JUNIA

Grande école d'ingénieurs

English-Taught Courses 2020-2021

JUNIA Grande école d'ingénieurs

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.

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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.

JUNIA HEI JUNIA ISA JUNIA ISEN

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Junia HEI
International Preparatory Cycle
English-Taught Courses
2020-2021

The Junia international preparatory cycle is a three-year course for students with a baccalaureate S, ES or STI2D or with a scientific degree of the Bac+1 or Bac+2 type.

Learn more at hei.fr.

INTERNATIONAL PREPARATORY CYCLE

JUNIA Grande école d'ingénieurs

YEAR 1 - FALL SEMESTER	ECTS
Mathematics 1	4
Thermodynamics 1	4
Structural Mechanics	5
Circuits	5
Programming	4
English	2
Second Language	1
Intercultural Communication	1
Project Management	3

YEAR 1 - SPRING SEMESTER	
Mathematics 1	3
Mechanical Design	5
Electronics	4
Database Systems	3
English	2
Second Language	1
Intercultural Communication	1
Creativity & Innovation	2
Business Practices 1	4
Two-Month Internship Discovery of a New Culture	5

YEAR 2 - FALL SEMESTER	ECTS
Mathematics 2	4
Thermodynamics 2	4
Control & Instrumentation	4
Sensors & Networks	4
Digital Electronics	5
English	4
Second Language	1
Business Practices 2	4

YEAR 2 - SPRING SEMESTER	
Fluid Dynamics	4
Materials for Mechanical Engineering	4
Information Systems	3
Mathematics 2	2
Industrial Engineering	4
Design & Mechanics	3
Mechanical Team Project	4
Three-month Internship Technician role in a company abroad	6

Contact

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MATHEMATICS 1

LEVEL: CPI YEAR 1
PERIOD: SEMESTERS 1 & 2
LANGUAGE: EN
ECTS: 7 TOTAL (4 S1, 3 S2)
HOURS: 90 TOTAL (50 S1, 40 S2)
TEACHER/COORDINATOR: BOUCHAIB MOUHMID

JUNIA Grande école d'ingénieurs

1-Course Objective

The acquisition of a knowledge base and methods in engineering mathematics.

2- Learning Outcomes

› Develop reasoning and modelling skills

› Establish links with other disciplines addressed during the engineering cycle

3- Assessment

50% Continous Assessment
50% Exam

5- Content

Arithmetic	Types of numbers Fractions Decimal numbers Powers Number systems Trigonometry
Algebra	Review of basics Algebraic expressions Powers as related to logarithms Rules of logarithms Multiplication / division / factorisation of algebraic expressions
Expressions and Equations	Evaluating expressions Independent variables Transposition of formulas Polynomial equations Simultaneous linear equations
Integration	Areas and volumes Improper integrals
Integral Transforms	Fourier series
One Variable Funtction Differentiations	Small increments Rates of change Critical values
Complex Numbers	Cartesian, polar and exponential forms
Functions, Graphs, Data	Cartesian and polar co-ordinates / axes Use of software tools for plotting graphs and charts
Matrices and Determinants	Matrix algebra Determinants Solving a stet of linear equations

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Vectors	Two and three dimensions Vector algebra
Differential Equations	First-order differential equations Second-order differential equations with constant coefficients
Numerical Methods	Bisection method Fixed-point iteration Convergence criteria Newton - Raphson Secant method Trapezoidal rule Simpson's rule Langrage interpolation polynomial

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THERMODYNAMICS 1

LEVEL: CPI YEAR 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 4
HOURS: 50
TEACHER/COORDINATOR: RAOUF MOBASHERI

1-Course Objectives

› Present the general principles of thermodynamics

› Present the different transformations of closed and open systems

› Study Carnot's machine and present the problem of thermal machines

2- Learning Outcomes

The students will know how to:

› Apply the 1st and 2nd principle of thermodynamics to solve problems

› Draw a cycle in a diagram or with a table of any gas (perfect or real)

3- Assessment

40% Continous Assessment
10% Practical Laboratory Sessions
50% Exam

5- Content

Introductory Concepts and Definitions	› Closed Systems and Open Systems › Control Volume and Control Mass › Property, State, and Process › Extensive and Intensive Properties › Macroscopic and Microscopic Views of Thermodynamics › Equilibrium › Specific Volume, Pressure, Temperature
Properties of a Pure Substance	› The Pure Substance › The Phase Boundaries › The P–v–T diagrams › Tables of Thermodynamic Properties › The Two-Phase States › The Liquid State, Solid States and the Superheated Vapor States › Thermodynamic Tables › Finding the State of a Pure Substance using Tables › The Ideal Gas States
First Law of Thermodynamics	› The Energy Equation › The Definition of Work › Work Done at the Moving Boundary of a Simple › Compressible System › Definition of Heat and Heat Transfer Modes › The First Law of Thermodynamics › Internal Energy › Enthalpy

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Energy Analysis for a Control Volume	› Conservation of Mass and the Control Volume › The Energy Equation for a Control Volume › The Steady-State Process › Multiple Flow Devices › The Transient Process › Engineering Applications
The Second Law of Thermodynamics	› Heat Engines and Refrigerators › The Second Law of Thermodynamics › Reversible and Irreversible process › The Carnot Cycle › Two Propositions Regarding the Efficiency of a Carnot Cycle › Thermodynamic heat engines, refrigerators and heat pumps › Thermal efficiency for heat engine, refrigerator and heat pumps › Engineering Applications
Entropy	› The Inequality of Clausius › Entropy › The Entropy of a Pure Substance › Entropy Change in Reversible Processes › The Thermodynamic Property Relation › Entropy Change of a Control Mass During an Irreversible Process › Entropy Generation and the Entropy Equation › Principle of the Increase of Entropy › Entropy as a Rate Equation
Second-Law Analysis for a Control Volume	› The Second Law of Thermodynamics for a Control Volume › The Steady-State Process and the Transient Process › The Steady-State Single-Flow Process › Principle of the Increase of Entropy › Engineering Applications; Efficiency

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STRUCTURAL MECHANICS

LEVEL: CPI YEAR 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 5
HOURS: 60
TEACHER/COORDINATOR: RAOUF MOBASHERI

1-Course Objectives

› Acquire an understanding of the principles of structural mechanics and engineering application analysis

› Study of the mechanics of structures makes it possible to calculate deformations, internal forces (or stresses) in structures

› Evaluate the performance of existing structures

› Developing the knowledge required to design engineering applications

2- Learning Outcomes

› Apply standard expressions and formulae to calculate material properties

› Analyze the dynamics response of engineering structures

› Analyze the response of engineering structures due to different loading conditions

› Appraise, compare and design engineering structures whilst evaluating their structural response to different loading conditions

3- Assessment

40% Continous Assessment
10% Practical Laboratory Sessions
50% Exam

5- Content

Introduction to Statics, Force Systems and Equilibrium	› Basic Concepts › Scalars and Vectors › Newton's Laws › Rectangular Components › Moment, Couple › Varignon's Theorem › Calculate the Resultants › Concentrated Forces and Distributed Forces › System Isolation and the Free-Body Diagram
Structures and Distributed Forces	› Plane Trusses › Method of Joints › Frames and Machines › Center of Mass and Centroids of Lines, Areas, and Volumes

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Introduction to Structural Mechanics, Stress and Strain under Axial loading	› Concept of Stress and Strain › Axial Stress and Shearing Stress › Bearing Stress in Connections › Stress on an oblique Plane under Axial loading › Determination of the Ultimate Strength of a Material › Allowable Load and Allowable Stress; Factor of Safety › Mechanical Testing under Tensile, Compressive Loading › Stress-Stain Diagram › Elasticity, Plasticity, Yield, Stress › Hooke's Law; Modulus of Elasticity › Statically Indeterminate Problems › Stress Under General Loading Conditions › Poisson's Ratio › Stress Concentration
Torsion	› Circular Shafts in Torsion › Torsional deformation of circular shafts › Torsion formula › Angle of Twist › Power transmissions › Statically Indeterminate Shafts › Design of Transmission Shafts › Torsion of Non circular Members
Bending	› Symmetric Members in Pure Bending › Deformation in Pure Bending › Stress in Pure Bending › Moment of Inertia › Parallel-Axis Theorem › Structures loaded in Bending › Statically Determinate Structures, Statically Indeterminate structures
Analysis and Design of Beams for under Bending and Shearing Stresses	› Distributed Loads – Internal and external Effects › Construction of Axial force, Shear Force and Bending Moment Diagrams › Shearing Stresses in Beams

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CIRCUITS

LEVEL: CPI YEAR 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 5
HOURS: 60
TEACHER/COORDINATOR: MEHDI NASSER

1-Course Objectives

› Use simple components (resistance, inductor, capacitor), master the basic theoretical notions of electrical circuits, interpret the different electrical quantities
› Assess the risks associated with the use of electrical energy
› Calculate the electrical quantities (currents, voltages and powers) present in electrical circuit
› Choose an electric machine and its order according to specifications
› Make industrial electrical diagrams and plans in accordance with good engineering practice and current standards
› Identification and characterization of disturbances affecting electrical networks

2- Learning Outcomes

› Choose an electrical machine and its control or an electrical transformer or rectifiers, choppers and inverters, according to established specification
› Make electrical diagrams
› Know how to use electricity measurement instruments and measure disturbances affecting the electrical networks

3- Assessment

40% Continous Assessment
20 % Practical Laboratory Sessions
50% Exam

5- Content

DC Circuits, Resistive Circuits	Series, parallel and mixed circuits Voltages, currents, power / Voltage and current dividers Ohm's law and Kirchhoff's laws Node and mesh methods Network theorems
Transient in DC Circuits	Energy storage elements Charging and discharging Analysis of RC, RL and RLC circuits Time constant Steady state analysis Faraday's law of induction
AC Circuits	Response of basic elements Inductive and capacitive reactance and circuits Complex impedance Current, voltages and phases representation
Power in an AC Circuit	Single and three phase circuits Apparent, reactive, active power Power factor Magnetism and Electromagnetism Power generation and distribution Power Electronics

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PROGRAMMING

LEVEL: CPI YEAR 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 4
HOURS: 45
TEACHER/COORDINATOR: LISE-MARIE VEILLON

1-Course Objectives

› Provide students with a basis for understanding the fundamental principles of data structure and algorithms
› Break down a problem into sub-problems
› Use appropriate algorithms to solve sub-problems
› Become familiar with the fundamental principles of data structures, algorithms and problem solving

2- Learning Outcomes

› Select and employ data structures appropriate to various problems
› Understand the relationship between algorithms and data structures
› Formulate and solve programming problems
› Understand the complexity of algorithms in terms of time and memory

3- Assessment

40% Continous Assessment
30 % Practical Laboratory Sessions
30% Exam

5- Content

Introduction	Introduction to programming environment
Basic data structures	Array List Linked list
Stacks & queues	Linear Binary
Algorithm	Algorithm analysis Complexity (Big-O Notation) Sorting Algorithm Recursive algorithms and data structure
Tree	General tree Binary tree

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INTERCULTURAL COMMUNICATION

LEVEL: CPI YEAR 1
PERIOD: SEMESTERS 1 & 2
LANGUAGE: EN
ECTS: 1 PER SEMESTER, 2 TOTAL
HOURS: 15 PER SEMESTER, 30 TOTAL
TEACHER/COORDINATOR: RIM MESTAGHANMI

1-Course Objectives

In-depth learning of the fundamentals of intercultural management and communication in order to be ready for international projects and collaborations.

