



Project Management for Energy and Environmental Engineering

Semestre 1 « Basic Sciences »			Semestre 2 « Eco technologies and Environment Process Engineering »			Semestre 3 « Energy Systems and Services for Efficiency »			Semestre 4	
		ECTS			ECTS			ECTS	ECTS	
ST1	Transfer Phenomena	4	ST3	Environment and Process Engineering	3	ST9	Thermodynamics for Energy systems	3	FEVI: Master Thesis (M Eng. or MSc.)	
ST2	Introduction to Energy and Environmental issues	3	ST4	Incineration and Waste Minimization	3	ST10	Renewables	3		
MGI1	Foundations of Mathematics	4	ST5	Air & Soil Remediation Processes	3	ST11	Energy Systems	4		
MGI2	Foundations of Economics	3	ST6	Water Treatment Processes	4	ST12	Energy Efficiency and Services	4		
MGI3	Putting Innovation Into Practice	3	ST7	Water Strategies and Innovation	3	ST13	Energy Networks	3		
SSG1	Management 1: Foundations	4	ST8	Process Modelling, Simulation and Control	4	ST14	Energy Modelling and optimization	3		
SSG2	Organization Science	3	SSG3	Management 2: Risk Analysis and Environment Management	4	SSG4	Management 3 (option 1)	4		
						SSG5	Energy Management (option 2)	4		
PR1	Project 1 (M Eng. or MSc.)	4	PR2	Project 2 (M Eng. or MSc.)	4	PR3	Project 3 (M Eng. or MSc.)	4		
LV1	Language 1 (French or Spanish)	2	LV2	Language 2 (French or Spanish)	2	LV3	Language 3 (French or Spanish)	2		
										30

1st Year-Semester 1 (September-January): “Basic Sciences”	
UV ST1 – Transfer Phenomena	4 ECTS
Objectives: To acquire fundamental knowledge and to understand the terminology and the scientific concepts used to describe mass and energy conservation, as well as transfer phenomena. This session prepares the students to access to a specialized engineering knowledge, applicable to industrial processes and energy conversion systems.	
Content: <u>Thermodynamics:</u> open/closed system, ideal and real gases, state equations, 1 st and 2 nd law, exergy analysis. <u>Fluid Mechanics:</u> Bernoulli’s law, pipe flow, Reynolds number, forces on obstacles, Navier-Stokes equations <u>Heat Transfer:</u> Conduction, Convection and Radiation heat transfer <u>Mass Transfer:</u> Fick’s law, mass diffusion, convective mass transfer with and without chemical transformation, heat-mass analogy. <u>Heat Exchangers:</u> Main Technologies and Design principles	
UV ST2 – Introduction to Energy and Environmental Issues	3 ECTS
Objectives: To describe the international policy context of energy and environmental issues. To know the key figures, the national and international commitments and they consequences in policies and regulations. To understand the possible actions in a constraint frame	
Content: <u>Energy and Environmental Policies:</u> Key figures, History of policies, Long term and midterm objectives <u>Stakeholders analysis:</u> Multiscale analysis and decision mechanisms <u>Policies/Standards/Regulations:</u> Case studies	
UV MIG 1 – Foundations in Mathematics	4 ECTS
Objectives: To ensure the minimum knowledge required in mathematics and statistics for specific lectures in energy and environment.	
Content: <u>Statistical Basics:</u> Descriptive statistics, data set processing, probability <u>Regression:</u> Simple and multiple linear regression <u>Math Basics:</u> Analysis, Laplace/Fourier Transform, Partial derivate and Differential equations, Linear Algebra	
UV MIG 2 – Foundations in Economics	3 ECTS
Objectives: To understand the contemporary economic systems and their influence on the processes of managerial decisions. To learn the basic concepts and techniques of accountancy in order to facilitate the communication with accountants, financial managers, bankers and auditors.	
Content: <u>Fundamental of economics:</u> Global economy, supply & demand, GDP and standard of living, labor markets and unemployment, investments & savings, economic growth, foreign trade and international economics. <u>Finance & Accounting:</u> Accountinc basic principles, financial statements, assets, liabilities and shareholders’ equity, role of the financial manager, investment decisions capital markets, debt policy and firm value, case studies.	
UV MIG 3 – Putting Innovation Into Practice	3 ECTS
Objectives: To gain the basic knowledge necessary to build its own professional company, To become familiar with the rules and laws of Intellectual Property Rights, To gain basics in entrepreneurship and its implementation.	
Content: Management of innovation, Entrepreneurship, Business plan, Intellectual Property rights, Strategy Management, Communication tools for innovation, Case studies	
UV SSG1 – Management 1: Foundations	4 ECTS
Objectives: To understand the reason of a project in link with the company activity. To be able to	

