hadoop and Spark frameworks. Hadoop is a technology that enables distributed storage and processing of data. Spark is a technology that has the specificity of processing distributed data very quickly, almost immediately.
COURSE DESCRIPTION	**Hadoop:** ■ Introduction to the framework ■ Primary components ■ Query language and connection to HDFS ■ Distributed processing **Spark:** ■ Introduction to the framework ■ Stream joins ■ Tolerance for faults ■ The différents APIs.

it risk and management

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 2	3	D. Delannoy	English

PREREQUISITES	None
LEARNING OUTCOMES	Targeted skills : 31(311/312/313), 32(321/322/323), 33(331/332/333), 56(561/562), 71(711), 110(1102) Risk management, which is taken into account in the development of the strategy and in all activities, is designed to identify events that may affect the functioning and therefore the viability of a company. It is designed to ensure the integrity of the information system and provide assurance that the cost must remain reasonable in relation to the issues. In connection with the business process management and IT risk management, this module provides guidance for mapping an Information System and defining action plans to enable it to render the expected services. The orientation is suitable for the engineering profiles of the areas of software development, big data, cyber security and connected objects, part of project management allows to integrate managerial profiles. At the end of the course, the student will: ■ Understand the challenges of an information system ■ Be able to identify the processes implemented ■ Know how to follow a method of risk analysis ■ Be able to identify, analyze and classify risks ■ Know how to design a business recovery plan The case-of-use approach requires the acquisition of transversal skills such as taking into account a need, analyzing and proposing solutions, project management, group work, communication and restitution.
COURSE DESCRIPTION	Based on the “experience”, “concrete cases” of business problems are developed in favor of a controlled management of business processes. These cases will illustrate the necessary steps in the MOA (project owner or contractor for whom the work is being carried out) and the MOE (project management or technical integration).

secured network architecture

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	3	F. Windal, H. Behabiles	English

PREREQUISITES	To follow this module, the student must know the basic notions of local networks (Ethernet, IP, static routing, TCP-UDP, DHCP, DNS, common web application protocols, know how to use the linux commands related to the networks (ifconfig, route, ...) and the analysis tools (Wireshark). Reference : “network and system base module” M1 Junia ISEN
LEARNING OUTCOMES	Targeted skills : 34(342/343), 43(431/432/433), 110(1102) This module provides a security focus of local networks and e-mail exchanges. It allows to implement these notions in the context of an enterprise network architecture. Orientation is suitable for engineering profiles in the big data and cyber security domains. At the end of the course, the student will know: ■ How to design a secure network architecture ■ How to implement mail management and infrastructure security applications ■ Communication protocols ■ How to evaluate the reliability of a configuration This module requires the acquisition of technical and transversal skills such as solution proposals, group work, communication and restitution.
COURSE DESCRIPTION	This module covers the following topics: ■ The process of the exchange protocols by mail ■ The identification and understanding of the attack mechanisms ■ The role of the various components needed to secure a network ■ The writing of a technical implementation and a recipe document ■ The e-mail filtering (fishing, ...) ■ The rules for securing a network, firewalling ■ The design of a secure architecture and implementation of components ■ The appliance configuration and testing

urbanization of it services

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	2	D. Delannoy	English

PREREQUISITES	None
LEARNING OUTCOMES	Targeted skills : 31(311/312/313), 32(321/322/323), 33(331/332/333), 56(561/562), 71(711), 110(1102) In connection with technical and management, this module allows to understand the stakes and to master the deployment of the new information technologies. The agility that determines responsiveness to evolutions applies not only to software development, but also to the way in which the businesses and functions of the company rely on a harmonious set of resources - hardware, software, personnel, data and Procedures. The construction of an information system can no longer be freed from urbanization without compromising its ability to integrate new needs as a city could fade due to the lack of adequate infrastructures. The aim is to provide a complementary managerial dimension to the technical training required for architectural missions. The orientation is suitable for the engineering profiles of the areas of software development, big data, cyber security and connected objects, part of project management allows to integrate managerial profiles. At the end of the course, the student will: ■ Understand the challenges of an information system ■ Be able to identify the architecture of an information system (from hardware to applications ■ Know how to follow a method of analysis of the computer heritage ■ Be able to identify, analyze and classify the axes of improvement of an information system ■ Know how to design an evolution plan ■ Know how to follow urbanization methods and good practices
COURSE DESCRIPTION	Such as urbanization of human habitat (organization of cities, territory), its concepts have been taken up in computer science to model and formalize the engineering of Information Systems (IS). Urban planning thus defines rules and a coherent, stable and modular framework, to which the various stakeholders refer for any investment and evolution decision relating to the Information System. An introduction to the use of “best practices” ITIL (Information Technology Infrastructure Library) presents the methods and tools that today are indispensable for improving the management of IT services. It brings together the means to structure and improve the efficiency, performance and costs of these services. The adoption of these good practices ensures that customers and suppliers (internal and external) have a service that meets internationally established quality criteria. This module covers the following topics: ■ The role and the stakes of an information system ■ The foundations and principles of urbanization ■ The strategic changes in the company ■ The market opportunities ■ The role of the players in the information system ■ The mapping tools and metamodel representation ■ The definition of the different missions of urbanization

JUNIA ISEN

embedded electronics

Master of Science and Engineering Program

Embedded Systems (ES) manage precise tasks in complete autonomy and in real time, providing solutions in a variety of economic sectors : energy, health, transport... ES covers a wide range of skills in the fields of energy consumption, integration, data processing, and communications.

This professional profile trains engineers who master the material aspects (electronics) and software implications (embedded systems or mobile applications) of high-tech systems that improve our everyday lives.

- AIM: Aeronautics, automobile...
- JOB OPPORTUNITIES: Embedded systems designer, communication electronics technician, integrator, tester, systems project leader, systems integrator, embedded applications architect...

LEARN MORE AT ISEN-LILLE.FR.FR

MASTER 1 - FALL SEMESTER	ECTS
Advanced Digital Signal Processing	3
Java 1	3
Analog Circuit Design	3
Digital Programmable Circuits: FPGA & VHDL	3
Wireless Technologies & Applications	3
Technical Project S1	7

MASTER 1 - SPRING SEMESTER	ECTS
Hands-on 32-bit ARM Microcontrolers	2
Power Electronics	3
Microwave Circuits	3
Digital Microelectronic Circuits	3
Audio Signal Processing	2
Technical Project S2	7
Three-month Internship	10

MASTER 2 - FALL SEMESTER	ECTS
Advanced Electronics	3
Mixed-signal Integrated Circuits for Audio Applications	3
High Frequency Electronics	3
Real-Time Computing for Embedded Systems	3
Automotive Electronics	2
Innovation Project	9
French as a Foreign Language	2

MASTER 2 - SPRING SEMESTER	ECTS
Final Industrial Internship	30

contact

David Boulinguez, Campus Director
david.boulinguez@junia.com

Return to Table of Contents

advanced digital signal processing

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	C. Krzeminski D. Boulinguez	English

PREREQUISITES	Due to the limited number of lectures, required prior knowledge concern the lectures in signal processing of previous academic year (CSI3). In particular, it is necessary to be have a deep knowledge of: ■ Fourier analysis ■ Sampling and Nyquist Frequency ■ Convolution ■ Introduction to Time Discrete Transform
LEARNING OUTCOMES	The main objective of this course is to presents the fundamental signal processing principles necessary for the design of digital systems used in many domains of application (electronics, telecommunication...).
COURSE DESCRIPTION	Course contents in the digital signal processing: ■ Reminder: Digital signal: sampling and quantization and Applications ■ Advanced discrete Fourier transform and applications (FFT,DCT) ■ Digital Filtering: introduction, IRF filter, IIR filter, bilinear transform ■ Training Exam: Implement of a digital filter in a DSP

analog circuit design

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	B. Stefanelli	English

PREREQUISITES	Master the basics of circuit analysis (Ohm's law, Kirchoff's laws, Thevenin-Norton, superposition theorem, Bode diagram) ■ Master the concepts involved in operational amplifiers circuits (biasing, small signal, linearity.).
LEARNING OUTCOMES	■ Determine the characteristics of linear circuits based on transistors and/or operational amplifiers, ■ Design linear circuits based on transistors and/or operational amplifiers, given a set of specifications, ■ Set-up simulations to verify and imrove characteristics.
COURSE DESCRIPTION	■ Semiconductor devices (diodes, transistors), ■ Linear operation of semiconductors (mono and multi-stage amplifiers, differential pairs, current mirrors), ■ Power stages, ■ Frequency response.

digital programmable circuits: fpga & vhdl

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	B. Stefanelli	English

PREREQUISITES	■ Master analysis and synthesis tools for combinational circuits, ■ Master the design flow of a simple finite-state machine. This corresponds to a standard digital electronics course like “Electronique Numérique” (1314-ISEN-L3S1-CSI3-ElecNum).
LEARNING OUTCOMES	Targeted skills : 32 (323), 34 (342/343), 42 (422), 1110 (11102) ■ Synthesize a digital function on FPGA, ■ Master VHDL basics.
COURSE DESCRIPTION	■ Introduction to the architecture of digital programmable circuits (FPGA), ■ Introduction to VHDL.

wireless technologies and applications

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	JM. Capron JF. Lampin	English

PREREQUISITES	None
LEARNING OUTCOMES	The objective of this lecture is to introduce the fundamentals of wireless communications, and their implementation in broadly used applications. It explains the technologies and architectures involved in wireless transmission of analog and digital information, focusing on the latter case. The bases of electromagnetism and transmission lines are developped, as a prerequisite to antenna analysis.
COURSE DESCRIPTION	The course includes two complementary parts: ■ The former deals with the fundamentals explaining the propagation of electrical signals along transmission lines. By extension to electromagnetism, this leads to antennas theory, whose operation and main characteristics (gain, radiation, ...) are developped. Link budget is finally studied, which shows the relation between emitted and received powers in case of a wireless transmission. ■ The second part deals with applications: it shows how the above principles can be used to build a RF system, such as cellular phone communications. The following topics are studied: - multiple access techniques to optimise the use of radio channels, - influence of noise and linearity on RF system performances, - IQ modulation for digital wireless communications, - basic functions in the architecture of a RF transmitter or receiver, - frequency synthesizer operation.

