
MASTER OF SCIENCE, TECHNOLOGY AND HEALTH

2021-2022

YEAR 1

INDUSTRIAL ENGINEERING

EIT MANUFACTURING

PROGRAMME SUPERVISOR(S):

Catherine DA CUNHA



YEAR 1 - Autumn Semester

CORE COURSES

Course code	Title	ECTS Credits
CSM	Basics of Computer Science and Mathematics	2
DESIMU	Discrete-Event Simulation	4
EcoGel	Economics and Management for Industrial Engineering	4
ENTMOD1	Enterprise Modelling	4
IND4PROC	Introduction to Ind4.0 Processes	4
METOP	Introduction to Optimization Methods	5
PRODMANAG1	Production Management	5

LANGUAGE COURSES

Course code	Title	ECTS Credits
CCE1	Cultural and Communication English	4
ESP1	Spanish Language	4
FLE1	French Language	4

YEAR 1 - Spring Semester

CORE COURSES

Course code	Title	ECTS Credits
ENTMGMT	Enterprise Management	4
INNOV	Innovation Engineering	4
IR2	Introduction to Research	2
SIMU2	Advanced Simulation	4
Sociol	Management and Socio-Organizational Aspects for Industrial Engineering	4
SSCHOOL	Summer School	5
STAD	Statistics and Data Analysis	5
SYSENG	System Engineering	4

LANGUAGE COURSES

Course code	Title	ECTS Credits
CCE2	Cultural and Communication English	4
ESP2	Spanish Language	4
FLE2	French Language	4

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Autumn Semester

Basics of Computer Science and Mathematics [CSM]

LEAD PROFESSOR(S): Raphaël CHENOARD

Objectives

At the end of the course (30 hours + personal work) the students will be able to:

- Know basics of programming languages (VBA, Python)
- Describe and implement an algorithm
- Understand object-oriented programming
- Understand basics notions for numerical analysis (vector, matrix, derivative)

Course contents

These lectures aim at introducing the following concepts:

- Basics of algorithmic;
- Basics of object-oriented programming;
- Vectors and matrices calculus;
- Derivatives and numerical applications

Languages such as Visual Basic and Python will be emphasized.

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	2	10 hrs	8 hrs	12 hrs	2 hrs	0 hrs

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Autumn Semester

Discrete-Event Simulation [DESIMU]

LEAD PROFESSOR(S): Maroua NOUIRI

Objectives

At the end of the course (30 hours + personal work) the students will be able to:

- Understand a discrete-event simulation-based analysis
- Model simple industrial processes using a discrete-event simulation software
- Gather key performance indicators from the simulation runs
- Analyse the results of the simulation

Course contents

These lectures constitute an introduction to the simulation of discrete event systems applied to manufacturing production systems. The main elements covered are:

- Principles of simulation
- Modelling for simulation
- configuration and tuning of a simulation model
- Analysis of key performance indicators values from simulation tool
- Optimization via simulation

After an introduction lecture, practical sessions will lead to a mini-project in full autonomy. Industrial software such as FlexSim will be used.

Course material

- Introduction to Simulation Using SIMAN, Pegden, C.D., Sadowski, R.P., Shannon, R.E., 2nd ed. McGraw-Hill, Inc., New York, NY, USA (1995)
- Simulation modeling and analysis, Law, A. M., Kelton, W. D., & Kelton, W. D. (Vol. 3). New York: McGraw-Hill (2007).

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	8 hrs	0 hrs	20 hrs	4 hrs	0 hrs

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Autumn Semester

Economics and Management for Industrial Engineering [EcoGel]

LEAD PROFESSOR(S): *Simon ROUSSEAU*

Objectives

Management Systems (MS) use accounting data to manage and analyze operations. This part of the programme focuses on the financial and economic operations generally applied in industrial engineering.

This course introduces current measurement and analysis standards, budget management, and economic indicators to run the business and explain operational results as well as performance outcomes.

Financial and economic aspects help and influence decision making. They play an important role in coordinating operational activities regarding performance goals and resource optimization.