<p>have a global view of a project with all its aspects. To master usual tools (informatics) for project manager. To manage team mobilized for a project. To acquire the methods and practices required to manage a project within a complex and international framework; Different aspects are described: life cycle, reference documents, project contract, team project, supervision, cost control, performance, deadlines and risk management.</p>	
<p>Content: <u>Tools for Project Manager:</u> Communication Management, Risk Management, Conflict Management, Team Building, Leadership – Project Manager Behaviors, Closing and Project Knowledge Management, Tools for Project Manager (MS project) <u>Intercultural Management:</u> Self awareness, perception of self and the other, stereotypes, cultural variables, ethnocentrism to ethno relativism, intercultural communication, cultural profiles and business environment</p>	
<p>UV SSG2 – Organization Science 3 ECTS</p>	
<p>Objectives: To understand sociology analysis of organizations and operational units in industry, the relationships and impacts in a project development.</p>	
<p>Content: <u>Intro to Organization Sciences:</u> Actors and strategies, definitions of Organization, Project dynamics and time aspects, case studies <u>Qualitative Methodology:</u> How to collect non formalized data, how to prepare and drive an interview.</p>	
<p>UV PR1 – Project 1 4 ECTS</p>	
<p>Objectives: To learn in practice teamwork, to find and summarize relevant information once given a subject, to become familiar with main tools for literature review.</p>	
<p>Content: <u>Case 1:</u> Every project group (3-4 students) will be assigned a part of a subject. A team work inside the group and with the other sub groups will provide the overall work. Feedback on the experience of learning by doing in the field of project management will used through regular milestones. Main subject and sub subjects are updated each year by the pedagogical team. Following this path each semester (moreover in case of a 4th semester done in a company) , the Master done by the students will be similar to a <i>Master of Engineering</i>. <u>Case 2:</u> In link with the pedagogical team, it can be possible for selected number of voluntary students to design this Project and the two other ones (in the 2nd and 3rd semesters) as a research activity. The subject must be in link with the research activity of the DSEE in order to ensure a good supervision of the students. Added to a 4th semester done in a laboratory these 3 research projects provide the master a research touch similar to the one provided in a <i>Master of Science</i>.</p>	
<p>UV LV1 – Language 1 2 ECTS</p>	
<p>Objectives: To make the students able to communicate in French in current life, for job interviews and in professional situations (meeting and working reports). To support their social, cultural and professional integration by a better knowledge of French culture. At the end of the course, students will get a French diploma (TEF, Test d’Evaluation de Français), assessing their language proficiency. <i>For native French speakers French course is replaced with Spanish course.</i></p>	
<p>Content: Intensive trainings are scheduled periodically along the 3 academic semesters of the Master course, as well as regular classes, once a week. Students are divided into small groups, depending on their French level. Oral participation is favored. Visits and social events are also organized to give the students the opportunity to meet French people, and discover some cultural aspects of Nantes and its region.</p>	

<p>1st Year-Semester 2 (February-July): “Eco Technologies and Environment Process Engineering”</p>	
<p>UV ST3 – Environment and Process Engineering 3 ECTS</p>	
<p>Objectives: To be able to understand environmental process engineering and to design solid-gas processes and define adapted industrial technologies for applications related to combustion and dedusting.</p>	
<p>Content: Chemical Reaction Engineering applied to environmental process (Energy & Mass</p>	