hands-on 32-bit arm microcontrollers

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	2	B. Stefanelli	English

PREREQUISITES	■ Master the basics of microcontroler architecture (ALU, IO's, memory...) and assembly language programming. ■ This corresponds to a standard digital electronics course like "Electronique Numérique" (1314-ISEN-L3S1-CSI3-ElecNum).
LEARNING OUTCOMES	Targeted skills : 32 (323), 34 (342/343), 42 (422), 110(1101/1102), 1110(11104) ■ Acquire the basics of ARM architecture, ■ Acquire a deeper knowledge of advanced microcontrolers hardware implementing ARM Cortex-M4 core, ■ Acquire the basics of inter-circuits and inter-systems data links.
COURSE DESCRIPTION	■ The ARM concept, STM32F446 architecture, ■ The clock tree and PLLs, ■ Basic I/Os, ■ The interrupts, ■ Timers and PWM, ■ The USART, SPI et I2C, ■ Low power modes, ■ Direct memory access, ■ CAN bus basics, ■ programming in C

power electronics

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	JM. Capron	English

PREREQUISITES	Reliable electricity bases (voltage and current laws) and electronics fundamentals (passive and active components)
LEARNING OUTCOMES	This lecture explains the fundamentals of switch-mode electronics systems when power and efficiency are a relevant issue. The principles given here can be applied to any power electronics application, but focus is given to switch-mode power supplies and DC-DC converters, since they are widely used in many equipments.
COURSE DESCRIPTION	■ Passive components: technology and applications of capacitors and inductors ■ Basic active power components: diodes and transistors (bipolar, MOSFETs) ■ Comparison between linear and switch-mode electronics ■ DC-DC converters with or without transformers ■ Power Factor Correction ■ Layout guidelines ■ Introduction to ElectroMagnetic Compatibility.

microwave circuits

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	B. Legrand	English

PREREQUISITES	The knowledege of the basics of the transmission lines theory in sinusoidal regime is required: ■ characteristic impedance of a transmission line, wave velocity ■ forward and reflected waves, reflection coefficient, standing wave ratio ■ voltage, current and impedance on a transmission line ■ SLUG, STUB ■ Impedance and reflection coefficient relationship on the Smith chart These prerequisites can be found in a lecture like : Wireless Technology and applications (0910-ISEN- M1P1-ST-MB-502)
LEARNING OUTCOMES	The goals of the lecture is to introduce the concepts, the techniques and the tools to design and realize electronic circuits at microwave frequencies such as amplifiers. In particular, the lecture explains the techniques of impedance matching between circuit stages. A second part of the course is focused on the concept of the S parameters that characterize electronic devices at microwave frequencies.
COURSE DESCRIPTION	■ Smith chart ■ Impedance matching networks using lumped elements and distributed elements ■ Microstrip lines and circuit board design ■ S parameters concept ■ Microwave amplifier design : gain, stability, noise ■ CAD (ADS software).

digital microelectronic circuits

JUNIA ISEN

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	E. Dubois	English

	PREREQUISITES	None
	LEARNING OUTCOMES	At the end of this class unit, a student must be able to: ■ Calculate the current-voltage characteristics of diodes, bipolar transistors and metal-oxidesemiconductor (MOS) transistors ■ Properly explain the mechanisms of charge transport in the above mentioned devices ■ Derive the voltage transfer characteristic (VTC) of a basic bipolar inverter stage ■ Derive the voltage transfer characteristic (VTC) of elementary CMOS circuits ■ Implement and properly design simple combinational logic circuits ■ Explain the operation of clocked circuits ■ Extract a circuit schematic from a circuit layout.
CONTENT	**Chap. 1**	■ Properties of digital circuits Definitions, voltage transfer characteristic (VTC), noise margin
	Chap. 2	■ Elementary digital bipolar circuits -The bipolar inverter stage in static regime, Analysis of different operating modes, The saturation regime and its numerical treatment, Calculation of the VTC
	Chap. 3	■ The Metal-Oxide-Semiconductor (MOS) Transistor: Introduction
	Chap. 4	■ The MOS capacitance: The ideal flatband condition, Different operating regimes, Calculation of the threshold voltage, The MOS capacitance
	Chap. 5	■ The MOS Transistor: Structure, Current-voltage model (Memmelinck diagram), Different types of MOS transistors, Dynamic model, Elements of advanced MOS modeling
	Chap. 6	■ Elementary MOS Circuits: The MOS inverter, Inverter with passive resistor load, CMOS inverter, Gate delay, fan-in, fan-out, The CMOS switch
	Chap. 7	■ Combinational circuits: Implementation & device sizing, Power consumption, delays and other issues
	Chap. 8	■ Clocked circuits: Latches & flip-flops, Dynamic logic
	Chap. 9	■ Process & layout: CMOS process, Layout: devices and parasitics, Interconnections, ESD protection.

audio signal processing

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 2	2	A. Pate	English

PREREQUISITES	■ Signal and image analysis (3rd year) ■ Basics of physics (waves and acoustics) ■ Scientific computing (e.g. Python or Matlab)
LEARNING OUTCOMES	Targeted skills : 31 (311/313), 32 (321/322/323), 41 (411/413), 111 (1111), 146 (1461), 56 (561/562) ■ Get familiar with digital signal processing and filtering through real-life applications in the audio domain (speech and music) ■ Know how to describe and analyze an audio signal in the time, spectral, and time-frequency domains ■ Know and implement classical audio analysis methods ■ As a group, apply and organize acquired knowledge to analyze and understand state-of-the-art methods.
COURSE DESCRIPTION	■ Basics of acoustics (propagation, atténuation, absorption, reflection, transmission, intensity, sound level, radiation, impulse response, reverberation) ■ Time (onset, energy, zero-crossing...) and frequency (fundamental frequency, spectral centroid, ...) signal descriptors ■ Detection of fundamental frequency and onset (methods in the time domain, frequency domain, as well as time-frequency domain) ■ Speech modeling and coding (source-filter, LPC, cepstrum) ■ Time-frequency analysis (STFT, filterbanks) ■ Introduction to sound synthesis, denoising, audio coding, audio compression.

advanced electronics

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	3	JM. Capron	English

PREREQUISITES	Master analysis and synthesis tools for analog circuits. This corresponds to a standard electronics course like “Electronique Analogique & Numérique” (0910-ISEN-L3S1-CSI3-ElecAna&Num). A basic knowledge of transistor-level circuit analysis is required, as found in the course “Analog circuits design” (0910-ISEN-M1P1-MSNN-MFO-CCI:fonctionsdeb).
LEARNING OUTCOMES	Targeted skills : 31 (311), 32 (321), 42 (422), 56 (562) ■ To gain the advanced knowledge that any engineer in electronics should have. ■ To be able to understand the basic operation of the main building blocks used in telecommunication systems. ■ To understand the design flow of digital systems, covering as well the methodology and the ressources design(memory, bus, CPU). ■ The main part of this class deals with analog electronics (for typically 80%). The remaining part is related to digital electronics.
COURSE DESCRIPTION	■ Oscillators, ■ Phase-Lock Loops, ■ Direct Digital Synthesis, ■ Digital systems architecture,

mixed-signal integrated circuits for audio applications

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	3	D. Delannoy	English

PREREQUISITES	■ fundamentals of digital signal processing ■ basics of analog circuit design. Knowledge of FPGA design and VHDL is useful but is not mandatory. ■ understanding of fundamental notions such as noise and non-linear distortion
LEARNING OUTCOMES	At the end of this course students: ■ understand principles of high resolution data conversion ■ understand requirements in terms of noise and distortion for audio processing ■ understand circuit techniques used for analog processing at audio frequencies ■ master design of digital signal processing architectures for data conversion ■ master design and simulation tools for digital circuits and mixed-signal systems.
COURSE DESCRIPTION	The course is designed to allow students to gain pratical experience in circuit and system design as well as theoretical insight into principles of data-conversion and signal processing systems. The course extensively relies on practical labs to illustrate theoretical aspects with focus on audio applications. Course content is structured around three major topics: ■ Delta-Sigma Analog-Digital Converters In this part, fundamental theory of data converters is recalled. The focus is then on the delta-sigma type analog-to-digital. The theory is supported by simulation exercises with MATLAB. A complete data converter architecture is implemented with programmable analog and digital circuits. ■ Digital-to-Analog conversion This part is covered by a half day practical exercise aiming at the implementation of a delta-sigma digital-to-analog converter in a Field Programmable Gate Array (FPGA). ■ Switched amplifiers for audio applications A half-day lecture introduces the design of switchedmode audio amplifiers in Integrated circuits (ICs), i.ex. for applications such as portable audio or wireless communication terminals. Another half-day is spent on the design and measurement of such an amplifier implemented by means of programmable circuits.

high frequency electronics

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	3	JM. Capron	English

PREREQUISITES	None
LEARNING OUTCOMES	Targeted skills : 34 (343), 146 (1461) This lecture presents which technics are involved to implement high-frequency electronics applications, covering wireless communications. It is illustrated by practical exemples which can be encountered in everyday life, for instance Radio-Frequency Identification (RFID) or Near-Field Communications (NFC)..
COURSE DESCRIPTION	■ Presentation and explanation of radio techniques for wireless communications (with practical demonstrations). ■ RFID and NFC technics. ■ Microwave electronics. - Specification and applications of microwave electronics. - Transmission lines. - Power transmission and S-parameters. - Microwave devices and associated functions.

real-time computing for embedded systems

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	3	D. Delannoy	English

PREREQUISITES	■ C programming and processors architecture.
LEARNING OUTCOMES	Implementing a real-time embedded application requires a good knowledge of basic mecanisms such as task scheduling, memory management, or drivers loading. The objective of this training is to address these topics through practical labs, based on Raspberry Pi boards.
COURSE DESCRIPTION	■ Introduction to embedded systems features. ■ Building of a real-time kernel. Booting mechanism. Code development and debugging. ■ Tasks scheduling and synchronisation. ■ Real-time systems performances and limitations.

automotive electronics

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	2	JM. Capron	English

PREREQUISITES	None
LEARNING OUTCOMES	Targeted skills : 52 (521), 71 (712, 713), 83 (831), 126 (1261, 1262), 56 (561) The objective of the course is to give a good knowledge of the automotive domain through the applications of electronics in current and future vehicles. In addition, specific issues such as quality, cost and reliability are also introduced. The trends and the involved technologies are studied.
COURSE DESCRIPTION	■ Electric and electronics applications in automotive ■ Hybrid vehicles ■ Data multiplexing (CAN network, etc...) ■ Wireless control ■ Automotive radar ■ Driving automation ■ Optical and electronics components for automotive ■ Reliability and test ■ Project management / Quality

JUNIA ISEN

software engineering

Master of Science and Engineering Program

Software and applications development encompasses all elements of the design chain of high-tech products: in embedded systems middleware and infrastructures. The quantity of data to be processed is ever larger, and methods of collection, storage and analysis are in constant progression.