2- Learning Outcomes

The students will know :

› How to be open-minded so the process will be successful

› How to respect, accept and understand the other cultures

› How to adapt to them

› What is the right attitude to adopt

› What are the specifities of the different cultures

› How to handle international negociations

› How to manage international projects and multicultural teams

› How to manage conflicts in intercultural context

3- Assessment

50% Continous Assessment
50% Exam

5- Content

› Globalization of the economy

› Internationalisation strategies

› Intercultural management in multinational firms (projects & teams management)

› Values, customs, and work methods of different cultures

› International negotiations

› Verbal and non-verbal communication

› Management of intercultural conflicts

› Preparation for the different intercultural shocks

› « Etiquettes & Protocoles » in international relations

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PROJECT MANAGEMENT

LEVEL: CPI YEAR 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
HOURS: 45
TEACHER/COORDINATOR: POLY VASSILIOU

1-Course Objectives

› Present the different phases of a project and the basic concepts that govern these phases

› Lead the student to think about the factors that determine the success of a project

› Understanding the complexity of a project

› Understand the difficulty of following, communicating and working in a team

› Discover what are the teachings of engineering techniques and organizational teachings (field of application, coherence, complementarity, interweaving)

› Allow a group of students to properly pose the problem, the methods to be implemented and to identify the technologies around the proposed topics

2- Learning Outcomes

› Master the tools commonly used during a project

› Organize and manage a small project by identifying and implementing the technologies and techniques necessary for a project

› Work independently and as a team on a project

› Raise a problem and implement a methodology

› Structure the results obtained

3- Assessment

40% Continous Assessment
30% Project
30% Exam

5- Content

Introduction to projet management	› What is a project ? › What is project management ? › The profession of project manager and interaction with other professions/departments inside the company. › The project team › Why bad projects are hard to kill : the necessity of an «Exit champion » › Resources : human, tangible, intangible › Resources versus Capabilities › Effective versus Efficent › Consequences of poor project management: waste of resources, damaged reputation & image, team demotivation… › The challenge of project management: a soft science based on techniques, tools and skills.

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Initiating Stage	I) The idea behind the project › Identifying and measuring the need to be fulfilled II) Does the need worth the product ? The decision to initiate or not the project › Feasibility Study ? › Market Research III) Defining more closely the project idea › Customer benefits and inconveniences balancing › Fixing the right target price › Choosing a Revenu Model › Choosing a Payment Method › Value chaine and operational considerations IV) Project financial assessment › Identifying all potential project costs › Evaluating the project's ROCE V) Project roadblocks and risks › Potential project risks › Internal versus external risks › Risk management steps
Planning Stage	› The importance of a well drafted project plan › The (financial and non-financial) costs of a poorly drafted project planning › The identification of all operations to be planned › The identification of project milestones and tasks interdependencies › PERT › GANTT › Critical Path Methode (CPM)
Execution and Control Stage	I) Actions to Take › Engaging and managing the project team › Execute project scope › Executing tasks tools : SCRUM, KANBAN › Permanent communication with all stakeholders › Control tasks : (c.f II) II) Control Tasks › Measurements of performance (cost, schedule, quality) › Perform quality controls : unit test and integration tests › Perform risk audits › Corrective actions : bug fixes › Change management (c.f III) › Determine variances and factors causing them › Manage reserves › Create forecasts III) Change management › The change management approach › The change management process

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Execution and Control Stage (cont.)	IV) What the execution/control stage produces › Project deliverables › Project status reports › Change requests and change management documents › Measurement reports of project activities and performances › Organisational sheets, i.e KANBAN, meeting reports
Closing Stage	I) Actions to Take concerning the end of the project › Deliverables up to date › Finalising open claims regarding contractual agreements › All costs charged › Closing project accounts › Reassigning personnel › Dealing with excess project material › Reallocating project facilities and equipment › Communication › Closing ceremony II) Actions to Take relating to drawn learnings › Collect project/phase records › Mesuring stakeholder satisfaction › Archiving information › Auditing project success or failure › Drawing recommendations for policy improvement or updating › Manage knowledge sharing and transfert III) What the closing stage produces › Project document updates › Final product, service or result transition › Final report (example to be shown)

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MECHANICAL DESIGN

LEVEL: CPI YEAR 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 5
HOURS: 80
TEACHER/COORDINATOR: POLY VASSILIOU

1-Course Objectives

› Introduction to the methods and practice of engineering design
› Become familiar with the basic principles of design and the design process
› The practice of drawing to improve visual thinking
› Design of Mechanical Elements

2- Learning Outcomes

› Understand the fundamental principles that govern the technical properties of materials and the interaction with processing
› Understand and apply design principles and be able to explain the reason for a technical design choice
› Choose the appropriate materials for a given application
› Communicate on the details of a technical design process
› Prepare sketches, detailed layout plans and interpret them as 3D objects
› Produce manufacturing drawings of components to ensure that they perform the desired function and can be manufactured

3- Assessment

30% Continous Assessment
10 % Practical Laboratory Sessions
20% Project
40% Exam

5- Content

Introduction to Mechanical Engineering Design	• Design Process • Design Considerations • Methods and practice of engineering design • Design Tools and Resources • The Design Engineer's Professional Responsibilities
Two-dimensional and 3D-dimensional technical drawings	• Standards and Measurement Systems • Standard Sheets and Drawing Scales • Instruments Used in Engineering Drawing • Types of lines in technical drawings and Dimensioning Rules • Understanding Projections and Visualization of 3D objects • Orthogonal drawing and Practice Visualizing • First-angle projection and Third-angle projection • Drawing three principle views of an object • Projecting a Missing View using two given views • Isometric Drawing • Dimetric Drawings • Oblique Projections (Cabinet and Cavalier)

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Materials Properties and Transformations of Stress and Strain	• Material Strength and Stiffness • Selection of a material • Stiffness, strength and fracture limited design • Engineering stress-strain diagrams and True stress-strain diagram • Cartesian Stress Components • Transformation of Plane Stress • Principal Stresses; Maximum Shearing Stress • Mohr's Circle for Plane Stress
Design of Mechanical Elements: Bearing	• Bearing Classification (Radial, Thrust and Combined load bearing) • Sliding Bearing (Journal bearings) • Rolling Contact Bearing • Industrial Liquid Lubricants Classification • Design of Boundary-Lubricated Bearings • Design of Full-Film Hydrodynamic Bearings • Raimondi and Boyd Charts • Bearing Life and Selection
Fastening and Power Screws	• Introduction to Permanent and Nonpermanent Fastening • Rivets • Threaded Fasteners (Screw and Bolts and Nuts) • Threaded Fastener Terminology • Types of Nuts and Washers • Fastener Materials • Identify a Metric Bolt • The Mechanics of Power Screws • Adhesive Bonding
Power Transmission	• Introduction to Power Transmission • Pneumatics and Hydraulics • Mechanical Power Transmission • Shafts Coupling • Gear Types and Gear Terminology • Belts & Pulleys • Chains & sprockets • Roller Chain Selection • Engineering Application and examples

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ELECTRONICS

LEVEL: CPI YEAR 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 4
HOURS: 60
TEACHER/COORDINATOR: FARAH HADDAD

1-Course Objectives

› Analogue electronics in terms of analysis, simulation and practical testing of analogue circuits and integrated systems
› Will use a problem-based pedagogy

2- Learning Outcomes

› Calculate the transfer function and the frequency response of an electronic system
› Plot the frequency response of an electronic system: Bode phase plot and Bode magnitude plot
› Select the suitable first or second order passive filter for a specified application (denoising, telecommunication, sound system, etc.)
› Understand the importance of electronic RLC oscillators and their utility in telecommunication and filtering
› Understand the functioning and use of a Bipolar Junction Transistor (BJT) and analyze BJT amplification circuits
› Understand the importance of feedback in electronics (operational amplifier, control system) and will be able to calculate the transfer function of a system with positive/negative feedback
› Know the basic characteristics of the operational amplifier (op amp), analyze voltage amplifier configurations of op amps, the operational configurations of op amp, the unity buffer application, as well as the comparator application and the Schmidt trigger application
› Simulate operational amplifier configurations, filter configurations etc. on CAD (https://www.falstad.com/circuit/circuitjs.html)

3- Assessment

50% Continous Assessment
10 % Practical Laboratory Sessions
40% Exam

5- Content

Feedback and transfer function in Electronics	› Control system: open loop vs closed loop systems › Introduction to Laplace transform (s domain) › Transfer function of a system › Block diagram of a system : rules and reduction › Feedback loop: positive and negative feedback block diagram, transfer function › Impedance in the s domain › Laplace application in electronics: From time domain to s domain: calculating the transfer function of electronic circuits in s domain
Frequency Response	› Frequency response vs Laplace transform : the frequency domain › Frequency response applications in electronics › Linear time invariant system

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Bode plots	› Logarithmic scale for electronics signal › The decibel scale › Bode magnitude plot, Bode phase plot › Bode plot elementary building blocks › Asymptotic and real Bode plots sketching rules
First order passive filters	› Filter definition and applications in electronics › Passive filters › First order high pass and low pass filters (RC, RL filters) › Bode plots of first order filters › Application of first order filter in electronics › Using first order filter as integrator and differentiator (signal generator circuits: square signal generator, triangular signal generator,) › Simulation on CAD (https://www.falstad.com/circuit/circuitjs.html)
Second order filters and oscillators	› Harmonic oscillator and resonance in electronics › Second order RCL filters: band pass and band stop filters : analysis, Bode plots and applications in electronics › RLC oscillators : analysis, Bode plots and applications in electronics
What is inside an op Amp? Introduction to transistors	› P, N type semi-conductors › PN junction › Forward biasing/ reverse biasing › NPN/ PNP bipolar junction transistors (BJT) › BJT Transistor: how do they work? › BJT Output characteristics: cut off region, linear active region, saturation › KVL / KCL laws in transistors › Transistor in CPU: Introduction to digital electronics › Current mirror circuit › BJT differential amplifier: common mode and differential mode
Operational amplifier	› Op amp applications in electronics › Op amp characteristics: real op amp vs ideal op amp, op amp macromodel › OP Amp Saturation › Transfer characteristic › Negative feedback in op Amp › Virtual short/ virtual ground › Operational Amplifiers in Linear active Region: › Voltage amplification circuits : inverting op amp and non-inverting op amp › Voltage follower › Current to voltage circuits › Operational Amplifiers in Linear active Region: Operational configurations › Inverting adder › Non-inverting adder › Simulation on CAD › Non-linear application of operational amplifiers › Ideal comparator › Schmitt trigger (positive feedback in op amp)

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DATABASE SYSTEMS

LEVEL: CPI YEAR 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
HOURS: 45
TEACHER/COORDINATOR: POLY VASSILIOU

1-Course Objectives

› The purpose of this course is to provide the fundamental concepts of database systems and their applications. After this course, a student can design by himself, implement and employ a Database Management System (DBMS) that is reliable, efficient, and convenient.
› The basic topics covered in this course are listed in the following.
  o Data modelling: conceptual data model, logical data model, and physical data model.
  o The Structured Query Language (SQL).
  o DBMS like Microsoft Access.

2- Learning Outcomes

› Understand how data can be collected and organized by examining the associated problems when storing redundant and inconsistent data.
› Become proficient in elaborating the fundamental rules to design data models: tables, columns, keys, relations, cardinalities, and roles.

› Implement databases by designing:
  o the conceptual data model,
  o the logical data model, and then
  o the physical data model.
› Become able to design the methodology for databases and verify their structural correctness.
› Accessing, querying, and manipulating data with SQL and application using a MySQL database server.
› Implement, set up, interact, and manage a DBMS using Microsoft Access.