Balances). Solid-gas Process Engineering: characterization of particulate solids and powders, flow through porous media, engineering and design of fluidized beds and cyclones, industrial applications	
UV ST4 – Incineration and Waste Minimization	3 ECTS
Objectives: To be able to design process related to combustion, solid waste incineration, gasification, solid thermal treatment, catalytic reactions. The course stresses the necessity to take into account the economic criteria, the legal constraints, the environmental impact (control and reduction of pollution and waste generation), and the energy costs in order to define an optimal design of processes.	
Content: Incineration & Combustion Processes: conventional fuels, waste as fuel, basics of combustion and flames, combustion equipment and furnaces, thermal techniques for waste treatment, incineration and gasification, energy recovery, pollution control equipment, ash disposal facilities, planning and strategies, case studies of success and failure. Waste Minimisation and Process Integration: typical causes and sources of waste, hazardous wastes, benefits and implementation of a waste management program, methodology and practical techniques to minimise waste, case studies.	
UV ST5 – Air & Soil Remediation	3 ECTS
Objectives: This course gives an overview of the main treatment processes applied in fields including air treatment, industrial gas purification and soil remediation. It combines both theoretical engineering knowledge and practical know-how (mini-project, industrial case studies).	
Content: Flue gas treatment Technologies: to be able to understand, design main technologies adapted for flue gas cleaning Biological Gas Treatment: Odour and COV treatment using biological filters are presented in this module through a "learn by project" seminar. Soil treatment: Overview of main technologies employed to treat soils polluted by industrial activities (oil, heavy metals, chemical compounds etc.)	
UV ST6 – Water Treatment Processes	4 ECTS
Objectives: This course gives an overview of the main treatment processes for drinking water and wastewater treatment. A multi-scale approach is developed including description of mechanisms, conventional models, technology presentation, system design and economic analysis. Students will gain knowledge about legislation regarding pollutant discard, and how to design and/or optimize treatment processes in order to respect pollutant emissions thresholds.	
Content: Biological Wastewater Treatment: Pollutant fraction in wastewater and main microbiological processes occurring in biological wastewater treatment plant are first presented, with an emphasis on activated sludge treatment process. Industrial wastewater treatment. Drinking Water Treatment: Basics of drinking water treatment processes are presented along with a background of physico-chemical involved in water treatment processes. Stormwater management and treatment.	
UV ST7 – Water Strategies and Innovation	3 ECTS
Objectives: To understand the main strategies and the driving forces for innovation in water management and water treatment technologies. To help the students to identify decision-makers and understand the role of the main actors. To understand new avenues for drinking and wastewater management (industrial, domestic, stormwater) with a multi-scale approach.	
Content: Water Strategies: use and treatment of water over the course of human history, the interrelationship between the water environment and public health, and the prospects for advanced treatment. PPCPs in the environment measure and treatment: Definition of Pharmaceuticals and Personal Care Products as Pollutants (PPCPs), how to measure PPCPs in Environment (water, soils) and how it affects ecosystems and health. Innovation in water for the future: Ecological sanitation and decentralized extensive wastewater management. Membrane processes as a solution for desalinization and water treatment.	
UV ST8 – Process Modeling, Simulation and Control	4 ECTS
Objectives: Based on solids knowledge gained in process engineering (UV-ST3, ST4 & ST5), this course aims at giving students the ability to use the most widespread software-tools dedicated to process modeling and control. Basic skills on how to obtain and compile data from static and dynamic systems will be provided using linear methods. The main objective is to enable students to reduce environmental impact and energy consumption of new or existing environmental processes through both modeling, simulation and control approaches.	
Content: An introduction to the field of process modeling is first given by highlighting differences between mechanistic and empirical approaches dynamic and static modeling.	

<p>The course includes four different modules (only two are mandatory).</p> <ol style="list-style-type: none"> 1) process control, MATLAB for linear system, and SIMULINK for dynamic process control. 2) process modeling & design, with practices on two softwares: ASPEN+ for static air, waste and Energy system modeling and optimization, and BIOWin for wastewater treatment processes 3) modeling of pollutant dispersion in the surroundings environment 4) modeling of membranes processes for water treatment 	
UV SSG3 – Management 2 : Risk Analysis and Environment Management	4 ECTS
<p>Objectives: To provide an overall view of energy and environmental issues on a planetary scale, to identify the scientific, technical, social, economic, legal and political stakes linked to sustainable management, to help the students to identify decision-makers and understand the role of the main actors. At the end of the course, the students will be familiarized with all aspect of environmental, risk and safety management systems and how these are evolving and being implemented by industry.</p>	
<p>Content: International Environmental Management: methodologies of environmental audits, implementation of environmental management system (ISO14001), materials inventory and substitution, recycling, and recovery, life cycle analysis Sustainability Management: the company, its social and natural environment – environmental economics constraints: effects on business activities – sustainable development: principles and practical implementation, eco-efficiency, industrial ecology – adaptation of environmental management systems ISO14001 and life cycle assessment ISO4040 to requirements of sustainability management. Case studies. Risk Analysis: major qualitative and quantitative methods of risk and process safety analysis, case studies.</p>	
UV PR2 – Project 2	4 ECTS
<p>Objectives: To apply technical knowledge, engineering tools for process design and control and to learn to optimize organization of work in a project team.</p>	
<p>Content:</p> <p><u>Case 1:</u> An engineering project dedicated to design, modelling, control of an industrial process applied for solid, air or water treatment, or energy recovery will be realized to complete this course. Each project is carried out by a team o 3 students and supervised by a tutor As for the 1st semester, by following this path (moreover in case of a 4th semester done in a company), the Master done by the students will be similar to a <i>Master of Engineering</i>.</p> <p><u>Case 2:</u> As mentioned for the 1st semester, in link with the pedagogical team, it can be possible for selected number of voluntary students to design this Project as a research activity. The subject must be in link with the research activity of the DSEE in order to ensure a good supervision of the students. Added to a 4th semester done in a laboratory these 3 research projects provide the master a research touch similar to the one provided in a <i>Master of Science</i>.</p>	
UV LV2 – Language 2	2 ECTS
<p>Objectives: To make the students able to communicate in French in current life, for job interviews and in professional situations (meeting and working reports). To support their social, cultural and professional integration by a better knowledge of French culture. At the end of the course, students will get a French diploma (TEF, Test d’Evaluation de Français), assessing their language proficiency. <i>For native French speakers French course is replaced with Spanish course.</i></p>	
<p>Content: Intensive trainings are scheduled periodically along the 3 academic semesters of the Master course, as well as regular classes, once a week. Students are divided into small groups, depending on their French level. Oral participation is favored. Visits and social events are also organized to give the students the opportunity to meet French people, and discover some cultural aspects of Nantes and its region.</p>	