This professional profile trains engineers specialized in cutting-edge technologies, such as Big Data and Cloud Computing.

- AIM: Mobile applications, Cloud, e-commerce, Web 3.0...
- JOB OPPORTUNITIES: Applications designer, website developer, IT solutions integrator, test engineer, systems and network architect, IT project leader, DSI (Director of Information Systems), facilities engineer, network operations engineer, web architect, multimedia developer...

LEARN MORE AT ISEN-LILLE.FR

MASTER 1 - FALL SEMESTER	ECTS
Network & System Base	3
Java 1	3
Operating Systems	3
Web Technologies	3
Artificial Intelligence	3
Quantum Communication	2
Technical Project S1	7
French as a Foreign Language	3

MASTER 1 - SPRING SEMESTER	ECTS
Java 2	3
Android	3
Data Base	3
UNIX	2
Quantum Computing	2
Network Programming	2
Technical Project S2	7
Three-month Internship	10

MASTER 2 - FALL SEMESTER	ECTS
Cloud Computing and Architecture	3
JEE	3
IT Risk and Management	3
Object Oriented Design	3
Urbanization of IT Services	2
Innovation Project	9
French as a Foreign Language	2

MASTER 2 - SPRING SEMESTER	ECTS
Final Industrial Internship	30

contact

David Boulinguez, Campus Director
david.boulinguez@junia.com

network & system base

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	D. Delannoy H. Benhabiles	English

PREREQUISITES	To follow this module, the student must know the basics of local networks (Ethernet, IP, static IP routing, TCP-UDP, DHCP, DNS, usual web application protocols, mail, ...).
LEARNING OUTCOMES	Targeted skills : 32(322/323), 34(342/343), 43(431/432/433), 112(1122) This module is a first implementation of local networks and linux systems. It takes up the notions cited in the prerequisites in scenarios intended to master the protocols and to identify the interactions between them. New concepts concerning the use of virtualization of linux machines are discussed. The orientation is suitable for all engineering profiles in software development, big data, cyber security, connected objects domains. At the end of the course, the student will: ■ Know how to use a linux operating system in a virtualization environment ■ Be able to configure the network interface of a machine on linux or Windows ■ Know communication protocols and parameters ■ Know how to present the mechanisms of communication ■ Be able to define and implement experiments illustrating particular points of operation Be able to implement basic network equipment ■ Know how to use a network traffic analysis tool ■ Know how to reproduce and interpret the results of an experiment The “hands-on” approach requires the acquisition of technical and transversal skills such as autonomy in understanding and learning, communication and restitution.
COURSE DESCRIPTION	This module covers the following topics: ■ The use of a virtualization environment such as VMware ■ The functioning of the main network protocols ■ The detailed analysis of protocols Ethernet, IP, TCP, UDP, ARP ■ The implementation of IP routing and subnetting ■ The DHCP Services configuration ■ The network interface configuration ■ The Service and application filtering ■ The diagnosis of a malfunction with Wireshark

operating systems

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	D. Delannoy	English

PREREQUISITES	To follow this module, the student must know the basic notions of local networks (Ethernet, IP, static routing, TCP-UDP, DHCP, DNS, usual web application protocols, Know how to use some basic linux commands. Reference : “network and system base module” M1 Junia ISEN
LEARNING OUTCOMES	Targeted skills : 34(342/343), 43(431/432/433), 112(1122) This module addresses concepts related to operating system concepts and virtualization. The orientation is suitable for all engineering profiles in big data, cyber security domains. At the end of the course, the student will: ■ Know the role and operation of an operating system, notions of file system, virtual memory, process, scheduleur. ■ Be able to implement mechanisms of synchronization of the processes (semaphores) ■ Know how to use bass controls of a linux operating system ■ Understand the interactions of an operating system with networks ■ Understand the Issues and Principles of Operating System Virtualization The “simulation” approach requires the acquisition of technical and transversal skills such as autonomy in understanding and restitution..
COURSE DESCRIPTION	This module covers the following topics: ■ The operation of a processor and a standard computer architecture ■ The operation of the EXT2 file system ■ The rights and security on Linux management ■ The memory management (Virtual memory, paging, swaping) ■ The shared storage (NAS, SAN) ■ The process management (Scheduler, Priorities) ■ The management of sharing and synchronization of resources (Semaphore, State variables) ■ The new Virtualization Models (NSX)

web technologies

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	D. Delannoy	English

PREREQUISITES	To follow this module, the student must know the basics of algorithm, procedural programming and data base concepts.
LEARNING OUTCOMES	Targeted skills : 34(342/343), 43(431/432/433), 63(634), 110(1102) This module is an illustration of the approach and use of web application development tools. The orientation is suitable for all engineering profiles domains software development, big data, cyber security, connected objects, engineer of business domains. At the end of the course, the student will: ■ Know the basics of Web Programming ■ Know the basics of php, html and css languages. ■ Know the difference and the usefulness of the different languages. ■ Be able to set up a local php server. ■ Be able to develop a basic website. ■ Be able to integrate a database with a website. ■ Be aware of good development practices.
COURSE DESCRIPTION	This module covers the following topics: ■ Structure of an html page ■ Using php primitives ■ Architecture of a php application ■ Implementation of CSS style sheets ■ Use of a database for a website ■ Use of object-oriented language in php ■ Use of javascript

artificial intelligence

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	N. Ihaddadene	English

PREREQUISITES	None
LEARNING OUTCOMES	■ Understand the application fields and basic concepts related to Artificial Intelligence (AI). ■ Learn how to model a problem and solve it with an AI approach. ■ Start using AI modeling, machine learning and development tools. ■ Browse recent advances in AI.
COURSE DESCRIPTION	■ Background, definitions and basic concepts. ■ Fields of application (Natural language processing, machine vision, robotics, ...). ■ Input concepts. ■ Modeling and problem solving. ■ Supervised learning. ■ Unsupervised learning. ■ Neural networks and Deep Learning.

quantum communication

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	2	I. Lefebvre JF. Robillard	English

PREREQUISITES	This module is intended to be accessible to all and requires as a prerequisite only a knowledge of the concepts seen in the course of quantum mechanics
LEARNING OUTCOMES	This module must allow: ■ to better master the fundamental principles and phenomena of quantum mechanics such as the superposition of states or entanglement ■ acquire a state-of-the-art vision of the use of these principles and their use in telecommunications and the exchange of quantum keys for cryptography
COURSE DESCRIPTION	■ Notions (Polarized photon - Superposition - Measurement - Intricacy - Correlated states) ■ Implementation problems (Decoherence - Noise) ■ Equipment used (Laser - Bi-photon generator - Photon counter - Optical fiber - Beam Splitter) ■ Applications (Network, Quantum Key Distribution) Teaching modalities

java 2

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	M. Morelle	English

PREREQUISITES	To follow this module, the student must know the concepts of object-oriented programming and master Java programming (class, inheritance, composition, exceptions). Reference : “Java 1” M1 Junia ISEN.
LEARNING OUTCOMES	Targeted skills : 31(311/312/313), 34(342/343), 43(431/432/433), 63(634), 110(1102) This module is a deepening of Java programming to create dynamic web applications. It does not deal with web programming. The orientation is suitable for engineering profiles in the software development domain. At the end of the course, the student will: ■ Know the concepts of object-oriented programming ■ Be able to develop an interactive Java application ■ Know how to interconnect a Java application with a relational database ■ Know how to organize a Java development project with the Maven tool ■ Be able to implement unit tests to ensure software quality
COURSE DESCRIPTION	This module covers the following topics: ■ The development of interfaces and polymorphism in Java ■ The mechanisms for accessing files ■ The mechanisms for managing the flow of incoming and outgoing information (NIO) ■ The testing tools (JUnit and AssertJ) and handling of the debug features of the IDE ■ The dependency management and scaffolding of a Java project with Maven ■ The notions of generic classes and methods ■ The use of collections ■ The mechanisms for accessing databases with JDBC ■ The development of graphical interfaces in Java (JavaFX) ■ The new syntaxes and functional approaches with Lambdas and Java 8 Streams

android

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	D. Delannoy	French

PREREQUISITES	To follow this module, the student must know the concepts of objects (construction of simple objects, construction of composite objects, inheritance, exceptions, inputs / outputs, threads, ...) and have implemented these notions in JAVA. Reference : “JAVA 1 module” M1 ISEN Lille
LEARNING OUTCOMES	Targeted skills : 34(342/343), 41(413/414), 43(431/432), 56(561/562), 63(634), 110(1102) This module is an illustration of the approach and the use of mobile application development tools. The orientation is suitable for all engineering profiles in software development, cyber security, connected objects domains. At the end of the course, the student will: ■ Know how to translate the client needs into functional specifications (application scenario) ■ Be able to design a scenario adapted to the customer needs and to the constraints related to the device used ■ Be able to develop an application under android and choose the ergonomics best suited to the subject ■ Know the Android development environment ■ Know how to use a configuration management environment (git) ■ Be able to present the application to a client ■ Know how to write a technical document of implementation and recipe ■ Be able to present its application and to argue the ergonomic choices The project approach requires the acquisition of technical and transversal skills such as the taking into account of a need, analysis and proposal of solutions, communication and restitution.
COURSE DESCRIPTION	This module covers the following topics: ■ The Android platform and its architecture ■ The development tools, development framework: Android Studio ■ The specificities of mobile terminals in terms of display and interaction with the user ■ The Android development ■ The life cycle of the application (simulation, testing and debugging) ■ The overview of the layout and the position of the component ■ The design of a graphical interface with views ■ The event management (implementation, reaction, listening) ■ The component model ■ The persistence of data ■ The use of the embedded database (SQLite), the insertion of data

data base

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	D. Delannoy	French

PREREQUISITES	To follow this module, the student must know the notions of databases (reading a Conceptual Data Model, SQL queries) and have implemented these notions.
LEARNING OUTCOMES	Targeted skills : 32(321/323), 34(342/343), 43(431/432), 56(561/562), 63(634), 110(1102) This module addresses the notions of data modeling based on the MERISE method and allows to understand the whole chain from conception to implementation in a relational database. The orientation is suitable for all engineering profiles in software development, big data, connected objects, engineer of business domains. At the end of the course, the student will: ■ Know the concept of Information System data modeling ■ Be able to model the data of a Small Information System ■ Know how to read a conceptual data model and transform it into tables ■ Know the process of creating a database under PostgresSQL ■ Know how to insert data into a database and select them according to different criteria ■ Know how to select data in a database according to different criteria
COURSE DESCRIPTION	This module covers the following topics: ■ The role of modeling ■ The relational principle of organization of information ■ The presentation of the MERISE method ■ The conceptual, logical and physical modeling ■ The implementation of relational databases ■ The principles of a Database Management System (DBMS) ■ The description language of the database (SQL) ■ The data manipulation language (SQL)

unix

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	2	J. Roland	English

PREREQUISITES	■ Basic UNIX usage experience ■ C programming
LEARNING OUTCOMES	■ Identify the different layers of the UNIX system architecture ■ Write programs in C to interact with the UNIX system layers (processes and files system) ■ Manipulate signals and timers ■ Exchange information between different processes.
COURSE DESCRIPTION	■ UNIX history ■ General UNIX architecture ■ The kernel ■ The UNIX filesystem ■ Processes ■ Signals ■ Interprocess communications

quantum computing

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	2	G. Chênevert JF. Robillard	English