3- Assessment

40% Continous Assessment
20 % Practical Laboratory Sessions
40% Exam

5- Content

Introduction	Role played by data and databases in society Approaches that are used to collect data Identify problems in collecting and storing data
Data modelling	Relations and constraints Conceptual data model Logical data model Physical data model
Collecting and manipulating data using SQL	Basic SQL Queries Aggregate functions Manipulating tables and data Advanced SQL queries including joins and nested queries Views
Microsoft access database	Creating, updating, and managing databases (including all its entities) using Microsoft access Data management organization Creating Queries Creating forms and menus Creating reports

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CREATIVITY/INNOVATION

LEVEL: CPI YEAR 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 2
HOURS: 30
TEACHER/COORDINATOR: RIM MESTAGHANMI

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1-Course Objectives

› Put the creativity process into practice and characterize the relationship between creativity and innovation processes
› Use creative tools to identify a problem, identify uses, solve problems, generate ideas, co-construct a project, evaluate solutions
› Identify and identify windows of technological opportunity

2- Learning Outcomes

› Know and implement techniques, methods, creativity tools
› Know the basic rules of the animation of the generation of ideas (constitution of the group, group warm-up, launch of the creative challenge, collection of ideas, creative relaunch, exploitation of the «divergences» and «convergences» phases)
› Be able to dynamically lead groups and creative meetings
› Develop metacognition skills, i.e. your ability to observe your own thought
› Be familiar with the fundamental concepts relating to innovation
› Know the different types of innovation
› Know the innovation processes and learn from them as regards their management
› Know the organizational (or even inter-organizational) and managerial mechanisms that are conducive to innovation
› Know the most recent methods and tools used by innovative companies

3- Assessment

50% Continous Assessment
50% Exam

5- Content

Introduction to creativity and innovation	Definitions : creativity and business innovation The links between creativity and innovation The difference between creativity, innovation and invention, with examples The notion of added value, for the firm and the consumer Get creative : agility game (i.e bricks, spaghetti)
Managing creativity	Firms having built their brand positioning around creativity How to develop an individual and collective creative spirit The key characteristics of creative people, and how to manage them Best business practices examples Obstacles/How to kill creativity Creativity techniques (i.e brainwriting exercise) Creativity and story-telling exercise

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Managing creativity (cont.)	Validate the creative idea in a design and problem-solving process The importance of asking the right questions, as as to come up with the right solutions Design thinking Lateral thinking : Edward deBono
Innovation management	Firms having built their brand positioning around innovation Different types of innovation : architectural, incremental, radical and disruptive Innovation trends : i.e co-innovation, open innovation Consumers and their attitude towards innovation Innovation acceptance and adoption : Rogers Adoption Curve The innovation processes Theories to better understand and manage innovation Best business practices examples Attempted innovation flops Obstacles/How to kill innovation Test phase innovation (i.e Philips' Experience Lab)

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BUSINESS PRACTICES 1

LEVEL: CPI YEAR 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 4
HOURS: 65
TEACHER/COORDINATOR: POLY VASSILIOU

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1-Course Objectives

› Understanding of interprofessional and interpersonal skills
› Demonstrate the importance of end-users in the broader context of technology and engineering in smart grid projects
› Demonstrate the importance and difficulty of critical thinking and reasoned judgments
› Understanding of micro and macro business environments
› Demonstrate the application of professional, management and ethical practices, both theoretical and applied in an engineering context
› Understand the interrelation between ethics, responsibility and law and learn how to operate and act responsibly, taking into account environmental, social and economic results

2- Learning Outcomes

› Develop an appropriate level of communication and critical thinking

› Understanding codes of conduct in the engineering profession and its organization in France and elsewhere

› Learn about effective management in the context of engineering

› Understand the research and scientific methodology

› Learn how to best deal with smart-grid projects end-users

› Learn how to analyze business micro/macro environments

› Acquire knowledge and critical analysis skills over major ethical issues

3- Assessment

40% Continous Assessment
20 % Project
40% Exam

5- Content

Communication and personal effectiveness	› Personal effectiveness: key aspects and self-evaluation › Communicating as an engineer › Communicating with and managing engineers › Communicating with stakeholders › End-users involvement and smart grid projects

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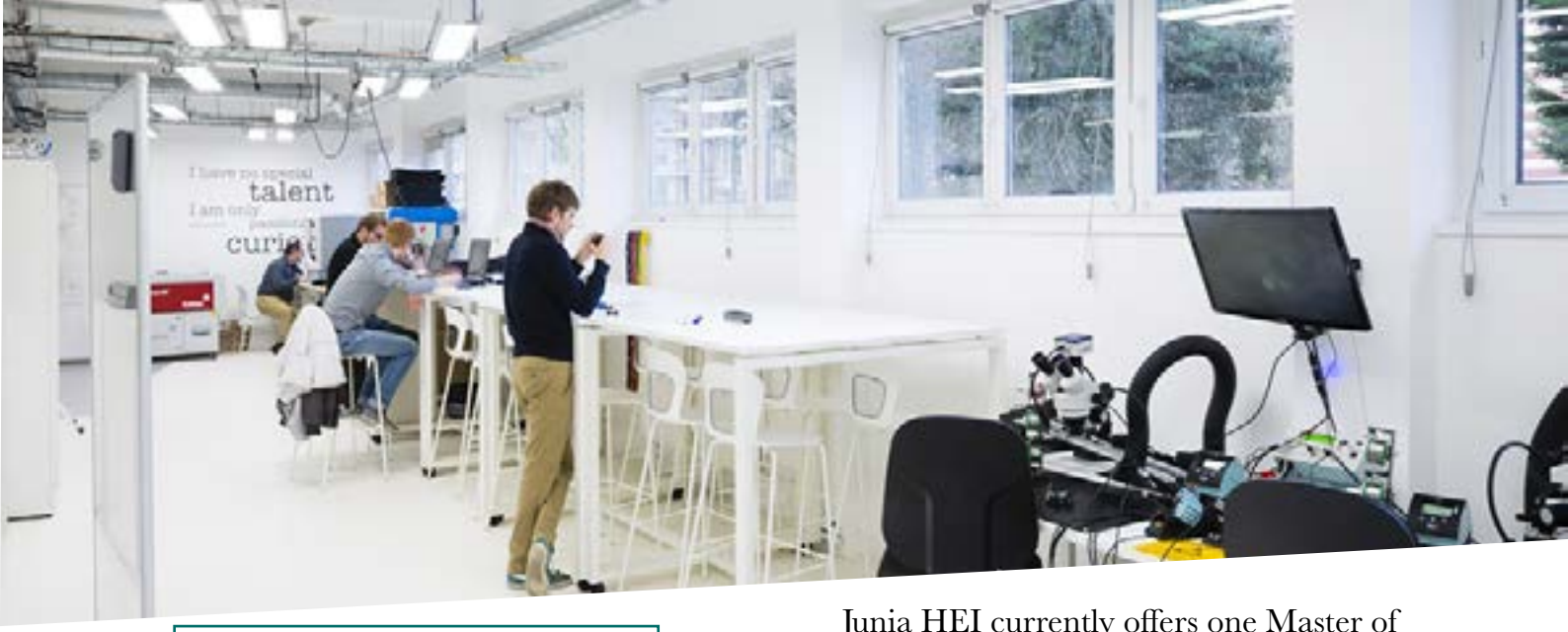
Critical Thinking and Reasoned Judgement	› Fact versus Opinion › Questionable facts › Quantitative and Qualitative research › Lobbying, influence and independence › Search & analysis of information, critical thinking exercises › Taking a stand and making a full reasoned judgment › Suggested topics: A professional Order for Engineers in France? › Smart grid projects (Linky)
Micro and macro business environment	› Micro environment and COSMIC analysis › Macro environment and PESTEL analysis › SWOT › Porter's 5 forces
Ethics and CSR issues	› The importance of Business Ethics › Stakeholder (Friedman) versus Stakeholder (Freeman) business models › Environmental ethics (pollution control, conservation of depletable resources) › Advertising (false and deceptive ads, disclaimers…) and Marketing ethics (seller's and manufacturer's duties, due care theory, strict liability…) › Sustainable Development (SD) and Corporate Social Responsibility (CSR) › Legal and ethical obligations concerning CSR communication and reporting › Greenwashing, CSR reports analysis and criticism

Return to Course List



GENERAL INFORMATION

Master of Science and Engineering Program

Junia HEI 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 word.

Junia HEI currently offers one Master of Science and Engineering programme 100% taught in English: Smart Cities.

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

MASTER 1 - FALL SEMESTER	ECTS
Heat Transfer	4
Information Systems	
Accounting - Finance	4
Performance Tools and Dashboard	
Visual Communication	
MASTER 1 - SPRING SEMESTER	
Electrical Power Distribution	4
Circular Economy	
Quality Control	4
Lean Manufacturing	
Intercultural Communication	
MASTER 2 - FALL SEMESTER	
Production Management	4
Operations Research	
Team Management and Human Resources	4
Legal Environment of Business	
Business Game	
MASTER 2 - SPRING SEMESTER	
Final Industrial Internship	30
Six-month Professional Experience	
Written Report and Oral Defense	

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HEAT TRANSFER

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 4 (FOR COMPLETE MODULE)
HOURS: 18
TEACHER/COORDINATOR: ALLAL CHAFI

This course is part of a module and must be taken in conjuction with Information Systems.

Prerequisites:

Notions of thermodynamics, Concepts of energy and its various forms

1-Course Objective

- The course will introduce the fundamental concepts of various modes of heat transfer. It will further elaborate these concepts with theories and applications to the solutions of practically relevant physical engineering problems. Some aspects of process design principales of various heat transfer equipment will be taken up in the later part of this course.
- Develop an awareness of the cost associated with heat losses
- Estimate the amount of energy losses in buildings

2- Learning Outcomes

- Cover the basic concepts of heat transfer.
- Present a wealth of real-world engineering applications to give students a feel for engineering practice.
- Carry out basic U-value calculations for windows and insulation materials.
- Understand the main ways in which a house loses heat energy.
- Understand the factors influencing heating system efficiency
- Describe and quantify fundamental heat transfer processes in buildings, inculding conduction, convection, radiation, thermodynamics, fluid flow and energy balances.

3- Assessment

50% Continous Assessment
15% Project
35% Exam

5- Content

Generalities - A course developing the basic ideas of energy and power and their applications from a quantitative and qualitative viewpoint.
- Difference between heat and temperature
- Difference between heat transfer and thermodynamics

Chapter 1 : Modes of heat transfer
- Conduction
- Introduction

continued on next page

- Physical mechanism of conduction
- Thermal conductivity of (solids, metals, non-metals, liquids, gases and construction and heat-insulation materials)
- Fourier's law
- Heat flux and heat transfer rate
- Convection
- Free and forced convection
- Newton's law of cooling
- Radiation
- Basic definition pertaining to radiation
- Emissive power
- Absorptivity
- Blackbody radiation
- Net radiation heat transfer
- Radiation effect on thermal comfort
- Simultaneous heat transfer mechanisms

Chapter 2 : 1-Dimentional, steady-state conduction
- Energy conservation equation
- Generalized heat diffusion equation
- Thermal diffusivity
- 1-D heat diffusion equation for cartesian coordinates
- The simple and plane wall
- Thermal resistance
- The composite wall
- Thermal resistance law for a series composite wall
- Simple wall with two fluids
- The overall heat transfer : U
- Applications

Chapter 3 : Heat exchangers and HVAC systems
- Main types of heat exchangers
- Flow conditions in the heat exchangers
- Heat tyransfer in HVAC systems

Project : Heat transfer in buildings
- Digital Twin technology for buildings
- Heating and cooling load culculations

6- Bibliography

Initiation aux transferts thermiques, J.F. Sacadura Editions TEC&DOC,

Heat Transfer: A practical approach, 2nd Edition Yunus A. Cengel, John M. Cimbala McGraw-Hill

Return to Course List

VISUAL COMMUNICATION

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: TBD
HOURS: 15
TEACHER/COORDINATOR: JOHANNA LARUE

1-Course Objective

Encourage students to develop skills in visual communication, learn how to design without being a designer. Find resources, and be able to realize a proper project presentation.

2- Learning Outcomes

› Provide good design for self and project promotion

› Define the purpose of their design, identify their target audience.

› Find and use tools to design their projects renderings

3- Assessment

100% Project

5- Content

First, the course will start with an introduction to visual communication, why a good image is better than a long text, with examples in different applications.

Secondly, students will learn the basics rules and how to use them, step by step.

At the end of the course, students will use their new skills through a transversal rendering in common with water management course.

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ELECTRICAL POWER DISTRIBUTION

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 4 (FOR COMPLETE MODULE)
HOURS: 19
TEACHER/COORDINATOR: DHAKER ABBES

This course is part of a module and must be taken in conjuction with Circular Economy.