<p>2nd Year-Semester 1 (September-January): “Energy systems and Services for Efficiency”</p>	
UV ST9 – Thermodynamics for Energy systems	3 ECTS
<p>Objectives: To gain necessary knowledge about concepts, thermodynamics cycles and technologies in order to be able to design energy production and conversion systems. Application cover heat and power generation as well as refrigeration cycles.</p>	
<p>Content: Steam cycle, gas turbine cycle, combined cycle for heat and power generation, nuclear</p>	

power cycle, refrigeration cycle, efficiency, COP	
UV ST10 – Renewables	3 ECTS
Objectives: To gain necessary knowledge about alternative energy resources and their technical implementation. To understand energy conversion and storage for renewable technologies and to evaluate the limits of their potential use.	
Content: Solar Photovoltaic, Solar Thermal, Wind energy, Biomass resources, Geothermal, Ocean Energy	
UV ST11 – Energy systems	4 ECTS
Objectives: To understand operation principles and design considerations of systems used for heat, mechanical and electrical energy generation or transformation. To know the technologies of heat engines, turbines, boilers and Internal Combustion Engines (ICE). To be able to perform calculation of thermo-physical phenomena running in the equipment. To initiate the students with modeling of complex thermodynamic cycles involved in ICE. To understand the formation of pollutants in the ICE and their controlling techniques.	
Content: <u>Heat Engines and Boilers:</u> Fuels technologies, combustion, firing solutions and equipment, design and technologies of boilers, flow in nozzle, Steam and gas turbines, CHP, demonstration of basic constructions and discussion of operation terms and limits <u>Design and innovation in ICE:</u> Engine design and operation parameters, modeling real engine flow and combustion processes, spray equations and spray penetration, preparation of fuel-air mixtures, chemical thermodynamics models for combustion emissions.	
UV ST12 – Energy Efficiency and Services	4 ECTS
Objectives: To be able to evaluate the energy demand and implement strategies of energy savings taking into account both societal and environmental features (transports, air and water management systems, interactions between the different stakeholders). To acquire the methodology skills and be able to select the best technical solution from multiscale analysis of systems, including buildings, districts, cities and industrial sites.	
Content: Energy Efficiency, Energy Demand and Strategies for EE, Application to Residential Sector, Technical and Economical analysis of energy options	
UV ST13 – Energy Networks	3 ECTS
Objectives: To provide understanding of energy network issues: implementation, management, interconnection, multiscale approach, energy resources and systems compatible with networks, Networks and Energy Efficiency.	
Content: Electricity Networks, Smart Grid, Smart Metering, Heating & Cooling Networks	
UV ST14 – Energy Modelling and Optimization	3 ECTS
Objectives: To be able to use relevant tools and model for energy engineering, depending the scale studied (system, process, industrial plant, region, country...) in view of proposing the most efficient energy systems mix	
Content: Thermodynamic tools for optimization (Pinch Method, Exergy optimization...), ThermoOptim, Retscreen, LEAD	
UV SSG4 (Option 1) – Management 3	4 ECTS
Objectives: To be able to analyze collective action at work and project dynamics in link with individual logics. To be aware of the individual, collective and social stakes related to management of industrial projects. To communicate efficiently in various situations and contexts. To understand the factors affecting both good and bad team performances. In addition the course aims at helping participants to work effectively and to negotiate in intercultural settings, through a better understanding of their own cultural conditioning and awareness of the differences in management and conflict styles throughout the world.	
Content: <u>Team work and Communication:</u> Communication modes and appropriate selection, listening and responding skills, communication with an audience, selling and negotiation skills, team building, setting targets and support provisions, improving team efficiency and motivation, good practices, problems and conflicts resolution. <u>Project Management:</u> Project Management, Project Planning, Project Scheduling, Project Cost	