PREREQUISITES	This opening module is intended to be widely accessible to all and has no specific prerequisites apart from a general mastery of the useful concepts of the common core of the third year (quantum mechanics, probability, digital electronics, programming).
LEARNING OUTCOMES	Target Skills : 34 (342), 101 (1011), 144 (1441), 146 (1461), 62 (622) To allow the student to acquire a factual and critical vision of the state of the art and the material and software perspectives related to the manipulation of quantum information. Master the foundations and put into practice simple algorithms in simulation or on real architecture (IBM Q).
COURSE DESCRIPTION	■ Quantum information: states and measurement ■ Physical modalities of the qubit ■ Logic gates ■ Universal quantum computer ■ Quantum simulation ■ Main algorithms: Grover, Shor, ... ■ Programming and simulation

network programming

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	2	E. Dubois	English

PREREQUISITES	■ C programming ■ Basic UNIX usage through shell commands ■ Basic Unix programming skills in C (processes, signals) ■ Basic IP knowledge
LEARNING OUTCOMES	Targeted skills : 33 (331), 34 (342/343), 43 (431/432/433) ■ Write simple TCP/IP and UDP/IP client and server programs in C ■ Face basic security issues in network program designs ■ Use basic network services (DNS, daytime...) within C programs.
COURSE DESCRIPTION	■ TCP/IP networking ■ Socket Programming ■ Client / Server design (TCP and UDP versions) ■ Names and addresses conversions ■ Case studies.

cloud computing and architecture

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	3	F. Windal D. Delannoy	English

PREREQUISITES	■ Java Courses (M1, semester 1) ■ Network & Sys base (M1, semester 1) ■ Data bases (CSI3, CIR3, semester 2)
LEARNING OUTCOMES	Target skills : 34(342,343), 41(412, 413,414), 42(422), 53(531,532), 54(541,542), 61(611,612,613), 62(621,622), 63(632,634) **Cloud Computing** The objective of this part of the course is to introduce the fundamental concepts of Google Cloud for a company. This platform includes various cloud services for computing, storage, networking, Big Data, machine learning, Internet of things, security, cloud management and application development that are directly launched on Google's servers. **Architecture** The objective of this part of the course is to understand the concept behind the term "Big data", from a perspective: ■ Architectural: resource organization, servers for performance optimization ■ Technological: the software suite deployed ■ Business: understanding the client's needs for the implementation of decision support tools
COURSE DESCRIPTION	**Cloud Computing** ■ Introduction of the fundamental concepts of cloud computing, technical aspects (data center architecture, non-relational databases) and economic aspects (service and billing) ■ Development & deployment of a web application on the Goolge Cloud platform - PaaS service **Big data Architecture** **Part 1: Deploying a Big Data Architecture** ■ Understand the notions of performance in the deployment of a Big Data architecture ■ Acquire knowledge about data storage solutions ■ Discern the differences between databases (NoSQL, Elastic, Oracle, MongoDB...) ■ Understand the importance of file systems (HDFS) in a Big Data architecture ■ Example of the implementation of the "Crédit Agricole" datalake

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	3	D. Delannoy	English

PREREQUISITES	To follow this module, the student must know the concepts of object-oriented programming and master Java programming (class, inheritance, composition, exceptions, inputs / outputs, threads, ...). Reference : “Java 1”, “Java 2” M1 Junia ISEN
LEARNING OUTCOMES	Targeted skills : 31(311/312/313), 34(342/343), 43(431/432/433), 63(634), 110(1102) This module is a deepening of Java programming to create dynamic web applications. The orientation is suitable for engineering profiles in the software development domain. At the end of the course, the student will: ■ Know how to use a development and versioning environment ■ Know how to describe a problem in the form of tests ■ Understand third-party architectures, ■ Be able to implement Web Services, ■ Be able to develop a JEE application.
COURSE DESCRIPTION	This module covers the following topics: ■ The use of version and build management tools (Maven) ■ Third party architectures / JEE ■ Development environments ■ The following JEE APIs: Servlets / JSP, JPA / JTA, JAX-RS, CDI

it risk and management

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 2	3	D. Delannoy	English

PREREQUISITES	None
LEARNING OUTCOMES	Targeted skills : 31(311/312/313), 32(321/322/323), 33(331/332/333), 56(561/562), 71(711), 110(1102) Risk management, which is taken into account in the development of the strategy and in all activities, is designed to identify events that may affect the functioning and therefore the viability of a company. It is designed to ensure the integrity of the information system and provide assurance that the cost must remain reasonable in relation to the issues. In connection with the business process management and IT risk management, this module provides guidance for mapping an Information System and defining action plans to enable it to render the expected services. The orientation is suitable for the engineering profiles of the areas of software development, big data, cyber security and connected objects, part of project management allows to integrate managerial profiles. At the end of the course, the student will: ■ Understand the challenges of an information system ■ Be able to identify the processes implemented ■ Know how to follow a method of risk analysis ■ Be able to identify, analyze and classify risks ■ Know how to design a business recovery plan The case-of-use approach requires the acquisition of transversal skills such as taking into account a need, analyzing and proposing solutions, project management, group work, communication and restitution.
COURSE DESCRIPTION	Based on the “experience”, “concrete cases” of business problems are developed in favor of a controlled management of business processes. These cases will illustrate the necessary steps in the MOA (project owner or contractor for whom the work is being carried out) and the MOE (project management or technical integration).

object oriented design

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	3	D. Delannoy	English

PREREQUISITES	To follow this module, the student must know the concepts of objects (construction of simple objects, construction of composite objects, inheritance, polymorphism, exceptions, ...) and have implemented these notions in JAVA or C ++. Reference : “Java 1” M1 Junia ISEN
LEARNING OUTCOMES	Targeted skills : 31(311/312/313), 43(431/432/433), 63(634) Training in the development of computer applications addressed by the use of an object-oriented programming language such as JAVA or C ++ would not be complete if it was not accompanied by a preliminary approach of structured design and compliance with standards . The design of an application in an object language consists of identifying reusable logical entities and organizing them in a flexible way, avoiding, as far as possible, the interdependencies. The main benefits that can be derived from this are mainly a better adaptability of the application in case of evolutions of needs, a greater efficiency in the organization of developments, and a greater maintainability of their source code. However, when implemented without respect for specific rules, this approach can also introduce a level of critical complexity that is a danger to the evolution of projects. This course aims at professionalizing the object-oriented design of a software, notably by studying certain design archetypes, called «Design Patterns», and by introducing a formal representation language Of the structure of a program (“Unified Modeling Language”). At the end of the course, the student will: ■ Know how to design the architecture of a complex program using an object-oriented language ■ Be able to choose the right design patterns to use depending on the problem ■ Know a part of the UML language to model an application ■ Know the main types of design patterns.
COURSE DESCRIPTION	UML (Unified Modeling Language) is the language used to model and represent the architecture of a software. The parts “diagram of classes” and “diagrams of interactions”, of interest to us in this course, allows to specify the different classes of the applications as well as their interactions in the form of diagrams. UML is a standard adopted by leading market players for object-oriented application design and project documentation. Design patterns describe class and object organizations to facilitate code reuse and maintenance. A design pattern can be seen as a form of organization to solve a generic design problem. It is therefore reusable and can be transposed to several applications. Thus, a design pattern describes an optimal solution to a problem often encountered in application development. This module covers the following topics: ■ The UML: class diagrams and sequence diagrams ■ The design patterns of GoF (Gand of Four) ■ The MVC pattern (Model Views Controllers) and its variants

urbanization of it services

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	2	D. Delannoy	English

PREREQUISITES	None
LEARNING OUTCOMES	Targeted skills : 31(311/312/313), 32(321/322/323), 33(331/332/333), 56(561/562), 71(711), 110(1102) In connection with technical and management, this module allows to understand the stakes and to master the deployment of the new information technologies. The agility that determines responsiveness to evolutions applies not only to software development, but also to the way in which the businesses and functions of the company rely on a harmonious set of resources - hardware, software, personnel, data and Procedures. The construction of an information system can no longer be freed from urbanization without compromising its ability to integrate new needs as a city could fade due to the lack of adequate infrastructures. The aim is to provide a complementary managerial dimension to the technical training required for architectural missions. The orientation is suitable for the engineering profiles of the areas of software development, big data, cyber security and connected objects, part of project management allows to integrate managerial profiles. At the end of the course, the student will: ■ Understand the challenges of an information system ■ Be able to identify the architecture of an information system (from hardware to applications ■ Know how to follow a method of analysis of the computer heritage ■ Be able to identify, analyze and classify the axes of improvement of an information system ■ Know how to design an evolution plan ■ Know how to follow urbanization methods and good practices
COURSE DESCRIPTION	Such as urbanization of human habitat (organization of cities, territory), its concepts have been taken up in computer science to model and formalize the engineering of Information Systems (IS). Urban planning thus defines rules and a coherent, stable and modular framework, to which the various stakeholders refer for any investment and evolution decision relating to the Information System. An introduction to the use of “best practices” ITIL (Information Technology Infrastructure Library) presents the methods and tools that today are indispensable for improving the management of IT services. It brings together the means to structure and improve the efficiency, performance and costs of these services. The adoption of these good practices ensures that customers and suppliers (internal and external) have a service that meets internationally established quality criteria. This module covers the following topics: ■ The role and the stakes of an information system ■ The foundations and principles of urbanization ■ The strategic changes in the company ■ The market opportunities ■ The role of the players in the information system ■ The mapping tools and metamodel representation ■ The definition of the different missions of urbanization

JUNIA ISEN

Digital Health

Over the last ten years, information and communication technologies (ICT) have been widely applied to the health sector, accelerating the digitalization, standardization, and intelligence of health services. Digital Health refers to the application of ICT in support of health and health-related fields and includes public health data, electronic medical records, telemedicine, mobile health applications, personalized medicine, home automation and more.
As a new Junia ISEN's multidisciplinary program, the Digital Health program invites students to discover the realm of digital health, from biology to medicine, to better understand data related to health, and to master advanced digital technology in this emerging sector.