Prerequisites

Electric basis: AC, Three Phase Systems, Star and delta configurations, Line modeling, Voltage drop, Active power, reactive power, etc.

1-Course Objective

- Understand the principle of distribution of electrical energy
- Decode the normative and regulatory technical documentation (NF - 15-100) to carry out the distribution of circuits in a housing.
- Make a domestic electrical installation
- Acquire the knowledge, necessary for modeling and reliability analysis of a power distribution system

2- Learning Outcomes

- Knowing Fundamentals of Electrical Distribution
- Design and choose the materials for a simple building installation.
- System and persons' protection : types of earthing system
- Modeling and reliability analysis of a power distribution system

3- Assessment

50% Exam 1
50% Exam 2

5- Content

Part I : Fundamentals of Electrical Distribution

- Chapter 1 : Facts about Power Distribution
- Chapter 2 : Domestic power distribution
- Chapter 3 : System and persons' protection : types of earthing system

Part II : Distribution System Reliability Assessment

- Introduction
- Reliability Indices
- Distribution Systems Characteristics
- Reliability Principles
- Application examples
- Designing Reliability Into Industrial and Commercial Power Distribution Systems

continued on next page

6- Bibliography

- « Electricity from the power station to the home » http://www.hydroquebec.com/learning/
- La norme française NF C15-100
- CHOWDHURY, Ali; KOVAL, Don.Power distribution system reliability: practical methods and applications.JohnWiley&Sons,2011.
- Sallam, Abdelhay A.,and OmP.Malik. Electric distribution systems.Vol.68. John Wiley&Sons,2011.
- Heising,C."IEEE recommended practice for the design of reliable industrial and commercial power systems."IEEEInc.,NewYork(2007).
- Short,Thomas Allen.Distribution reliability andpower quality.CRCPress,2005.

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CIRCULAR ECONOMY

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 4 (FOR COMPLETE MODULE)
HOURS: 19
TEACHER/COORDINATOR: DHAKER ABBES

This course is part of a module and must be taken in conjuction with Electrical Power Distribution.

1-Course Objective

› Encourage the students to get involved and to believe in the Circular Economy model

› Highlight the situation

› Get the key of the circular economy model

2- Learning Outcomes

› Have a greater understanding of the global context

› Think positive – be inspired to design cities and buildings that could have a positive impact rather than reducing their impacts

› Develop a capacity to interrogate the potential of new construction

› Be open-minded and critical to evaluate information and ideas

› Learn about existing solutions

3- Assessment

50% Project
50% Exam

5- Content

The first part of the class will be a supervised courses during which students:

› read articles about the global context (problems, issues, strategies, solutions)
› discuss with their group the main points
› pitch in front of the others.

Skills: be efficient in the readings, sum up, work with a group, pitch

During the second class we will visit a construction site in Lille.

Many examples, solutions and case studies of everyday-life and building industry will be discuss during the third and fourth class. Students will also have time to work on their own study case.

The last class will be a sum-up of the key points. A multiple choice exam will also be done in order to evaluate the understanding of the students.

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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.

Contact

hei.master.smartcities@junia.com

English-Taught Courses

MASTER 1 - FALL SEMESTER	ECTS
Principles and Future Trends in Urbanism Transport and Mobility Issues	5
Architecture, Construction & Sustainable Design Fundamentals of Energy and Renewable Energies	4
Means of Expression Innovation and Collaborative Project	5
Workshop 1	3
MASTER 1 - SPRING SEMESTER	
Urban Project Management Environmental Law Ubiquity and Internet of Things	5
Dynamic Thermal Simulation and HVAC Building Management Systems and Home Automation	5
BIM Introduction Lecture to Major Urban Challenges Future Cities: Smart, Inclusive, Sustainable	5
Workshop 2	4
MASTER 2 - FALL SEMESTER	
Emergent Economy in the City	
Green Building Certification and Environmental Footprint	
Learning Expedition	
Smart Grid and Energy Management at Building Scale	
Sociopolitical Approach of the City	
Sustainable Refurbishment	
Urban Environment Principles	
Water Management, Landscaping and Green Spaces	
Workshop 3	

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PRINCIPLES AND FUTURE TRENDS IN URBANISM

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS:
HOURS: 25
TEACHER/COORDINATOR: VEDRANA IKALOVIC, ANA RUIZ BOWEN

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

1-Course Objective

› Introduce main principles of part and contemporary urbanism

› Be able to identify efficient eco-neighborhood

2- 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

3- Assessment

60% Continous Assessment
25% Project
15% Exam

5- 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 eco-neighborhood 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.

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TRANSPORT AND MOBILITY ISSUES

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS:
HOURS: 30
TEACHER/COORDINATOR: PHILIPPE TOSTAIN, AURÉLIE MONTIGNY

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

1-Course Objective

› 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 intermodality

› Present potentials of an interchange hub for urban development

› Imagine such an interchange hub in Lille

2- 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

3- Assessment

40% Continous Assessment
60% Project

5- 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":
    - o Definition of interchange hubs and reference developments
    - o Methodology, presentation of site and sources
    - o Project statement, team organization
    - o Tutorial course
    - o Presentation

Return to Course List

ARCHITECTURE, CONSTRUCTION AND SUSTAINABLE DESIGN

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS:
HOURS: 30
TEACHER/COORDINATOR: OLIVER PAGE, ANA RUIZ BOWEN

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

1-Course Objective

› Introduction to architecture and construction approaches

› Understand the project context (multidisciplinary, complexity)

› Present fundamental environmental issues in sustainable architecture

2- 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

3- Assessment

50% Continous Assessment
30% Project
20% Exam

5- 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

Return to Course List

FUNDAMENTALS OF ENERGY AND RENEWABLE ENERGIES

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS:
HOURS: 30
TEACHER/COORDINATOR: DHAKER ABBES

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

1-Course Objective

› 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.

2- 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.

3- Assessment

50% Continous Assessment
25% Practical Courses
25% Exam

5- 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)

continued on next page

- 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)

6- 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.
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- 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 l 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

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MEANS OF EXPRESSION

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS:
HOURS: 20
TEACHER/COORDINATOR: ANA RUIZ BOWEN, VEDRANA IKALOVIC

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

1-Course Objective

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.

2- 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, mark-making materials

› Interpret and evaluate information and ideas from primary and secondary resources

3- Assessment

60% Continous Assessment
40% Project

5- 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.

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INNOVATION AND COLLABORATIVE PROJECT

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS:
HOURS: 30
TEACHER/COORDINATOR: ANA RUIZ BOWEN

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

1-Course Objective

› 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

2- 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

3- Assessment

40% Continous Assessment
30% Practical Courses
30% Project

5- 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.

Return to Course List

WORKSHOP 1

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
HOURS: 48
TEACHER/COORDINATOR: ANA RUIZ BOWEN

1-Course Objective

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.

2- 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

3- Assessment

40% Continous Assessment
30% Project
30% Exam

5- 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.

Return to Course List

URBAN PROJECT MANAGEMENT

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 5 (FOR THE COMPLETE MODULE)
HOURS: 15
TEACHER/COORDINATOR: FRANÇOIS LAURENT TOUZAIN

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

1-Course Objective

Provide a general overview and a toolkit about urban transformation management

2- 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

3- Assessment

70% Continous Assessment
30% Project

5- 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

Return to Course List

ENVIRONMENTAL LAW

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 5 (FOR THE COMPLETE MODULE)
HOURS: 15
TEACHER/COORDINATOR: SYRINE ISMAILI-BASTIEN

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

1-Course Objective

Give students a basic legal culture on environmental obligations protection

2- 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

3- Assessment

70% Continous Assessment
30% Project

5- 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.

Return to Course List

UBIQUITY AND INTERNET OF THINGS

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 5 (FOR THE COMPLETE MODULE)
HOURS: 20
TEACHER/COORDINATOR: ALAIN FRULEUX

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

1-Course Objective

Have a general knowledge about IoT technologies in a smart cities context

2- 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

3- Assessment

60% Continous Assessment
40% EXAM

5- Content

› Introduction

› From smart object to connected object
  o Smart object or sensor
  o The Arduino phenomenon
  o Transition toward ARM architecture : the Rapsberry example
  o Connected object = Smart object + Communication solution

› Ubiquitous network : from PAN to WAN
  o Wire networks (xDSL, Fibre, Ethernet)
  o Wireless networks (3g/4g, femtocell, Wifi, Bluetooth)
  o Machine 2 Machine (Zwave, Zigbee, LORA / SIGFOX) or sensor networks
  o Vehicular application (V2V and V2I)
  o Contactless technologies (RFID et NFC)

› Cloud computing
  o Datacenter
  o Cloud providers : Amazon, Microsoft, Google
  o Virtualization : PAAS, SAAS, IAAS

› Development and value-creation
  o Analysis (Big data) et Visualization
  o Example of big data for cities

› Inhibitors of deployment
  o Standardization, interoperability, data management, safety, organization, acceptability

Return to Course List

DYNAMIC THERMAL SIMULATION AND HVAC

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 5 (FOR THE COMPLETE MODULE)
HOURS: 30
TEACHER/COORDINATOR: ZHENG TAN

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

1-Course Objective

› Introduction to architectural science and thermal performance of buildings

› Basic calculation for HVAC systems design

› Utilization of dynamic thermal simulation software

2- 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

3- Assessment

40% Continous Assessment
30% Project
30% Exam

5- 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.

Return to Course List

BUILDING MANAGEMENT SYSTEMS AND HOME AUTOMATION

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 5 (FOR THE COMPLETE MODULE)
HOURS: 25
TEACHER/COORDINATOR: LAURENT PEYRODIE

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

1-Course Objective

› 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

2- 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.

3- Assessment

60% Continous Assessment
40% Project

5- 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

Return to Course List

BIM

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 5 (FOR THE COMPLETE MODULE)
HOURS: 30
TEACHER/COORDINATOR: SIMONE ARAGNO

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.

1-Course Objective

› Introduction to parametric environmental design

› Introduction to the BIM concepts

› Presentation of the collaborative approaches available for the BIM

2- 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

3- Assessment

50% Continous Assessment
50% Project

5- 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

Return to Course List

INTRODUCTION LECTURE TO MAJOR URBAN CHALLENGES

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 5 (FOR THE COMPLETE MODULE)
HOURS: 10
TEACHER/COORDINATOR: ANA RUIZ BOWEN

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

1-Course Objective

› 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

2- 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

3- Assessment

85% Continous Assessment
15% Practical courses

5- 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.

Return to Course List

FUTURE CITIES: SMART, INCLUSIVE AND SUSTAINABLE

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 5 (FOR THE COMPLETE MODULE)
HOURS: 20
TEACHER/COORDINATOR: MONTSERRAT PAREJA-EASTAWAY

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

1-Course Objective

› 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.

›

2- 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)

3- Assessment

65% Continous Assessment
35% Project

5- 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.

1. Global world and urban contexts. The effects of globalization in local thinking. Challenges and projects around the global urban competitiveness.

2. Economic structure and urbanization: from the post-fordist city to the post-modern city.

continued on next page

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.

3. 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?

4. Pathways and the built environment: urban regeneration as a practice to enhance territorial development. From flagship projects to arts factories.

5. Attractiveness and the city: conflicts and successes in the shared use of space.

Return to Course List

WORKSHOP 2

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 4
HOURS: 48
TEACHER/COORDINATOR: ANA RUIZ BOWEN

1-Course Objective

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.

2- 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

3- Assessment

100% Project

5- 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.

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EMERGENT ECONOMY IN THE CITY

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS:
HOURS: 15
TEACHER/COORDINATOR: MONTSERRAT PAREJA-EASTAWAY

1-Course Objective

› Understand key economic concepts

› Approach the relationship between economy and the local development

› Learn the functionalities of Business Models

2- 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.

3- Assessment

60% Continous Assessment
40% Project

5- 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.