management, Case Study	
<u>International Negotiations</u> : Actors and Processes, instrumental and behavioral aspects, stake, conflict, convergence & divergence, consultation, confrontation and conciliation	
UV SSG4 (Option 2) – Energy Management	4 ECTS
Objectives: To examine sustainable options for energy production, supply and consumption and to enable a critical evaluation of emerging ideas and technologies. To understand the energy recovery and management techniques of production and distribution systems. To know incentives, market opportunities and requirements for improving energy efficiency in the different sectors. To know the methods of energy audit.	
Content: Energy & Environmental Auditing, Energy Management, Economics of Energy Project (Carbon markets, Energy markets), Standardization & Energy	
UV PR3 – Project 3	4 ECTS
Objectives: To be able to gather relevant information about a given subject, To be able to provide pedagogical materials, To be able to “teach” the audience	
Content:	
<u>Case 1:</u> A part of a course given by a regular lecturer is identified to become a subject for a group of 3 students (and removed from his/her course). The group have to work in strong link with the lecturer in order to prepare and present this part of the course to the rest of the class. As for the 1 st semester, by following this path (moreover in case of a 4 th semester done in a company), the Master done by the students will be similar to a <i>Master of Engineering</i> .	
<u>Case 2:</u> As mentioned for the 1 st semester, in link with the pedagogical team, it can be possible for selected number of voluntary students to design this Project as a research activity. The subject must be in link with the research activity of the DSEE in order to ensure a good supervision of the students. Added to a 4 th semester done in a laboratory these 3 research projects provide the master a research touch similar to the one provided in a <i>Master of Science</i> .	
UV LV3 – Language 3	2 ECTS
Objectives: To make the students able to communicate in French in current life, for job interviews and in professional situations (meeting and working reports). To support their social, cultural and professional integration by a better knowledge of French culture. At the end of the course, students will get a French diploma (TEF, Test d’Evaluation de Français), assessing their language proficiency. <i>For native French speakers French course is replaced with Spanish course.</i>	
Content: Intensive trainings are scheduled periodically along the 3 academic semesters of the Master course, as well as regular classes, once a week. Students are divided into small groups, depending on their French level. Oral participation is favored. Visits and social events are also organized to give the students the opportunity to meet French people, and discover some cultural aspects of Nantes and its region.	

2nd Year-Semester 2 (February-July):	
“MS Thesis”	
FEM – Master Thesis	30 ECTS
Objectives: Crowning achievement of the studies, the professional project is the springboard towards professional activity. According to one’s personal career objective, every student can choose to carry out either an industrial or research project for a period of 6 months. The internship gives the opportunity to get a consistent professional experience as an engineer in a company, an institution or a laboratory, having activities in the energy or environmental area. The mission assigned must answer a real industrial need, whilst the results obtained have to bring a real added value. Aside demonstration of the ability of the student to use technical and engineering knowledge, the exercise enables to evaluate in a professional situation the individual management skills, as well as the inter and intra personal qualities.	
Content:	
The subject must include:	
<ul style="list-style-type: none"> - Technical, scientific achievements (conception, design, optimization, improvement of processes, industrial units, farms...) 	

- And/or implementation of new methodologies, or systems of management (hygiene, safety and environment (HSE), risk, ...)
- Analysis of the global context, by considering the economical, financial, social, human, cultural, geographical, policy and regulations aspects.

All along the duration of the project, the student is supervised by two tutors:

- One in the company or the laboratory, who defines the missions and guarantee an adequate environment for the development of the student's work
- Another one from the Ecole des Mines de Nantes, who (as an academic referee), may advise or support the student during the project.

At the end of the project, a Master thesis is submitted by the student to both the tutors. This is followed with an oral defense in front of a jury. The global evaluation of the exercise is based on the partial assessments made by each tutor and the jury of the defense.