- AIM: Telehealth, Telemedicine, Mobile health...
- JOB OPPORTUNITIES: Health data analyst, Engineer in biostatistics, Application development engineer in digital health, Project leader in digital health...

LEARN MORE AT ISEN-LILLE.FR

MASTER 1 - FALL SEMESTER	ECTS
Introduction to Digital Health	3
Java 1	3
Systems and Networks	3
Design of Bio-MEMS Systems	3
Artificial Intelligence	3
French as a Foreign Language	3
Technical Project	4

MASTER 1 - SPRING SEMESTER	ECTS
Bioinformatics	3
Bioethics	2
Data Base	3
MEMS Applications: Biology and Clinics	3
Advanced Machine Learning	3
Electives (choose one):	
Android	3
Internet of Things	3
Humanities & Management	5
Technical Project	7
Three-month Internship	10

MASTER 2 - FALL SEMESTER	ECTS
Artificial Intelligence Applied to Health	3
Health Data Management	3
Biostatistics	3
Cloud Computing and Architecture	3
Urbanization of IT Services	2
Humanities & Management	5
French as a Foreign Language	2
Innovation Project	9

MASTER 2 - SPRING SEMESTER	ECTS
Six-month Internship	30

contact
XXX, XXX
XXX@junia.com

introduction to digital health

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	H. Cao	English

PREREQUISITES	■ None
LEARNING OUTCOMES	This course allows students to discover the world of digital health, to understand health-related data, and to know the needs of the digital health market.
COURSE DESCRIPTION	■ Presentations related to health or health data ■ Testimonials from people working in the digital health field (explaining their company / profession) ■ A company visit (in the digital health field) ■ A project (related to digital health)

systems & networks

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	D. Delannoy H. Benhabiles	English

PREREQUISITES	To follow this module, the student must know the basics of local networks (Ethernet, IP, static IP routing, TCP-UDP, DHCP, DNS, usual web application protocols, mail, ...).
LEARNING OUTCOMES	Targeted skills : 32(322/323), 34(342/343), 43(431/432/433), 112(1122) This module is a first implementation of local networks and linux systems. It takes up the notions cited in the prerequisites in scenarios intended to master the protocols and to identify the interactions between them. New concepts concerning the use of virtualization of linux machines are discussed. The orientation is suitable for all engineering profiles in software development, big data, cyber security, connected objects domains. At the end of the course, the student will: ■ Know how to use a linux operating system in a virtualization environment ■ Be able to configure the network interface of a machine on linux or Windows ■ Know communication protocols and parameters ■ Know how to present the mechanisms of communication ■ Be able to define and implement experiments illustrating particular points of operation Be able to implement basic network equipment ■ Know how to use a network traffic analysis tool ■ Know how to reproduce and interpret the results of an experiment The “hands-on” approach requires the acquisition of technical and transversal skills such as autonomy in understanding and learning, communication and restitution.
COURSE DESCRIPTION	This module covers the following topics: ■ The use of a virtualization environment such as VMware ■ The functioning of the main network protocols ■ The detailed analysis of protocols Ethernet, IP, TCP, UDP, ARP ■ The implementation of IP routing and subnetting ■ The DHCP Services configuration ■ The network interface configuration ■ The Service and application filtering ■ The diagnosis of a malfunction with Wireshark

design of bio-MEMS systems

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	Vincent Senez	English or French

PREREQUISITES	■ None
LEARNING OUTCOMES	At the end of the course, the student should be able to make the link between the different scientific fields that underlie the BioMEMS field. He/she should be able to identify the tools necessary for the fabrication of such devices which are both in the field of microelectronics but also specific techniques such as soft lithography. He must be able to give examples of applications. He must also master the design methodology and be ready to choose a physical mechanism to realize a function in function in application areas such as screening, diagnosis, monitoring or therapy. He must be able to show the advantages of a miniaturized system compared to a standard laboratory tool.
COURSE DESCRIPTION	The objective of the course is to provide the basic knowledge for the design and fabrication of miniaturized systems dedicated to life sciences called BioMEMS.

artificial intelligence

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	N. Ihaddadene	English

PREREQUISITES	■ None
LEARNING OUTCOMES	■ Understand the application fields and basic concepts related to Artificial Intelligence (AI). ■ Learn how to model a problem and solve it with an AI approach. ■ Start using AI modeling, machine learning and development tools. ■ Browse recent advances in AI.
COURSE DESCRIPTION	■ Background, definitions and basic concepts. ■ Fields of application (Natural language processing, machine vision, robotics, ...). ■ Input concepts. ■ Modeling and problem solving. ■ Supervised learning. ■ Unsupervised learning. ■ Neural networks and Deep Learning.

french as a foreign language

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1 & 2	3	Vira Wannepain	French

This French as a Foreign Language course is mandatory course for all non-French-speaking, degree-seeking students in the Master program. Students are placed according to their French level, as assessed using the Common European Framework.

OBJECTIVES AND SKILLS DEVELOPED	Develop French language skills in a social context, both written and oral, in order to improve communication: Listening, Reading, Speaking, Writing
CONTENT AND ORGANIZATION	■ Written and oral reception activities ■ Conceptualization of linguistic content ■ Training exercises in the classroom and at home ■ Written and oral production: simulation, role-playing, playful activities ■ Final Tasks mobilizing all the skills of a didactic unit
EVALUATION	■ Continuous assesment, oral presentations, final exam

bioinformatics

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	H. Cao	English

PREREQUISITES	Basic knowledge in biology, statistics and computer science program
LEARNING OUTCOMES	With the recent the growing importance of global approaches in the analysis of living organisms and biomedical research, a growing demand for young engineers with an integrated vision based on knowledge and skills at the crossroads of different disciplinary fields are needed to deal with large amounts of data which need to be managed, understood and analyzed in automated ways. The new challenge for bioinformatics engineer is to develop tools to understand specific mechanisms of human diseases, cellular and molecular networks, ecological systems… At the end of this module, the student will have acquired new theoretical knowledge on the latest advances in the fields of genetics, epigenetics and their study in the field of health, but also technical skills in the statistical study of data from global approaches, interpretation and application.
COURSE DESCRIPTION	The teaching module is divided into 8 sessions: ■ Bioinformatics and its fields of application ■ Sequencing techniques and research applications ■ Epigenetics: modifying gene expression without mutation ■ Bioinformatics and biostatistics: essential partners? ■ Bioinformatics and health research: gadget or real tool for public health? ■ R and the human genome ■ Genetic mutations, GWAS and Mendelian randomization: a clinical trial from Nature ■ Bioinformatics and genetics: correlations and causality

bioethics

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	2	H. Cao	English

	PREREQUISITES	■ None
	LEARNING OUTCOMES	The course proposes to describe and analyze some objects and methods of contemporary bioethics. The elaboration of a “knowledge about how to use knowledge” has indeed proved necessary in the most technologically advanced societies. From conception to death, from the genome to the brain, don’t technologies claim to improve our lives and do us good? It is precisely on the way of considering the “good” and the ways of achieving it that the bioethical quest is situated in all its complexity and indeterminacy. To do so, the discourse and practice of bioethics must be composite and multidisciplinary. We will look at the theoretical difficulties and pragmatic issues raised by contemporary bioethical questions, with particular attention to issues related to digital health.
CONTENT	Introduction	■ History of bioethics ■ Introduction to ethics
	Block 1 : Biology, genetics and ethics	■ Biological advances and bioethical controversies ■ Ethics and personalized medicine ■ Ethics, digital health, biological data and Biobanking
	Block 2 : Ethics and digital health	■ Ethics and digital health ■ Data (digital, biological, health...) ■ Artificial intelligence and Big Data

data base

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	D. Delannoy	French

PREREQUISITES	To follow this module, the student must know the notions of databases (reading a Conceptual Data Model, SQL queries) and have implemented these notions.
LEARNING OUTCOMES	Targeted skills : 32(321/323), 34(342/343), 43(431/432), 56(561/562), 63(634), 110(1102) This module addresses the notions of data modeling based on the MERISE method and allows to understand the whole chain from conception to implementation in a relational database. The orientation is suitable for all engineering profiles in software development, big data, connected objects, engineer of business domains. At the end of the course, the student will: ■ Know the concept of Information System data modeling ■ Be able to model the data of a Small Information System ■ Know how to read a conceptual data model and transform it into tables ■ Know the process of creating a database under PostgresSQL ■ Know how to insert data into a database and select them according to different criteria ■ Know how to select data in a database according to different criteria
COURSE DESCRIPTION	This module covers the following topics: ■ The role of modeling ■ The relational principle of organization of information ■ The presentation of the MERISE method ■ The conceptual, logical and physical modeling ■ The implementation of relational databases ■ The principles of a Database Management System (DBMS) ■ The description language of the database (SQL) ■ The data manipulation language (SQL)

MEMS applications : biology & clinics

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Vincent Senez	English or French

PREREQUISITES	This course introduces biological and clinical applications of MEMS technology. Therefore, students are highly encouraged to take the course on “Design of Bio-MEMS Systems”.
LEARNING OUTCOMES	By the completion of this course, the students will be able to understand the fundamental mechanisms underlying the LOC devices and to follow the latest developments on biological and clinical applications of MEMS and microfluidics.
COURSE DESCRIPTION	MEMS technology found numerous application opportunities in a wide range of fields: automotive industry, telecommunication, optics, consumer electronics, military, etc. One particular field of application is biotechnology. BioMEMS has been applied in medical and health related technologies as Lab-on-a-chip (LOC) and Micro Total Analysis Systems (µTAS). Integrating microfluidics with the mechanical and electrical capabilities of the MEMS technology is crucial to provide devices as miniaturized biosensors, point-of-care diagnostic devices, polymerize-chain-reaction chips and organs-on-a-chip.

advanced machine learning

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	F. Windal H. Benhabiles	English

PREREQUISITES	None
LEARNING OUTCOMES	The objective of this course is to familiarize you with the very advanced concepts of Machine Learning. The main algorithms will be presented and illustrated in intuitive ways, with practical and concrete cases where we want to make predictions. In this course you will also: ■ Explore the field of machine learning with its models, algorithms and data training ■ Understand supervised and unsupervised machine learning algorithms. ■ Use monolayer and multilayer neural networks to calculate outputs ■ Discover the technological tools for understanding machine learning.
COURSE DESCRIPTION	■ Advanced neural networks ■ Random forests ■ Decision trees ■ Support vector machines.