1. 'Project ecologies' and the city: the ability to create 'atmospheres' for networking and collaboration: the case of the video games sector

2. The emergence of innovative ecosystems: the case of districts of innovation' as tools for urban development

3. New cultural centers of production: the case of factories of creativity in Bilbao and Barcelona

4. Smart cities and technology: the case of 'co-working spaces, living labs, fab labs and innovative incubators'

5. Urban tourism and attractiveness: the case of gastronomy (from foodies to high cuisine) and fine arts (galleries and festivals)

6. Social innovation and urban developments: the case of citizens participation and involvement in the re-use of urban space

Return to Course List

GREEN BUILDING CERTIFICATION AND ENVIRONMENTAL FOOTPRINT

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS:
HOURS: 30
TEACHER/COORDINATOR: THOMAS BATORI

1-Course Objective

The global aim is to take green building dimension in account for a smart city design

2- Learning Outcomes

› Know the different green building frameworks

› Explain the different phases of a certification

› Make the connection between technical requirements and environmental footprint.

3- Assessment

40% Continous Assessment
60% Project

5- 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).

6- Bibliography

http://www.breeam.com
https://www.cerway.com

Return to Course List

LEARNING EXPEDITION

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS:
HOURS: 27
TEACHER/COORDINATOR: ANA RUIZ BOWEN

1-Course Objective

› 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

2- 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.

3- Assessment

40% Continous Assessment
60% Project

5- 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.

1. Urban policy, master planning and infrastructure in smart cities
2. Smart grids, optimization and synergic technology in community and neighborhoods
3. Case studies of awarded smart/green buildings and technology
4. Seminar with local government departments and industry partners
5. Academic program with local universities
6. Knowledge transformation and adaptation in French cities.

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SMARTGRID AND ENERGY MANAGEMENT AT BUILDING SCALE

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS:
HOURS: 30
TEACHER/COORDINATOR: DIANA FLOREZ RODRIGUEZ

1-Course Objective

› 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.

2- 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.

3- Assessment

40% Continous Assessment
60% Project

5- 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

continued on next page

Practical work:

› Technical visits

Project:

› Analysis of smart grid case studies from all over the world.

6 - 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

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SOCIO-POLITICAL APPROACH OF THE CITY

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS:
HOURS: 15
TEACHER/COORDINATOR: COLETTE SABA TOUZAIN

1-Course Objective

To give students the tools for a critical lecture about the elusive concept of smart cities.

2- 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.

3- Assessment

60% Continous Assessment
40% Project

5- 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.

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SUSTAINABLE REFURBISHMENT

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS:
HOURS: 15
TEACHER/COORDINATOR: ZHENG TAN

Prerequisites

› Thermal transfer
› Architecture, construction and sustainable design
› Dynamical thermal simulation and HVAC

1-Course Objective

› Introduction to building refurbishment specificities in comparison to new buildings

› Presentation of sustainable refurbishment approaches and realizations

2- Learning Outcomes

› Present the building refurbishment specificities

› Propose refurbishment strategies with a sustainable approach

› Building simulation and data analyses

3- Assessment

60% Continous Assessment
40% Project

5- 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.

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URBAN ENVIRONMENT PRINCIPLES

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS:
HOURS: 30
TEACHER/COORDINATOR: ZHENG TAN

Prerequisites

› Thermal transfer
› Architecture, construction and sustainable design
› Principle and future trends in urbanism
› Future cities: smart, inclusive and sustainable

1-Course Objective

› 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

2- 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

3- Assessment

50% Continous Assessment
50% Project

5- 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.

6- Bibliography

Oke, T., Mills, G., Christen, A., & Voogt, J. (2017). Urban Climates. Cambridge: Cambridge University Press. doi:10.1017/9781139016476

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WATER MANAGEMENT, LANDSCAPING AND GREEN SPACES

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS:
HOURS: 30
TEACHER/COORDINATOR: DIDIER LARUE

1-Course Objective

› 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.

2- 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.

3- Assessment

65% Continous Assessment
35% Project

5- 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.

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WORKSHOP 3

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS:
HOURS: 48
TEACHER/COORDINATOR: ANA RUIZ BOWEN

Prerequisites

› Workshop 1
› Workshop 2

1-Course Objective

The subject of Workshop 3 is the built environment: conception, design, and performance. The main objective to develop knowledge and understanding of this field.

2- 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.

3- Assessment

65% Continous Assessment
35% Project

5- 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.

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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.

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.

MASTER 1 - FALL SEMESTER	ECTS
Welcome Session	6
French as a Foreign Language	3
MASTER 1 - SPRING SEMESTER	
French as a Foreign Language	3
Summer Internship	6
MASTER 2 - SPRING SEMESTER	
Final Internship	30
Six-month Professional Experience	
Written Report and Oral Defense	

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.

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WELCOME SESSION

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 6
COORDINATOR: SOPHIE DUPONT WARGNIEZ

1-Objectives and Skills developed

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

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.

2-Content and Organization

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

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FRENCH AS A FOREIGN LANGUAGE

LEVEL: MASTER 1
PERIOD: SEMESTER 1 & 2
LANGUAGE: FR
ECTS: 3
TEACHER/COORDINATOR: VIRA WANNEPAIN

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.

1-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

2-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

3- Evaluation

- Continuous assesment, oral presentations, final exam

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SUMMER INTERNSHIP

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: FR OR EN
ECTS: 6
TEACHER/COORDINATOR: SOPHIE DUPONT WARGNIEZ

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.

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.

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

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.

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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.*

Contact

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

English-Taught Courses

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	
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	
Sustainable Agriculture and Smart Farming	30

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

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PROJECT: FOOD CHAINS 2 AND INITIATION TO PROJECT MANAGEMENT

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 6
TEACHER/COORDINATOR: HÉLÈNE LERUSTE

1-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.

2-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)

3-General 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

4- Evaluation

› Evaluation of knowledge on animal and plant production (on-line quiz)

› Group oral evaluation + report on the project in agriculture

Return to Course List

RUMINANT NUTRITION AND ROUGHAGE SYSTEMS

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: JOOP LENSINK / VALÉRIE JACQUERIE

1-Main objectives

› Train future animal nutrition managers (formulation, R & D, sales) and breeding advisors

› Enhance knowledge on ruminant feed and roughage systems

2-Skills developed

› Identify problems related to feed-imbalanced diets (health, product quality, sustainability...)

› Develop a systematic and systemic approach regarding ruminant farms

3-General 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

4- Evaluation

› Written individual exam

5- 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

Return to Course List

URBAN FARMING

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: PÉNÉLOPE CHEVAL

1-Main objectives

This course is based on the definition of urban agriculture, its context, its typology, its issues and the questions it raises.

2-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.

3-General 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

4- Evaluation

Student project + Final Exam at the end of the course

5- 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.

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PLANT BIOTECHNOLOGIES

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: FR, WITH ENGLISH TRANSLATION
ECTS: 6
TEACHER/COORDINATOR: CAROLINE DEWEER

1-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

2-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)

3-General 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

4- Evaluation

Reports, oral defense in group

Return to Course List

PLANT BREEDING AND GENETICS

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: ALI SIAH

1-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

2-Skills developed

› Analyze constraints, technical and economic challenges of genetic improvement of various plant species.

3-General 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

4- Evaluation

› Individual exam – Synthesis report and oral defense on a subject not developed during the courses.

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PRECISION LIVESTOCK FARMING

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: HERNAINA ANDRIAMANDROSO

1-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.

2-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.

3-General 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.

4- 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.

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CROP MODELING

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: SITRAKA ANDRIANARISOA

1-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

2-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.

3-General content

Lectures and concrete cases (36 hours)

Topic	Teaching hours
Definition, designing, parameterization, calibration and validation of crop model	8
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)	8
Models for weeds management, crop protection and fertilization	10
Examples of applied models: used in automatic robot, used in farm management	10

4- Evaluation

› Individual work to simulate some situations of crop systems

› Individual evaluation: written exam as multiple choice questions

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ANIMAL WELFARE: FROM CONSUMER DEMAND TO FARM AUDITING

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: VANESSA GUESDON / HÉLÈNE LERUSTE

1-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

2-Skills developed

› Set-up (simple but valid) animal welfare scoring protocols

› Analyze results of a farm audit

› Capacity to anticipate future evolution

3-General content

› Welfare definitions

› Factors influencing animal welfare

› Legislation and future evolution

4- Evaluation

› Oral presentations in group, Final exam

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BIOCONTROL FOR CROP PROTECTION

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: JÉRÔME MUCHEMBLED / ALI SIAH

1-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.

2-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

3-General 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).

4- Evaluation

› Individual exam on the different course content.

› Synthesis report and oral defense on a subject not developed during the courses.

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LIVESTOCK HOUSING AND BUILDING CONCEPTION

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: JOOP LENSINK

1-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

2-Skills developed

› Conceptualize a cattle building project

› Advise farmers on building aspects and project

› Realize a building quality audit

3-General 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.

4- 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

continued on next page

5- Program

Session	Duration	Topic / Method
Session 1	4h	**Lecture**: Introduction to livestock housing, animal behavior, basis of housing
Session 2	4h	**Visit**: dairy farm with construction project
Sessions 3 and 4	8h	**Lecture**: resting, feeding and thermal requirements
Session 5	4h	**Free session**: construction project
Session 6	4h	**Lecture**: environmental legislation, storage capacities of manure
Session 7	4h	**Lecture**: building concepts and automatization
Session 8	4h	**Lecture**: dairy calves housing and innovation
Session 9	4h	**Visit**: building concepts in several species
Session 10	4h	**Lecture**: ventilation and climate control

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PROJECT IN AGRICULTURE

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 6
TEACHER/COORDINATOR: ERIC TAISNE

1-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.

2-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)

3-General content

› 11 days dedicated to the study, including one whole week.

› Projects presentation, choice of the groups and the affectation of the projects

4- Evaluation

› Intermediate evaluation after 3-4 workweeks

› Final oral evaluation in the presence of the partner, written report

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AGRICULTURE AND CLIMATE CHANGE

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: HÉLÈNE DESMYTTÈRE

"Climate change adaptation and mitigation are among the major challenges facing agriculture" (Saj and Torquebiau, 2018).

1-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.

2-Skills developed

- Understand environmental and sustainable development challenges
- Use environmental analyses tools
- Critical thinking (reconsideration) and curiosity

2-General content

- Fundamentals on climate change and understanding of the relationship with agriculture
- Impacts and practices' assessments tools
- Presentation of concrete research and development projects

3- Evaluation

- Individual written exam
- Group oral presentation

4- Program

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	Lecture
Impact of climate change on crops	Visit
Livestock farming adaptation	Lecture
Carbon sequestration	Lecture
Reducing emissions in farms	Lecture
SOERE observatories	Visit

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GLOBAL FOOD POLITICS

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: ERIC TAISNE / SABINE WEILAND (ESPOL)

1-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.

2-General 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.

3- Evaluation

› Regular attendance of the sessions is a requirement. **Exams**: 3 hours written exam (essay).

4- Program

› Session 1 – Introduction: The Geopolitics of Food

› Session 2 – Food as a Policy Field

› Session 3 – Food Governance

› Session 4 – Food Consumption

› 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

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APPLIED AGRICULTURAL SCIENCES TO SPECIALIZED CROPS

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: PAULINE TRAPET

1-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.

2-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

3-General content

News, evolutions and innovations of technical itineraries applied to specialized crops :

› Arboriculture (Apple orchards)

› Grape vine

› Vegetables production

4- Evaluation

› Individual assessment (50 or 100%) and/or oral presentations by groups (30 minutes) (50 or 100%)

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LIVESTOCK PRODUCTION SYSTEMS

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 6
TEACHER/COORDINATOR: VALÉRIE JACQUERIE / HÉLÈNE LERUSTE

1-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

2-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

3-General 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).

4- Evaluation

Oral defense in group – Written report.

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SPECIALIZATION: SUSTAINABLE AGRICULTURE AND SMART FARMING

2019-2020

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 30
TEACHER/COORDINATOR: BERTRAND VANDOORNE / HERINAINA ANDRIAMANDROSO

1- Objectives and 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.

2- Content and organisation

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.

3-Evaluation

Different evaluation methods will be used and equally distributed between:

› Individual written evaluations

› Group works

› Evaluation based on the participation and professional attitude

4- Training Modules

The main topics addressed during the training will be:

continued on next page

1. **Tools for supporting farming and farmers**: Farm strategy, consulting and projects (10 days)

2. **Agriculture and society:** Societal issues around technology (5 days)

3. **Professional skills**:

- Agriculture and Water (5 days)
- Agriculture and territories (3 days)
- Innovative and sustainable cropping systems (10 days)
- Precision Agriculture (20 days)

4. **Group project** (40 days)

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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)*

Contact

Julien Castelin, Academic Advisor
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English-Taught Courses

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	
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	
Sustainable Management of Pollution	30
MASTER 2 - SPRING SEMESTER	
Final Internship	30
Six-month Professional Experience	
Written Report and Oral Defense	

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FIELD STUDY IN ENVIRONMENT

LEVEL: MASTER 1
PERIOD: SEMESTERS 1 AND 2
LANGUAGE: EN
ECTS: 6
TEACHER/COORDINATOR: NADÈGE OUSTRIÈRE

1-Main objectives

Manage, in a collaborative work, a long study dealing with an environmental issue.

2-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.

3-General content

› Eleven (11) days dedicated to the study, including one whole week.

› Project presentation, choice of the groups and the project assignment.

4- Evaluation

› Intermediate evaluation after 3-4 work weeks

› Final oral evaluation in the presence of the partner, written report

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ENVIRONMENTAL POLLUTANTS

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: JULIEN CASTELIN

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

1-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

2-Skills developed

› Be able to identify links between activities and pollution
› Practice collaborative group work: work, oral presentation, written report

3-General 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.

4- 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.

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TOXICOLOGY - ECOTOXICOLOGY

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 6
TEACHER/COORDINATOR: NADÈGE OUSTRIÈRE

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

1-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.

2-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

3-General 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.

4- Evaluation

Individual written exam and oral group presentation

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POLLUTANT BEHAVIOUR IN ABIOTIC MATRICES

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: NADÈGE OUSTRIÈRE

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

1-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

2-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.

3-General 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

4- Evaluation

Individual written exam and written report

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WASTE MANAGEMENT

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: JOHANNE GÉA

1-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.

2-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.

3-General 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...)

4- Evaluation

› Written report in group

› Group oral defense

› Individual written exam

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GEOGRAPHICAL INFORMATION SYSTEM (GIS) - BASIC KNOWLEDGE

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: SÉBASTIEN DÉTRICHÉ

1-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...)

2-Skills developed

› Know how to use a GIS software (QGIS)

› Use GIS to deal with environmental issues

3-General 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)

4- Evaluation

Individual exam on the software

Return to Course List

SOIL QUALITY INVESTIGATION - CONSULTANCY TOOLS

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: JULIEN CASTELIN

1-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.

2-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.

3-General content

Courses, lectures and field visits:

› **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

continued on next page

= 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.

4- Evaluation

Group oral presentation and individual written exam based on the lectures.

Return to Course List

APPLIED STATISTICS TO ENVIRONMENT

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: KARIN SAHMER

1-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..

2-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.

3-General 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

4- 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.

Return to Course List

HUMAN RISK ASSESSMENT

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: AURÉLIE PELFRÊNE

1-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.

2-Skills developed

Introduction to: human risk assessment concepts, risk calculation (from theory to practice), computerized models for assessment of contaminated land exposure

3-General 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

4- Evaluation

› Individual evaluation: written test about the lecture
› Group evaluation: oral presentation (group project on a case study)

5- Program

› Lecture
› Examples: introduction to computerized models for human risk assessment
› Practical (exercises on risk calculations)
› Case study (group project of 3/4 students)

Return to Course List

WASTE WATER MANAGEMENT

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: JULIEN CASTELIN

1-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.

2-Skills developed

Both technical skills and operational skills.

3-General 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.

4- Evaluation

Individual written exam based on the lectures and case studies done

Return to Course List

WATER AND SEDIMENT MANAGEMENT

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 6
TEACHER/COORDINATOR: JULIEN CASTELIN

1-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.

2-Skills developed

› Practice collaborative group work: work, oral presentation, written report…

› Perform GW monitoring and sampling operations

› Analyze survey reports, maps and data

3-General 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.

4- Evaluation

Practical in lab, group assignments and individual written exam based on the lectures, visits.

Return to Course List

AUDIT PRACTICES

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: JULIEN CASTELIN

1-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…).

2-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

3-General 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.

4- Evaluation

In groups, students will conduct an internal audit.

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SPECIALIZATION: SUSTAINABLE MANAGEMENT OF POLLUTION

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 30
TEACHER/COORDINATOR: JULIEN CASTELIN

1- Objectives and 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)

2- Content and organization

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.

3-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"

continued on next page

4- Teaching units

The SMaP specialization includes 5 modules:
1 / **“Applied techniques of pollution remediation”**, with 3 teaching units:

› Physical and chemical treatment techniques

› Biological treatment technique

› Phytoremediation

2 / **“Sustainable management of polluted areas”**, covering the following topics:

› Alternative use of polluted sites & sustainable management of polluted areas

› Ecological restoration & landscape management

3 / **“Applied Statistics”**:

› Computer and statistical tools

4 / **“Project Management”**, including:

› Professional semester-long project

› Responsiblity: promotion/communication/sustainable projects

5 / **“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.

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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

Contact

Caroline Kaczmarek, Academic Advisor
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English-Taught Courses

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	
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	
Two Specialization Options: – Sustainable Product Development: Ecodesign of Food Products – Quality Management Systems in the Agrofood Sector	30

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

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FOOD TECH PROJECT - INTRODUCTION

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 6
TEACHER/COORDINATOR: VINCENT DUMORTIER/EMMANUELLE MARTIN

1-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).

2-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.

3-General 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.

4- Evaluation

Intermediate evaluation (report and presentation of case study results): 75%
Final evaluation: Poster (s): 25%

Return to Course List

QUALITY ASSURANCE AND HACCP

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: CAROLINE KACZMAREK

1-Main objectives

› Understand the concept of quality, its added value and impact

› Understand how to define quality in a particular context

2-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

3-General 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.

4- Evaluation

Written reports

Return to Course List

UNIT OPERATIONS

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 6
TEACHER/COORDINATOR: ALEXANDRE BERTH

1-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.

2-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).

3-General content

Lectures, practical class, visits of food plant, project. Topics covered:

continued on next page

- 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.

4- Evaluation

Written reports on practicals, written exam

Return to Course List

DATA ANALYSIS AND APPLIED STATISTICS TO AGROFOOD

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: PIERRE VANDENDRIESSCHE

1-Main objectives

To take into account the multiple backgrounds, this course is designed to improve basic and advanced knowledge of statistics and probabilities

2-Skills developed

Being able to master all relevant statistical tools related to statistical quality control, process control and R&D in Food Science.

3-General 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

4- Evaluation

Presentation of case study analyze in groups of 3 or 4 students.

- 50% written presentation (Power point)
- 50% oral presentation

Return to Course List

BIOPROCESS

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN (FR IN SEMESTER 2)
ECTS: 3
TEACHER/COORDINATOR: CAROLINE CHOMA

1-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

2-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).

3-General content

Lectures/conferences; Visiting companies (Roquette, DSM, Lesaffre, etc); Tutorial work and/or Practical work (biomass production and yield of production calculation)

1. INTRODUCTION (bioprocesses and biotechnology definitions).

2. MICROORGANISMS POTENTIALITIES: What are they? and their life dissection (nutrient requirements; biomass production & anabolism; growth phases)

3. 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...).

4. PROCESSES AND EQUIPMENT/ HOW TO MANAGE BIOPROCESSES (Biomass production; Equipment: and their control devices; Culture management).

5. OPTIMIZATION AND PERSPECTIVES

4- Evaluation

Written works

Return to Course List

AGROFOOD PROFESSIONAL PROJECT

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN OR FR
ECTS: 3
TEACHER/COORDINATOR: CAROLINE KACZMAREK

1-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

2-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

3-General content

› Skills and jobs in the food sector

› CV and cover letter

› Networking (LinkedIn)

› Mock interviews

› Written report workshops

4- Evaluation

› CV

› Written report

Return to Course List

PRODUCTION MANAGEMENT

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: PIERRE VANDENDRIESSCHE

1-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

2-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

3-General 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)

4- Evaluation

Exam, serious game results (ranking against other competing teams)

Return to Course List

PRODUCT FORMULATION

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 6
TEACHER/COORDINATOR: EMMANUELLE MARTIN

1-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.

2-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.

3-General 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

4- Evaluation

Intermediate and final assessment

Return to Course List

FOOD TECH PROJECT

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 6
TEACHER/COORDINATOR: VINCENT DUMORTIER

1-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).

2-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.

3-General 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.

4- Evaluation

Presentation and report or other deliverable for the partner firm.

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INGREDIENTS

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: EMMANUELLE MARTIN

1-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

2-Skills developed

Know how to propose a list of ingredients in adequation with desired formula

3-General 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

4- Evaluation

70% individual written final exam

30% Report or oral defense in a group

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NUTRITION

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: LUCILE GABEREL

1-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.

2-Skills developed

› Calculation of a human food ration and of the nutritional values of a food product

› Nutritional audit approach

› Researches on official websites

3-General 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

4- Evaluation

Oral presentation 40%
Written exam 60%

5- Program

1	**2**	**3**	**4 and 5**
Lecture	**Lecture**	**Lecture**	**Lecture + practical**
Nutrition basics Balanced diet	Balanced diet **Practical** Food ration calculation	Specific populations nutritional needs Health issues related to nutrition	Nutrition labeling **Self-directed time** Research for group project

continued on next page

6 and 7	**8**	**9**	**10**
Outing	**Lecture + practical**	**Oral presentations**	**EXAM**
Danone Research Center	Nutrition in an agrifood company Nutritional audit approach	Group project	

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SENSORY EVALUATION

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: LAUREEN SIMON

1-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

2-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

3-General 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

4- Evaluation

Group written report – Group oral presentation – Individual exam

Return to Course List

PACKAGING AND ECO DESIGN

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: EMANUELLE MARTIN

1-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

2-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

3-General 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

4- Evaluation

Oral defense in groups

Return to Course List

PHYSICAL, CHEMICAL, AND MICROBIOLOGICAL CHARACTERIZATION OF FOOD

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 6
TEACHER/COORDINATOR: VINCENT DUMORTIER

1-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, and Microbiology.

2-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

3-General 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.

4- Evaluation

Written reports (practicals), individual written exam

Return to Course List

SPECIALIZATION: SUSTAINABLE PRODUCT DEVELOPMENT - ECODESIGN OF FOOD PRODUCTS

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 30
TEACHER/COORDINATOR: EMMANUELLE MARTIN-DERVAUX

1- Objectives and skills developed

Acquire fundamentals of product research & development

Continuously improve the environmental performance of renovated and new products

› 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 research and development activities.