android

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	D. Delannoy	French

PREREQUISITES	To follow this module, the student must know the concepts of objects (construction of simple objects, construction of composite objects, inheritance, exceptions, inputs / outputs, threads, ...) and have implemented these notions in JAVA. Reference : “JAVA 1 module” M1 ISEN Lille
LEARNING OUTCOMES	Targeted skills : 34(342/343), 41(413/414), 43(431/432), 56(561/562), 63(634), 110(1102) This module is an illustration of the approach and the use of mobile application development tools. The orientation is suitable for all engineering profiles in software development, cyber security, connected objects domains. At the end of the course, the student will: ■ Know how to translate the client needs into functional specifications (application scenario) ■ Be able to design a scenario adapted to the customer needs and to the constraints related to the device used ■ Be able to develop an application under android and choose the ergonomics best suited to the subject ■ Know the Android development environment ■ Know how to use a configuration management environment (git) ■ Be able to present the application to a client ■ Know how to write a technical document of implementation and recipe ■ Be able to present its application and to argue the ergonomic choices The project approach requires the acquisition of technical and transversal skills such as the taking into account of a need, analysis and proposal of solutions, communication and restitution.
COURSE DESCRIPTION	This module covers the following topics: ■ The Android platform and its architecture ■ The development tools, development framework: Android Studio ■ The specificities of mobile terminals in terms of display and interaction with the user ■ The Android development ■ The life cycle of the application (simulation, testing and debugging) ■ The overview of the layout and the position of the component ■ The design of a graphical interface with views ■ The event management (implementation, reaction, listening) ■ The component model ■ The persistence of data ■ The use of the embedded database (SQLite), the insertion of data

internet of things

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	J. Nassar	English

PREREQUISITES	■ None
LEARNING OUTCOMES	At the end of this course, the student will be able to: ■ Identify the main technologies used in the Internet of Things and their challenges ■ Recognize and compare the main components of a computer ■ Connect remotely to a computer using the command line ■ Programming software on a remote computer ■ Connect a computer to a network and the Internet ■ Program sensors on Raspberry Pi
COURSE DESCRIPTION	■ Through a project of programming a connected object, introduction and practice of multiple computer concepts: ■ Introduction to the Internet of Things: current state, applications, and main technologies ■ Understanding the contents of a computer and the role of an operating system ■ Basic remote computer administration ■ Building python programs

artificial intelligence applied to health

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	3	H. Cao	English

PREREQUISITES	■ Basic concepts related to Artificial Intelligence (Reference: Artificial Intelligence (M1, Junia ISEN) ■ Basics of probability, usual probability distributions (Binomial, Normal, Student, Chi-squared, Fisher)
LEARNING OUTCOMES	To provide students with the methodological and practical foundations of statistical inference (estimation and hypothesis testing), the techniques of multi-factor analysis of variance and the methodology of experimental design. The course focuses on the implementation of the various methods studied with R or Python software. At the end of the course, the students must be able to : ■ Select the appropriate hypothesis test to answer a biomedical question posed ■ Describe the conditions of application and the different steps of the test ■ Perform the test with R or Python software ■ Interpret and discuss the results of the test ■ Determine if linear regression is appropriate to answer a biomedical question posed ■ Propose a linear regression model that can answer the question and that is adapted to the available data ■ Describe and verify the conditions for the application of the linear regression model ■ Estimate the linear model with R or Python software ■ Present and interpret the results of the linear model
COURSE DESCRIPTION	■ Hypothesis testing (Student, Wilcoxon, ANOVA, Fisher, McNemmar) ■ Simple and multiple linear regression ■ Applications; AI and genomics, AI and images, AI and morphology, AI and patient pathways

health data management

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 2	3	H. Cao	English

PREREQUISITES	Basic knowledge in database model and database request
LEARNING OUTCOMES	Health Data Management is the systematic organization of health data in digital form. In the hospital, the data comes from the different software used by the different actors around the patient care. Health Data Management deals not only with organizing medical data but also integrating it to build analysis to make patient care more efficient, while protecting the privacy and security of the data. The aims of this course are the following : ■ Learn what types of data are managed in Health Data Management in a hospital ■ Raise the student awareness of data protection considerations (GDPR) ■ Understand the IT organization in a hospital and get some clues about interoperability challenges and storage considerations ■ Understand the digital national policy in healthcare (“Ségur de la santé”) ■ Discover concrete applications of Health Data Management in order to get benefits for healthcare organizations, medical staff and patients.
COURSE DESCRIPTION	■ What is Health Data Management ? ■ General data protection regulation (GDPR) in healthcare ■ Interoperability challenges (Workflow, interfaces,…) ■ Digital Ségur in Healthcare ■ Data reuse : what for ? ■ Health Data Management for strategic aims : examples of application in a French Comprehensive Cancer Centre.

biostatistics

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 2	3	H. Cao	English

PREREQUISITES	■ Artificial Intelligence (M1, Junia ISEN) ■ Artificial Intelligence Applied to Health (M2, Junia ISEN)
LEARNING OUTCOMES	Become familiar with the methodology and practical implementation of descriptive health statistics; multidimensional data exploration, statistical models for the analysis of categorical data (binary, with more than 2 ordered modalities or not), survival models, high dimensional regression models and their practical implementation with R of Python software for the analysis of data from epidemiological or clinical studies. At the end of the course, the students must be able to : ■ Describe the frequency of a health problem and the variation of its distribution according to the characteristics of time, place and people ■ Select an appropriate multidimensional method to explore and resume a biomedical data, perform the method with R or Python software, interpret and discuss the results of the analysis ■ Select the appropriate duration model to analyze survival data, estimate the model with R or Python, present and interpret the results ■ Select the appropriate regression model for high dimensional medical data, estimate the model with R or Python, present and interpret the results ■ Construct health score
COURSE DESCRIPTION	■ Dimension reduction methods (PCA, CA) ■ Descriptive epidemiology ■ Duration models (survival data analysis, censoring, truncation), estimation of the survival function, regression models (Cox) ■ Regression models for the analysis of categorical data (logit, multinomial,...) ■ Regression of bio-medical data in high dimension (variable selection, Integration of genetic variables, classical clinic-biological variables and “omics” type variables) ■ Health score construction

cloud computing and architecture

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	3	F. Windal D. Delannoy	English

PREREQUISITES	■ Java Courses (M1, semester 1) ■ Network & Sys base (M1, semester 1) ■ Data bases (CSI3, CIR3, semester 2)
LEARNING OUTCOMES	Target skills : 34(342,343), 41(412, 413,414), 42(422), 53(531,532), 54(541,542), 61(611,612,613), 62(621,622), 63(632,634) **Cloud Computing** The objective of this part of the course is to introduce the fundamental concepts of Google Cloud for a company. This platform includes various cloud services for computing, storage, networking, Big Data, machine learning, Internet of things, security, cloud management and application development that are directly launched on Google's servers. **Architecture** The objective of this part of the course is to understand the concept behind the term "Big data", from a perspective: ■ Architectural: resource organization, servers for performance optimization ■ Technological: the software suite deployed ■ Business: understanding the client's needs for the implementation of decision support tools
COURSE DESCRIPTION	**Cloud Computing** ■ Introduction of the fundamental concepts of cloud computing, technical aspects (data center architecture, non-relational databases) and economic aspects (service and billing) ■ Development & deployment of a web application on the Goolge Cloud platform - PaaS service **Big data Architecture** **Part 1: Deploying a Big Data Architecture** ■ Understand the notions of performance in the deployment of a Big Data architecture ■ Acquire knowledge about data storage solutions ■ Discern the differences between databases (NoSQL, Elastic, Oracle, MongoDB...) ■ Understand the importance of file systems (HDFS) in a Big Data architecture ■ Example of the implementation of the "Crédit Agricole" datalake

urbanization of it services

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	2	D. Delannoy	English

PREREQUISITES	None
LEARNING OUTCOMES	Targeted skills : 31(311/312/313), 32(321/322/323), 33(331/332/333), 56(561/562), 71(711), 110(1102) In connection with technical and management, this module allows to understand the stakes and to master the deployment of the new information technologies. The agility that determines responsiveness to evolutions applies not only to software development, but also to the way in which the businesses and functions of the company rely on a harmonious set of resources - hardware, software, personnel, data and Procedures. The construction of an information system can no longer be freed from urbanization without compromising its ability to integrate new needs as a city could fade due to the lack of adequate infrastructures. The aim is to provide a complementary managerial dimension to the technical training required for architectural missions. The orientation is suitable for the engineering profiles of the areas of software development, big data, cyber security and connected objects, part of project management allows to integrate managerial profiles. At the end of the course, the student will: ■ Understand the challenges of an information system ■ Be able to identify the architecture of an information system (from hardware to applications ■ Know how to follow a method of analysis of the computer heritage ■ Be able to identify, analyze and classify the axes of improvement of an information system ■ Know how to design an evolution plan ■ Know how to follow urbanization methods and good practices
COURSE DESCRIPTION	Such as urbanization of human habitat (organization of cities, territory), its concepts have been taken up in computer science to model and formalize the engineering of Information Systems (IS). Urban planning thus defines rules and a coherent, stable and modular framework, to which the various stakeholders refer for any investment and evolution decision relating to the Information System. An introduction to the use of “best practices” ITIL (Information Technology Infrastructure Library) presents the methods and tools that today are indispensable for improving the management of IT services. It brings together the means to structure and improve the efficiency, performance and costs of these services. The adoption of these good practices ensures that customers and suppliers (internal and external) have a service that meets internationally established quality criteria. This module covers the following topics: ■ The role and the stakes of an information system ■ The foundations and principles of urbanization ■ The strategic changes in the company ■ The market opportunities ■ The role of the players in the information system ■ The mapping tools and metamodel representation ■ The definition of the different missions of urbanization

french as a foreign language

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	2	Vira Wannepain	French

This French as a Foreign Language course is mandatory course for all non-French-speaking, degree-seeking students in the Master program. Students are placed according to their French level, as assessed using the Common European Framework.