Build the path to make a difference on a global scale

› To promote a cross-fertilization between the company's departments or businesses in order to further expand the use of eco-design processes through each step of the company's activities

2- Content and Organization

Common course: Research & Development

› Lectures
› Workshops
› Formulation sessions in food companies R&D labs
› Group projects
› Outings
› Coelab innovation project

Specific course: Ecodesign of Food Products

› Lectures
› Group projects
› Outings

3- Evaluation

› Coelab project
› Oral presentations other projects
› Exams

4- Teaching units

COMMON COURSE

Challenges for food companies: Market trends (nutrition, sustainability), CSR approach, Consumers perception

Essentials of product formulation and development: Innovation management, Fundamentals of

continued on next page

formulation (with lab exercises), Culinary expertise, Formulation of complex systems with different approaches or ingredients (clean label, gluten free, algae, vegetable proteins, with no added sugar, with fewer fats, bioprocesses…), Experimental design applications
Technical choices impacts: Case studies: nutrition and technological challenges, Research project: product-process interactions
Legal and regulatory framework: INCO regulation, INPI presentation
Coelab innovation project: Theoritical inputs: codesign, innovation

SPECIFIC COURSE ECODESIGN OF FOOD PRODUCTS

- **Ecodesign strategies:** Ingredients and recipe (sourcing procurement decisions, food products design and use), Processing impact on environment (monitoring, targeting and reporting, best available technology, clean technologies), Food companies testimonies: Danisco (DuPont), Barilla, API Restauration, Danone, etc
- **Decision making tools:** Life Cycle Analysis, Other ecodesign tools, Cost-benefit analysis
- **Development of value-added products from food waste:** Situation and opportunities, Wastes recovery, Discarded food products valorisation: examples
- **Moving towards a CSR strategy**: From ecodesign to ecosociodesign (society, consumers, value chain actors, workers, local communities), Communication (communication policy, consumer information and satisfaction, CSR reporting)

Return to Course List

SPECIALIZATION: QUALITY MANAGEMENT SYSTEMS IN THE AGROFOOD SECTOR

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 30
TEACHER/COORDINATOR: CAROLINE KACZMAREK

1- Objectives and skills developed

The aim is to train futures engineers able to:

› Manage quality in the agrofood sector (food safety, environment, industrial risks) by combining the quality of the products and the economic issues;

› To answer to an international demand.

The specific objectives consist in giving to the students:

› An international vision of the food supply chain from farm to fork, its constraints and opportunities;

› The necessary tools through operational approaches to put in place and improve a management system able to answer to international standards and norms (food safety management systems, environmental management…);

› The skills to develop an integrated management system dealing with food safety risks, food fraud, food defense, environmental risks, security…

Skills developed through this program:

› The ability to communicate and to manage different projects through an international context in multicultural teams;

› The capacity to develop the right methodology and use scientific knowledges to solve problems;

› The ability to manage several projects in a sustainable way;

› The ability to work while using the English language.

2- Content and Organization

Organization through 3 points:

› Fundamental: lectures, tutorials;

› Projects: co-elab project, case studies…;

› Visits: testimonies, companies, conferences.

There are 8 modules:

› Module 1. Quality management in production

› Module 2. Food safety Management systems

continued on next page

- Module 3. Resource management and responsibility
- Module 4. Environmental and risks management
- Module 5. Integrated management systems and quality strategy
- Module 6. Monitoring tools
- Module 7. Communication tools
- Module 8. Co-Elab project

3-Evaluation

Continuous assessment, oral presentations, practical + 4 exams.

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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.*

Contact

Sophie Gozdziaszek, Academic Advisor
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English-Taught Courses

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	
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	
Management Option - Trade & Agribusiness	30

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

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INTRODUCTION TO FINANCE

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: VAN HONG VU

1-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.

2-Skills developed

› Be able to understand how firm decisions affect a financial report.

› Be able to analyze firm financial health.

3-General content

1. Generality about accounting
2. The Balance sheet and Income Statement:
    a. How to construct them?
    b. How to analyze them?
3. The Cash-flow statement: construction and analysis
4. Cost accounting analysis: from the raw material to the finished good, how much does it cost?

4- Evaluation

Written exam and a firm financial analysis.

Return to Course List

EXPORT

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 6
TEACHER/COORDINATOR: XAVIER ALIX

1-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

2-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.

3-General 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).

4- Evaluation

Individual written work (30%)
Practical study in group (50%)
Oral group presentation of their export project (20%)

5- Program

Session	Duration	Topic / Method
Session 1	4 h	**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
Session 2	4 h	**Lecture**: Marketing; Marketing research; Marketing planning; Marketing segmentation; Marketing mix; Promotion; Business planning; Some tools (SMART, SWOT, PESTEL); Marketing plan; Case study; Data collection

continued on next page

Session 3	4 h	**Lecture**: Ensure the presence of products on the market; Entry strategies; Various ways to implant in the targeted country (licensing, foreign direct investment, etc.)
Session 4	4 h	**Lecture**: Building commercial policy; Exporting; Product; Exporting cost, pricing and sale; promotion; Countertrade, International contracts
Session 5	4 h	**Lecture**: WTO and regulation of international trade; Dispute settlement; world events and their consequences on business: how to prevent issues and adapt the business
Session 6	4 h	**Lecture**: Transport and logistics; Infrastructures; Terms of Trade = Incoterms, International ocean, air, land and multi-modal transportation; Packaging for export
Session 7	4 h	**Lecture**: International logistics security; Documentation and customs procedures; Custom clearance; Payment; Basic business finance; Finance for international Trade; Terms of payment
Session 8	4 h	**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)
Session 9	4 h	**Lecture**: Using international logistics for competitive advantage; suppliers and support organization; exchange and questions about the full course; Preparation of the week-long project
Week-long project	35 h	**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

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DECISION TOOLS: STATISTICS AND MARKET RESEARCH

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: AMAR DJOUAK

1-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.

2-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.

3-General content

- Quantitative surveys: methodology and tools
- Descriptive and inferential statistics
- Putting into practice acquired notions by carrying out a case study (survey)

4- Evaluation

Oral group exam

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INTRODUCTION TO MARKETING

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: JULIE CHRISTIAEN

1-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.

2-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

3-General 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.

4- Evaluation

Oral presentation on case study (80%)
Written recommendation to convince external financial investors (20%)

5- Program

Session	Duration	Topic / Method
Session 1 & 2	8h	Lecture – International marketing strategy
Session 3	4h	Lecture – Market study in an international context
Session 4	4h	Lecture – Marketing policies
Session 5	4h	Lecture – Financial issues

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Session 6 – 7 – 8	12h	Case study – launch and coaching /Market study, marketing strategy and marketing policies
Session 9	4h	Case study – coaching / financial recommendations
Evaluation session	4h	ORAL PRESENTATION

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PURCHASE AND PROCUREMENT

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: ALAIN MILLECAMPS

1-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.

2-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…)

3-General 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

4- Evaluation

Participation: 25%
Presentations: "Purchasing Game": 75%

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TRADE NEGOTIATION

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN (FR IN ANOTHER PERIOD OF S2)
ECTS: 3
TEACHER/COORDINATOR: ALAIN MILLECAMPS

1-Main objectives

To be able to negociate with professional buyers and to understand and plan the different steps of a structured selling appointement.

2-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

3-General 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

4- Evaluation

Continuous assessment

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BUSINESS DEVELOPMENT PROJECT

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 6
TEACHER/COORDINATOR: ALAIN MILLECAMPS

1-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.

2-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

3-General 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

4- Evaluation

The integration of those concepts is implemented in a business case study, which is the final deliverable.
Project report: 50%
Final presentation: 50%

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DIGITAL BUSINESS

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: MARC-ANTOINE D'HULST

1-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

2-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

3-General 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

4- 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

5- Program

For this program, the objective is to alternate theoretical knowledge and practical highlights

Return to Course List

B-TO-B MARKETING

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: ULKU TARHAN

PREREQUISITES: Fundamental aspects of marketing – Concepts, methods, tools knowledge

1-Main objectives

To introduce and train students to specific characteristics of BtoB marketing..

2-Skills developed

To be able to figure out how to work through BtoB marketing issues, using relevant tools and methods.

3-General content

- Global view: BtoB marketing specificities
- BtoB Market research
- Strategic BtoB Marketing
- Marketing policies applied to BtoB

4- Evaluation

Individual assessment

5- Program

Learn: Theoretical courses – **Practice**: tutorials – **Discover**: Professional experience presentations

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LEADERSHIP MANAGEMENT

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: SIMON OWEN

New Course -
details available soon

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MANAGEMENT CONTROL

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: VAN HONG VU

1-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

2-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

3-General 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

4- Evaluation

The grade will be based upon the total points students earn during this course. The point breakdown is as follows :

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Type	Performance	Grade ratio (%)
Final Exam	20	60
Final Assignment	20	35
Attendance - Participation - Homework	20	5
Total		100

FINAL EXAM

The format of the final exam (weighting 60% of available marks) may include any combination of true/false, multiple-choice, short-answer, numerical answer, and problem solving type questions.

The topics covered in lecture, section and the homework assignments should be your guide for topics tested on the exams. There are no practice exams available for study.

Structure of Exam	Occupied time	Type de questions/problems	Number o questions/Problem solving	Evaluation	Total points
Part 1	60 minutes	Multiple Choice Questions	1-40	1 correct answer, no negative point (0.25 points)	10
Part 2	60 minutes	Problem Solving	Problem 1 Problem 2	1 correct answer, no negative points (5 points)	10
	120 minutes				20

ASSIGNMENT

The final assignment (weighting; 35% of available points) is to help students to improve their understanding and practices on the management control systems of an organisation that they have chosen to work on.

Type of assignment: group or individual assignment. Each group is from 2 to 3 students.

Required/Schedule/Deadline/Others: to be updated

ATTENDANCE – PARTICIPATION – HOMEWORK

Attendance, participation in class and working on the homework are required (weighting; 35% of available points). Each student is responsible for all that is said and done in the lecture and its practices.

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.

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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

Date	Time	Topics (*)	Objectives
	2 h	1.General introduction about the management control -The control process -Performance measurement systems -Management control in large corporations	
	2 h	2. Defining the performance of an organization -Definitions of performance -The performance model of an organization -Managing the balance between stakeholders -Managing multi-dimensional organisational performance	
	4 - 6 h	3. Measuring an organisation's performance financial indicators -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	
	4 - 6 h	4. Dashboards in management control system -Introduction objectives and principles assigned to dashboards. -Building performance dashboard. -Building "panoramic" dashboards. -Coordinating a system of dashboards: the architecture and the applied methods	
	4 h	5. Business Planning -The principles of planning: main purpose, basic functions, functions linked to organization - The operational implementation of business planning	
	6 h	6. Analysing results -The objectives and principles of results analysis - Results monitoring using a cost accounting approach - Results monitoring with dashboards - Other methods of analysing results	
	4 h	7. The key roles in management control -The stakeholders in the managements control process -The controllers and performance management dynamic	
	4 h	The Environmental Services Case Study (Optional)	

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FINANCIAL ANALYSIS

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 6
TEACHER/COORDINATOR: SOPHIE GOZDZIASZEK

1-Main objectives

Analyze and understand the operation of a listed company

2-Skills developed

Understand IFRS consolidated financial statements and conduct a financial analysis of a listed company.

3-General 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

4- 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

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CONSUMER BEHAVIOR

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: DR. FATMA GÜNERI

1-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.

2-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)

3-General content

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

continued on next page

- 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

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

4- Evaluation

50% exam – 50% final project

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SPECIALIZATION: MANAGEMENT OPTION - TRADE & AGRIBUSINESS

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 30
TEACHER/COORDINATOR: JULIE CHRISTIAEN

1-Main objectives and 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.

3-General content and organization

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.

4- Evaluation

Assessments will be used and equally distributed between :

› Individual written assessments
› Oral presentations
› Written reports
› Evaluation based on the participation and professional attitude

5- Training Modules

Modules linked to trade and management skills will be :

› 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)

continued on next page

› Business management case study (1 week)

Modules linked to technical / agriculture skills will be :

› 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 will be :

› 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)

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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.

MASTER 1 - FALL SEMESTER	ECTS
Java 1	3
Technical Project S1	7
French as a Foreign Language	3
MASTER 1 - SPRING SEMESTER	
Technical Project S2	7
Three-month Internship	6
MASTER 2 - FALL SEMESTER	
French as a Foreign Language	2
Innovation Project	9
MASTER 2 - SPRING SEMESTER	
Final Industrial Internship	30
Six-month Professional Experience	
Written Report and Oral Defense	

JAVA 1

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: M. MORELLE

1-Prerequisites

Basic algorithms and data structures in the computer software

2-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.

3-Course Description

› General presentation of JAVA programming language
› Simple objects construction
› Composite objects construction
› Inheritance
› Exceptions
› Out/Input
› Threads
› Introduction to graphical applications development

Return to Course List

TECHNICAL PROJECT

LEVEL: MASTER 1
PERIOD: SEMESTER 1 AND 2
LANGUAGE: EN
ECTS: 7
TEACHER/COORDINATOR: JM CAPRON, M. MORELLE

1-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.