OBJECTIVES AND SKILLS DEVELOPED	Develop French language skills in a social context, both written and oral, in order to improve communication: Listening, Reading, Speaking, Writing
CONTENT AND ORGANIZATION	■ Written and oral reception activities ■ Conceptualization of linguistic content ■ Training exercises in the classroom and at home ■ Written and oral production: simulation, role-playing, playful activities ■ Final Tasks mobilizing all the skills of a didactic unit
EVALUATION	■ Continuous assesment, oral presentations, final exam

JUNIA ISEN

BioNanoTechs

XXXX

LEARN MORE AT ISEN-LILLE.FR

MASTER 1	ECTS
Choose 4 courses:	12
Semiconductors physics and components (S1)	3
Design of Bio-MEMS Systems (S1)	3
Hands-on 32-bit ARM microcontrollers (S1)	2
Quantum Communications (S1)	2
Wireless Technologies & Applications (S1)	3
Waves and Components (Labs) (S2)	3
MEMS Applications: Biology and clinics (S2)	3
Energy Harvesting (S2)	2
Quantum Computing (S2)	2
Digital Microelectronics Circuits (S2)	2
Artificial Intelligence (S2)	3
Audio Signal Processing (S2)	2
Humanities & Management: Responsibility activity, Project Management, Management Skills, Intercultural Communication	5
French as Foreign Language	3
2 Technical projects (S1 & S2)	4 (S1) 7 (S2)
3 months Internship (S2)	3

MASTER 2 - FALL SEMESTER	ECTS
Choose 3 courses:	9
Microelectronics	3
Optoelectronics	3
MEMS Sensors and actuators, mechanics, acoustics	3
Advanced Electronics	3
Electives (choose one):	
Automotive Electronics	2
Hardware	2
Humanities & Management	5
French as Foreign Language	2
Innovation Project	9

MASTER 2 - SPRING SEMESTER	ECTS
Six-month Internship	30

contact

XXX, XXX
XXX@junia.com

semiconductors physics and components

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	Xavier Wallart	English or French

PREREQUISITES	Basic notions of Quantum Mechanics and Solid State Physics
LEARNING OUTCOMES	At the end of this course, the student must: ■ Master the general equations governing the concentrations of free carriers and their spatial and temporal evolutions in semiconductors ■ Know the different operating regimes of a diode and a transistor ■ Understand the light-semiconductor interaction ■ Get an overview of future trends in opto and microelectronic components
COURSE DESCRIPTION	This course provides the basic tools to understand the physics of semiconductors and thus understand the functioning of the micro and optoelectronic components that are at the heart of our connected daily lives: transistors, photodiodes, light-emitting diodes. It also introduces the simulation of fundamental electronic properties and offers an opening to the most advanced aspects in terms of nanotechnologies. Teaching semiconductor physics will allow the student to: ■ Identify the key parameters of the band structure of a semiconductor: band gap (direct and indirect), effective mass ■ Differentiate intrinsic and extrinsic semiconductor with the 2 types of doping ■ Calculate the concentrations of free carriers and the conductivity of a semiconductor ■ Derive spatial and temporal evolutions from free carrier densities ■ Describe the phenomena of optical absorption and luminescence By implementing these basic notions in the description of the operation of semiconductor devices, the student: ■ Will include the detailed operation of a p-n junction, MOS transistor, photodiode and light-emitting diode ■ Will know the main material parameters of the operation of these devices ■ Understand the limitations of the components ■ Will be able to make the link with their use in microelectronic circuits and common applications

design of bio-MEMS systems

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	Vincent Senez	English or French

PREREQUISITES	■ None
LEARNING OUTCOMES	At the end of the course, the student should be able to make the link between the different scientific fields that underlie the BioMEMS field. He/she should be able to identify the tools necessary for the fabrication of such devices which are both in the field of microelectronics but also specific techniques such as soft lithography. He must be able to give examples of applications. He must also master the design methodology and be ready to choose a physical mechanism to realize a function in function in application areas such as screening, diagnosis, monitoring or therapy. He must be able to show the advantages of a miniaturized system compared to a standard laboratory tool.
COURSE DESCRIPTION	The objective of the course is to provide the basic knowledge for the design and fabrication of miniaturized systems dedicated to life sciences called BioMEMS.

hands-on 32-bit arm microcontrollers

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	2	B. Stefanelli	English

PREREQUISITES	■ Master the basics of microcontroler architecture (ALU, IO's, memory...) and assembly language programming. ■ This corresponds to a standard digital electronics course like "Electronique Numérique" (1314-ISEN-L3S1-CSI3-ElecNum).
LEARNING OUTCOMES	Targeted skills : 32 (323), 34 (342/343), 42 (422), 110(1101/1102), 1110(11104) ■ Acquire the basics of ARM architecture, ■ Acquire a deeper knowledge of advanced microcontrolers hardware implementing ARM Cortex-M4 core, ■ Acquire the basics of inter-circuits and inter-systems data links.
COURSE DESCRIPTION	■ The ARM concept, STM32F446 architecture, ■ The clock tree and PLLs, ■ Basic I/Os, ■ The interrupts, ■ Timers and PWM, ■ The USART, SPI et I2C, ■ Low power modes, ■ Direct memory access, ■ CAN bus basics, ■ programming in C

quantum communication

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	2	I. Lefebvre JF. Robillard	English

PREREQUISITES	This module is intended to be accessible to all and requires as a prerequisite only a knowledge of the concepts seen in the course of quantum mechanics
LEARNING OUTCOMES	This module must allow: ■ to better master the fundamental principles and phenomena of quantum mechanics such as the superposition of states or entanglement ■ acquire a state-of-the-art vision of the use of these principles and their use in telecommunications and the exchange of quantum keys for cryptography
COURSE DESCRIPTION	■ Notions (Polarized photon - Superposition - Measurement - Intricacy - Correlated states) ■ Implementation problems (Decoherence - Noise) ■ Equipment used (Laser - Bi-photon generator - Photon counter - Optical fiber - Beam Splitter) ■ Applications (Network, Quantum Key Distribution) Teaching modalities

wireless technologies and applications

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1	3	JM. Capron JF. Lampin	English

PREREQUISITES	None
LEARNING OUTCOMES	The objective of this lecture is to introduce the fundamentals of wireless communications, and their implementation in broadly used applications. It explains the technologies and architectures involved in wireless transmission of analog and digital information, focusing on the latter case. The bases of electromagnetism and transmission lines are developped, as a prerequisite to antenna analysis.
COURSE DESCRIPTION	The course includes two complementary parts: ■ The former deals with the fundamentals explaining the propagation of electrical signals along transmission lines. By extension to electromagnetism, this leads to antennas theory, whose operation and main characteristics (gain, radiation, ...) are developped. Link budget is finally studied, which shows the relation between emitted and received powers in case of a wireless transmission. ■ The second part deals with applications: it shows how the above principles can be used to build a RF system, such as cellular phone communications. The following topics are studied: - multiple access techniques to optimise the use of radio channels, - influence of noise and linearity on RF system performances, - IQ modulation for digital wireless communications, - basic functions in the architecture of a RF transmitter or receiver, - frequency synthesizer operation.

waves and components labs

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Monique Pouille-Favre	French & English

PREREQUISITES	■ Basic knowledge of Physics and Electronics ■ Strong motivation for research and innovation
LEARNING OUTCOMES	At the end of each lab, the student will be able to ■ Master measurement equipment as well as data processing software ■ Conduct experiments ■ Analyze and explain the results ■ Write a report and carry out a state of the art
COURSE DESCRIPTION	■ This module offers the student to discover the world of research through experiments carried out in a wide variety of fields ranging from the physics of materials to the waves and radiation that can propagate there. ■ This experimental approach will be carried out through the use of instrumental techniques implemented in the research laboratories of ISEN, IEMN, IBL and IRCL. ■ The objective is therefore to enrich the student's skills to pursue a career as a researcher and/or engineer in the fields of research and innovation.

MEMS applications : biology & clinics

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	Vincent Senez	English or French

PREREQUISITES	This course introduces biological and clinical applications of MEMS technology. Therefore, students are highly encouraged to take the course on “Design of Bio-MEMS Systems”.
LEARNING OUTCOMES	By the completion of this course, the students will be able to understand the fundamental mechanisms underlying the LOC devices and to follow the latest developments on biological and clinical applications of MEMS and microfluidics.
COURSE DESCRIPTION	MEMS technology found numerous application opportunities in a wide range of fields: automotive industry, telecommunication, optics, consumer electronics, military, etc. One particular field of application is biotechnology. BioMEMS has been applied in medical and health related technologies as Lab-on-a-chip (LOC) and Micro Total Analysis Systems (µTAS). Integrating microfluidics with the mechanical and electrical capabilities of the MEMS technology is crucial to provide devices as miniaturized biosensors, point-of-care diagnostic devices, polymerize-chain-reaction chips and organs-on-a-chip.

energy harvesting

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	2	Jean-François Robillard	English & French

PREREQUISITES	Basic notions in thermodynamics, physics and electronics
LEARNING OUTCOMES	At the end of this course, the student must: ■ Know the main sources of energy recoverable in the environment for autonomous systems. ■ Know the associated orders of magnitude. ■ To reappropriate the notions of essential thermodynamics: Carnot yields, Chambadal-Novikov and to be introduced to the theory of linear response. ■ Know how the p-n junction works under illumination ■ Know the main properties and use cases of micro batteries and super capacities.
COURSE DESCRIPTION	This course provides an introduction to electrical energy recovery methods dedicated to powering small electronic systems to ensure their autonomy. Four themes are declined more precisely: i) photovoltaics, ii) thermoelectricity, iii) vibration mechanical energy and iv) storage in micro batteries and super capacities. A TP is proposed to take in hand a prototyping kit of electrical energy management and illustrated in the case of photovoltaic and thermoelectric energy. The course opens on themes related to research in this field. Teaching in Energy Harvesting will allow the student to: ■ Be able to size a recovery system in relation to the need for power supply. ■ Determine the energy stored in a mechanical system in vibration. ■ Determine the main useful quantities of a Peltier module. ■ Propose an energy recovery solution for a given use case. ■ Manipulate an energy management circuit to illustrate a photovoltaic and thermoelectric use case.

quantum computing

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	2	G. Chênevert JF. Robillard	English

PREREQUISITES	This opening module is intended to be widely accessible to all and has no specific prerequisites apart from a general mastery of the useful concepts of the common core of the third year (quantum mechanics, probability, digital electronics, programming).
LEARNING OUTCOMES	Target Skills : 34 (342), 101 (1011), 144 (1441), 146 (1461), 62 (622) To allow the student to acquire a factual and critical vision of the state of the art and the material and software perspectives related to the manipulation of quantum information. Master the foundations and put into practice simple algorithms in simulation or on real architecture (IBM Q).
COURSE DESCRIPTION	■ Quantum information: states and measurement ■ Physical modalities of the qubit ■ Logic gates ■ Universal quantum computer ■ Quantum simulation ■ Main algorithms: Grover, Shor, ... ■ Programming and simulation

digital microelectronic circuits

JUNIA ISEN

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	E. Dubois	English

	PREREQUISITES	None
	LEARNING OUTCOMES	At the end of this class unit, a student must be able to: ■ Calculate the current-voltage characteristics of diodes, bipolar transistors and metal-oxidesemiconductor (MOS) transistors ■ Properly explain the mechanisms of charge transport in the above mentioned devices ■ Derive the voltage transfer characteristic (VTC) of a basic bipolar inverter stage ■ Derive the voltage transfer characteristic (VTC) of elementary CMOS circuits ■ Implement and properly design simple combinational logic circuits ■ Explain the operation of clocked circuits ■ Extract a circuit schematic from a circuit layout.
CONTENT	**Chap. 1**	■ Properties of digital circuits Definitions, voltage transfer characteristic (VTC), noise margin
	Chap. 2	■ Elementary digital bipolar circuits -The bipolar inverter stage in static regime, Analysis of different operating modes, The saturation regime and its numerical treatment, Calculation of the VTC
	Chap. 3	■ The Metal-Oxide-Semiconductor (MOS) Transistor: Introduction
	Chap. 4	■ The MOS capacitance: The ideal flatband condition, Different operating regimes, Calculation of the threshold voltage, The MOS capacitance
	Chap. 5	■ The MOS Transistor: Structure, Current-voltage model (Memmelinck diagram), Different types of MOS transistors, Dynamic model, Elements of advanced MOS modeling
	Chap. 6	■ Elementary MOS Circuits: The MOS inverter, Inverter with passive resistor load, CMOS inverter, Gate delay, fan-in, fan-out, The CMOS switch
	Chap. 7	■ Combinational circuits: Implementation & device sizing, Power consumption, delays and other issues
	Chap. 8	■ Clocked circuits: Latches & flip-flops, Dynamic logic
	Chap. 9	■ Process & layout: CMOS process, Layout: devices and parasitics, Interconnections, ESD protection.

artificial intelligence

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	3	N. Ihaddadene	English

PREREQUISITES	None
LEARNING OUTCOMES	■ Understand the application fields and basic concepts related to Artificial Intelligence (AI). ■ Learn how to model a problem and solve it with an AI approach. ■ Start using AI modeling, machine learning and development tools. ■ Browse recent advances in AI.
COURSE DESCRIPTION	■ Background, definitions and basic concepts. ■ Fields of application (Natural language processing, machine vision, robotics, ...). ■ Input concepts. ■ Modeling and problem solving. ■ Supervised learning. ■ Unsupervised learning. ■ Neural networks and Deep Learning.

audio signal processing

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	2	A. Pate	English

PREREQUISITES	■ Signal and image analysis (3rd year) ■ Basics of physics (waves and acoustics) ■ Scientific computing (e.g. Python or Matlab)
LEARNING OUTCOMES	Targeted skills : 31 (311/313), 32 (321/322/323), 41 (411/413), 111 (1111), 146 (1461), 56 (561/562) ■ Get familiar with digital signal processing and filtering through real-life applications in the audio domain (speech and music) ■ Know how to describe and analyze an audio signal in the time, spectral, and time-frequency domains ■ Know and implement classical audio analysis methods ■ As a group, apply and organize acquired knowledge to analyze and understand state-of-the-art methods.
COURSE DESCRIPTION	■ Basics of acoustics (propagation, atténuation, absorption, reflection, transmission, intensity, sound level, radiation, impulse response, reverberation) ■ Time (onset, energy, zero-crossing...) and frequency (fundamental frequency, spectral centroid, ...) signal descriptors ■ Detection of fundamental frequency and onset (methods in the time domain, frequency domain, as well as time-frequency domain) ■ Speech modeling and coding (source-filter, LPC, cepstrum) ■ Time-frequency analysis (STFT, filterbanks) ■ Introduction to sound synthesis, denoising, audio coding, audio compression.

french as a foreign language

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 1 & 2	3	Vira Wannepain	French

This French as a Foreign Language course is mandatory course for all non-French-speaking, degree-seeking students in the Master program. Students are placed according to their French level, as assessed using the Common European Framework.

OBJECTIVES AND SKILLS DEVELOPED	Develop French language skills in a social context, both written and oral, in order to improve communication: Listening, Reading, Speaking, Writing
CONTENT AND ORGANIZATION	■ Written and oral reception activities ■ Conceptualization of linguistic content ■ Training exercises in the classroom and at home ■ Written and oral production: simulation, role-playing, playful activities ■ Final Tasks mobilizing all the skills of a didactic unit
EVALUATION	■ Continuous assesment, oral presentations, final exam

microelectronics

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	3	Antoine Frappe	French & English

PREREQUISITES	■ Fundamentals of analog electronics and digital electronics ■ Analog circuit design ■ Design of digital electronic circuits
LEARNING OUTCOMES	At the end of this course, the student must: ■ Know the design tools and flows used in microelectronics ■ Design and validate in post-layout simulation a microelectronic system in advanced CMOS technology ■ Master the basics of using the tools of the Cadence suite
COURSE DESCRIPTION	This course is an introduction to microelectronic integrated circuit design methods and tools. This module includes an introduction to microelectronics, a description of the design flows and tools needed, getting started with the Cadence software suite through basic cell design, and implementing ring oscillator-type components. Teaching in Microelectronics will allow the student to: ■ Implement integrated circuit design flows. ■ Know how to use the main tools of microelectronic circuit development and design. ■ Know how to size functional blocks based on transistors. ■ Simulate the influence of physical elements and compare theoretical simulations with simulations including real elements.

optoelectronics

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	3	Bruno Grandidier	French & English

PREREQUISITES	This course draws on the basics of electromagnetism, wave physics and solid state physics seen in previous years.
LEARNING OUTCOMES	■ Understand fundamental concepts and identify key parameters in the fields of optoelectronics and photonics. ■ Solve simple calculations related to the physical models described in this course ■ Analyze solid state physics problems using numerical or analytical methods ■ Illustrate and qualitatively describe ongoing developments in quantum optics
COURSE DESCRIPTION	This course focuses on the study, manufacture and characteristics of devices combining optical and electronic phenomena such as optical fibers, photodetectors or optical transmitters. The teaching will address the following themes: ■ Reminder of electromagnetic theory ■ Propagation of electromagnetic waves in vacuum and media ■ Basic concepts in crystals and optical response of materials ■ Optoelectronic devices and laser diodes ■ Device manufacturing technology and methods ■ Example of a single-photon source based on Quandela technology

MEMS sensors and actuators, mechanics, acoustics

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	3	Bertrand Dubus	French & English

PREREQUISITES	Basic knowledge of COMSOL Multiphysics software
LEARNING OUTCOMES	■ General knowledge of typical MEMS architecture and functions ■ Detailled knowledge of the design flow on a specific function ■ Design using COMSOL Multiphysics software ■ Knowledge of some limitations and design rules ■ Fabrication Technology
COURSE DESCRIPTION	■ Overview of the various domains using MEMS technologies. ■ MEMS design, simulation (comsol) ■ introduction to clean room manufacturing and device characterization

advanced electronics

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	3	JM. Capron	English

PREREQUISITES	Master analysis and synthesis tools for analog circuits. This corresponds to a standard electronics course like “Electronique Analogique & Numérique” (0910-ISEN-L3S1-CSI3-ElecAna&Num). A basic knowledge of transistor-level circuit analysis is required, as found in the course “Analog circuits design” (0910-ISEN-M1P1-MSNN-MFO-CCI:fonctionsdeb).
LEARNING OUTCOMES	Targeted skills : 31 (311), 32 (321), 42 (422), 56 (562) ■ To gain the advanced knowledge that any engineer in electronics should have. ■ To be able to understand the basic operation of the main building blocks used in telecommunication systems. ■ To understand the design flow of digital systems, covering as well the methodology and the ressources design(memory, bus, CPU). ■ The main part of this class deals with analog electronics (for typically 80%). The remaining part is related to digital electronics.
COURSE DESCRIPTION	■ Oscillators ■ Phase-Lock Loops ■ Direct Digital Synthesis ■ Digital systems architecture

automotive electronics

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	2	JM. Capron	English

PREREQUISITES	None
LEARNING OUTCOMES	Targeted skills : 52 (521), 71 (712, 713), 83 (831), 126 (1261, 1262), 56 (561) The objective of the course is to give a good knowledge of the automotive domain through the applications of electronics in current and future vehicles. In addition, specific issues such as quality, cost and reliability are also introduced. The trends and the involved technologies are studied.
COURSE DESCRIPTION	■ Electric and electronics applications in automotive ■ Hybrid vehicles ■ Data multiplexing (CAN network, etc...) ■ Wireless control ■ Automotive radar ■ Driving automation ■ Optical and electronics components for automotive ■ Reliability and test ■ Project management / Quality

hardware for artificial intelligence

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 2	Semester 1	2	Benoît Larras	English

PREREQUISITES	None
COURSE DESCRIPTION	Computational processors have to deal with a growing amount of data to be processed for an immense variety of applications. Because of that, conventional architectures of processors reach their limit in the quantity of data they can process in real time, and/or the energy needed to process this amount of data. The aim of this course is to explore solutions to mitigate this problem at different levels of the processing chain. The course will cover the efficiency aspects from the structural point of view (GPU-based and architectures and AI accelerators) down to the physical level (new kinds of electronic components) for a future generation of processors.

french as a foreign language

Level	Period	ECTS Credits	Teacher Coordinator	Language
MASTER 1	Semester 2	2	Vira Wannepain	French

This French as a Foreign Language course is mandatory course for all non-French-speaking, degree-seeking students in the Master program. Students are placed according to their French level, as assessed using the Common European Framework.

OBJECTIVES AND SKILLS DEVELOPED	Develop French language skills in a social context, both written and oral, in order to improve communication: Listening, Reading, Speaking, Writing
CONTENT AND ORGANIZATION	■ Written and oral reception activities ■ Conceptualization of linguistic content ■ Training exercises in the classroom and at home ■ Written and oral production: simulation, role-playing, playful activities ■ Final Tasks mobilizing all the skills of a didactic unit
EVALUATION	■ Continuous assesment, oral presentations, final exam

JUNIA Grande école d'ingénieurs

2 rue Norbert Ségard
59014 Lille cedex
FRANCE

JUNIA.COM