2-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).

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THREE-MONTH INTERNSHIP

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 10
TEACHER/COORDINATOR: E. LITTON

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.

Return to Course List

INNOVATION PROJECT

LEVEL: MASTER 2
PERIOD: SEMESTER 1 AND 2
LANGUAGE: EN
ECTS: 9
TEACHER/COORDINATOR: D. BOULINGUEZ

1-Prerequisites

None

2-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

3-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)

Return to Course List

FINAL INDUSTRIAL INTERNSHIP

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 30
TEACHER/COORDINATOR: E. LITTON

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

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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…

Contact

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

English-Taught Courses

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	
Metaheuristics	3
Advanced Machine Learning	3
Data Base	3
Quantum Computing	2
Technical Project	7
Three-month Internship	10

MASTER 2 - FALL SEMESTER	
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	
Final Industrial Internship	30

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NETWORK & SYSTEM BASE

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: D. DELANNOY, H. BENHABILES

1-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, ...).

2-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.

3-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

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DATA REPORT, COMMUNICATION AND VISUALISATION

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: F. WINDAL, H. BENHABILES

1-Prerequisites

Bases in Probability & Statistics

2-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.

3-Course Description

1. Programming with R language

2. Libraries for data visualization (ggplot2, dyplr, tidyverse)

3. Shiny for dynamic web pages

4. Rmarkdown and Rbook for report, presentation

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ADVANCED STATISTICAL ANALYSIS

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: F. WINDAL

1-Prerequisites

Bases in Probability/statistics
Data Report, Communication and VisualIsation (S1M1)

2-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:
1. 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.
2. To expose you to a wide range of methods with great application potential.
3. 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.

3-Course Description

1. Description of a digital series

2. Estimate-Confidence Interval

3. Comparison of two means

4. Comparison of two variances

5. 1-factor analysis of variance

6. Analysis of variance with 2 factors without repetitions

7. Tests based on the Chi2 criterion

8. Links between two quantitative variables

9. Simple regression

10. Multiple regression

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ARTIFICIAL INTELLIGENCE

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: N. IHADDADENE

1-Prerequisites

None

2-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.

3-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.

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QUANTUM COMMUNICATION

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 2
TEACHER/COORDINATOR: I. LEFEBVRE, JF. ROBILLARD

1-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

2-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

3-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

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METAHEURISTICS

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS:
TEACHER/COORDINATOR: F. WINDAL, H. BENHABILES

1-Prerequisites

Java programming

2-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».

3-Course Description

1. The simulated annealing method
2. Evolutionary algorithms
3. Artificial ants
4. Research with taboos

Return to Course List

ADVANCED MACHINE LEARNING

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: F. WINDAL, H. BENHABILES

1-Prerequisites

None

2-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:

1. Explore the field of machine learning with its models, algorithms and data training

2. Understand supervised and unsupervised machine learning algorithms.

3. Use monolayer and multilayer neural networks to calculate outputs

4. Discover the technological tools for understanding machine learning.

3-Course Description

1. Advanced neural networks

2. Random forests

3. Decision trees

4. Support vector machines.

Return to Course List

DATA BASE

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: D. DELANNOY

1-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.

2-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

3-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)

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QUANTUM COMPUTING

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 2
TEACHER/COORDINATOR: G. CHÊNEVERT, JF. ROBILLARD

1-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).

2-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).

3-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

Return to Course List

CLOUD COMPUTING AND ARCHITECTURE

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: F. WINDAL, D. DELANNOY

1-Prerequisites

› Java Courses (M1, semester 1)
› Network & Sys base (M1, semester 1)
› Data bases (CSI3, CIR3, semester 2)

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

3-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
1. Understand the notions of performance in the deployment of a Big Data architecture
2. Acquire knowledge about data storage solutions
3. Discern the differences between databases (NoSQL, Elastic, Oracle, MongoDB...)
4. Understand the importance of file systems (HDFS) in a Big Data architecture
5. Example of the implementation of the "Crédit Agricole" datalake

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HADOOP AND SPARK ECOSYSTEM

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: F. WINDAL, H. BEHABILES

1-Prerequisites

Java, Cloud Computing and Big Data Architecture

2-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.

3-Course Description

Hadoop:
1. Introduction to the framework
2. Primary components
3. Query language and connection to HDFS
4. Distributed processing

Spark:
1. Introduction to the framework
2. Stream joins
3. Tolerance for faults
4. The différents APIs.

Return to Course List

IT RISK AND MANAGEMENT

LEVEL: MASTER 2
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: D. DELANNOY

1-Prerequisites

None

2-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.

3-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).

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SECURED NETWORK ARCHITECTURE

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: F. WINDAL, H. BEHABILES

1-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

2-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.

3-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

Return to Course List

URBANIZATION OF IT SERVICES

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 2
TEACHER/COORDINATOR: D. DELANNOY

1-Prerequisites

None

2-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

3-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

continued on next page

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

Return to Course List

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…

Contact

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david.boulinguez@junia.com

English-Taught Courses

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	
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	
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	
Final Industrial Internship	30

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ADVANCED DIGITAL SIGNAL PROCESSING

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: C. KRZEMINSKI, D. BOULINGUEZ

1-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

2-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...).

3-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

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ANALOG CIRCUIT DESIGN

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: B. STEFANELLI

1-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..).

2-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.

3-Course Description

› Semiconductor devices (diodes, transistors),

› Linear operation of semiconductors (mono and multi-stage amplifiers, differential pairs, current mirrors),

› Power stages,

› Frequency response..

Return to Course List

DIGITAL PROGRAMMABLE CIRCUITS: FPGA & VHDL

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: B. STEFANELLI

1-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).

2-Learning Outcomes

Targeted skills : 32 (323), 34 (342/343), 42 (422), 1110 (11102)

› Synthesize a digital function on FPGA,

› Master VHDL basics.

3-Course Description

› Introduction to the architecture of digital programmable circuits (FPGA),

› Introduction to VHDL,.

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WIRELESS TECHNOLOGIES AND APPLICATIONS

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: JM. CAPRON, JF. LAMPIN

1-Prerequisites

None

2-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..

3-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.

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HANDS-ON 32-BIT ARM MICROCONTROLLERS

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 2
TEACHER/COORDINATOR: B. STEFANELLI

1-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).

2-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.

3-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

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POWER ELECTRONICS

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: JM. CAPRON

1-Prerequisites

Reliable electricity bases (voltage and current laws) and electronics fundamentals (passive and active components)

2-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.

3-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.

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MICROWAVE CIRCUITS

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: B. LEGRAND

1-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-IS-EN-M1P1-ST-MB-502)

2-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.

3-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).

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DIGITAL MICROELECTRONIC CIRCUITS

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: E. DUBOIS

1-Prerequisites

None

2-Learning Outcomes

At the end of this class unit, a student must be able to:

1. Calculate the current-voltage characteristics of diodes, bipolar transistors and metal-oxide-semiconductor (MOS) transistors
2. Properly explain the mechanisms of charge transport in the above mentioned devices
3. Derive the voltage transfer characteristic (VTC) of a basic bipolar inverter stage
4. Derive the voltage transfer characteristic (VTC) of elementary CMOS circuits
5. Implement and properly design simple combinational logic circuits
6. Explain the operation of clocked circuits
7. Extract a circuit schematic from a circuit layout.

3-Course Description

› 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.

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AUDIO SIGNAL PROCESSING

LEVEL: MASTER 2
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 2
TEACHER/COORDINATOR: A. PATE

1-Prerequisites

› Signal and image analysis (3rd year)

› Basics of physics (waves and acoustics)

› Scientific computing (e.g. Python or Matlab)

2-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.

3-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.

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ADVANCED ELECTRONICS

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: JM. CAPRON

1-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).

2-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.

3-Course Description

- Oscillators,
- Phase-Lock Loops,
- Direct Digital Synthesis,
- Digital systems architecture,

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MIXED-SIGNAL INTEGRATED CIRCUITS FOR AUDIO APPLICATIONS

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: D. DELANNOY

1-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

2-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.

3-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:
1. 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.

2. 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).

3. Switched amplifiers for audio applications A half-day lecture introduces the design of switched-mode 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.

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HIGH FREQUENCY ELECTRONICS

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: JM. CAPRON

1-Prerequisites

None

2-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)..

3-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.

Return to Course List

REAL-TIME COMPUTING FOR EMBEDDED SYSTEMS

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: D. DELANNOY

1-Prerequisites

C programming and processors architecture.

2-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.

3-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..

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AUTOMOTIVE ELECTRONICS

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 2
TEACHER/COORDINATOR: JM. CAPRON

1-Prerequisites

None

2-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.

3-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

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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…

Contact

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

English-Taught Courses

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	
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	
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	
Final Industrial Internship	30

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NETWORK & SYSTEM BASE

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: D. DELANNOY, H. BENHABILES

1-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, ...).

2-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.

3-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

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OPERATING SYSTEMS

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: D. DELANNOY

1-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

2-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..

3-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)

Return to Course List

WEB TECHNOLOGIES

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: D. DELANNOY

1-Prerequisites

To follow this module, the student must know the basics of algorithm, procedural programming and data base concepts.

2-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.

3-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

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ARTIFICIAL INTELLIGENCE

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: N. IHADDADENE

1-Prerequisites

None

2-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.

3-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.

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QUANTUM COMMUNICATION

LEVEL: MASTER 1
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 2
TEACHER/COORDINATOR: I. LEFEBVRE, JF. ROBILLARD

1-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

2-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

3-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

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JAVA 2

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: M. MORELLE

1-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.

2-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

3-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

Return to Course List

ANDROID

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: D. DELANNOY

1-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.

2-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

3-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)

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DATA BASE

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: D. DELANNOY

1-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.

2-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

3-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)

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UNIX

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 2
TEACHER/COORDINATOR: J. ROLAND

1-Prerequisites

› Basic UNIX usage experience

› C programming

2-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.

3-Course Description

› UNIX history

› General UNIX architecture

› The kernel

› The UNIX filesystem

› Processes

› Signals

› Interprocess communications

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QUANTUM COMPUTING

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 2
TEACHER/COORDINATOR: G. CHÊNEVERT, JF. ROBILLARD

1-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).

2-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).

3-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

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NETWORK PROGRAMMING

LEVEL: MASTER 1
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 2
TEACHER/COORDINATOR: E. DUBOIS

1-Prerequisites

› C programming

› Basic UNIX usage through shell commands

› Basic Unix programming skills in C (processes, signals)

› Basic IP knowledge

2-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.

3-Course Description

› TCP/IP networking

› Socket Programming

› Client / Server design (TCP and UDP versions)

› Names and addresses conversions

› Case studies.

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CLOUD COMPUTING AND ARCHITECTURE

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: F. WINDAL, D. DELANNOY

1-Prerequisites

› Java Courses (M1, semester 1)
› Network & Sys base (M1, semester 1)
› Data bases (CSI3, CIR3, semester 2)

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

3-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
1. Understand the notions of performance in the deployment of a Big Data architecture
2. Acquire knowledge about data storage solutions
3. Discern the differences between databases (NoSQL, Elastic, Oracle, MongoDB...)
4. Understand the importance of file systems (HDFS) in a Big Data architecture
5. Example of the implementation of the "Crédit Agricole" datalake

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JEE

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: D. DELANNOY

1-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

2-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.

3-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

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IT RISK AND MANAGEMENT

LEVEL: MASTER 2
PERIOD: SEMESTER 2
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: D. DELANNOY

1-Prerequisites

None

2-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.

3-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).

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OBJECT ORIENTED DESIGN

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 3
TEACHER/COORDINATOR: D. DELANNOY

1-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

2-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.

3-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

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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

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URBANIZATION OF IT SERVICES

LEVEL: MASTER 2
PERIOD: SEMESTER 1
LANGUAGE: EN
ECTS: 2
TEACHER/COORDINATOR: D. DELANNOY

1-Prerequisites

None

2-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

3-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

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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

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