Course contents

At the end of the course (30 hours + personal work) the students will be able to:

- Understand the data provided by financial statements and how the information can be used to assess the economic health of a company
- Calculate financial ratios based on financial statements and how to interpret them to analyse a company
- Understand the difference between cash flow and profit
- Understand how to measure the performance of a company, its economic sustainability and its competitiveness
- Calculate and analyze the profitability threshold
- Understand how companies choose strategic investments based on financial considerations in order to gain or retain competitive advantage
- Understand how a company can finance its investments and its activities
- Understand how to measure and analyze costs by using financial accounting data
- Focus on Activity-Based Costing (ABC): the method of allocating overhead expenses based on actual activities and processes, not arbitrarily.
- Understand what a budget is, how it is designed and constructed and how it fits into the long term planning of the company
- Understand how to set up financial KPIs and how to use them

Exercises will be completed during and between classes.

Course material

- Tukker, A., 2015. Product services for a resource-efficient and circular economy - A review. *Journal of Cleaner Production*, 97, pp.76–91.
- Berliner C. and Brimson J. (1988). *Cost management for today's advanced manufacturing, the CAM-I conceptual design*, Harvard Business School Press.
- Johnson H.T. (1992) *Relevance regained, from Top-down control to Bottom-up empowerment*, Free Press
- Johnson H.T. and Kaplan R.S. (1987) *Relevance lost: the rise and fall of management accounting*, Boston, Harvard Business School Press
- Malmi T. and Brown D. (2008). Management Control systems as a package – Opportunities, challenges and research directions, *Management Accounting Research*, vol. 19, n°4, p. 287-300.
- Vargo S. and Lusch R. (2008). Service-dominant logic: continuing the evolution, *Journal of the Academy of marketing Science*, vol. 36, n° 1, p. 1-10.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	14 hrs	14 hrs	0 hrs	4 hrs	0 hrs

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Autumn Semester

Enterprise Modelling [ENTMOD1]

LEAD PROFESSOR(S): Farouk BELKADI

Objectives

At the end of the course (30 hours + personal homework) the students will be able to:

- Understand the hierarchical organisation of industrial enterprise
- Conduct an operational management method
- Construct enterprise business models including various points of view and using several tools

Course contents

These introductory lectures aim to present the main elements that define the architecture of an enterprise. After this introduction, the following items will be presented in detail:

- Introduction to Enterprise organization
 - Functional decomposition of an enterprise
 - Levels of decision in the enterprise
- Enterprise Modelling concepts
 - Definition of the concepts of process, tasks and activities
 - Definition of actors and roles
 - Definition of informational and physical flows (distinction data/information/knowledge)
- Introduction to Enterprise Management methods
 - The concept of performance
 - Main processes of enterprise management
 - Integration of the human factor in enterprise models
- Business process modelling with IDEF0-SADT
 - Introduction to process modelling
 - Structure of IDEF diagram
- Business Process Modelling Notation (BPMN)
 - Introduction to BPMN diagram
 - BPMN symbols
 - Examples of BPMN processes
- Decision-based modelling with GRAI method
 - Main concepts: decision centers, functional view, temporal view, hierarchy, etc.)
 - Modelling concepts (decision and execution activities, objectives, constraints, etc.)
 - GRAI grid and Network
- Introduction to Archimate
 - Business process and service layer
- Introduction to UML class diagram for the description of enterprise structure

Practical exercises and homework will help students to apply the learned modelling languages in various case studies.

Course material

- Livre blanc - Introduction au BPM. Stéphane PLANQUART
- Business Process Model and Notation (BPMN) OMG official Standard document: <http://www.omg.org/spec/BPMN/2.0>
- BPMN 2.0 by Example. OMG official Standard document <http://www.omg.org/spec/BPMN/2.0/examples/PDF/10-06-02.pdf>
- The GRAI method <http://chen33.free.fr/M2/Courses/GRAI%20INTEROP%20part%201.BV.pdf>
- Integrating value modeling into ArchiMate. University of Twente

- Business Process Modeling Introduction to ARIS Methodology <http://www.training.com.br/download/Business%20Process%20Modelling%20-%20Introduction%20to%20ARIS%20Methodolgy.pdf>

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	14 hrs	14 hrs	0 hrs	4 hrs	0 hrs

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Autumn Semester

Introduction to Ind4.0 Processes [IND4PROC]

LEAD PROFESSOR(S): Gilles CARABIN

Objectives

At the end of the course the students will be able to understand the main processes in an industrial company and how Computer Aided tools are able to help the experts in their daily tasks. Concretely, the courses will be divided into five sections. Every section presents one topic with an introduction course and practical classes for training.

Course contents

This introductory course will address the following items:

- Introduction to Design and Computer Aided Design
 - o What is the main functions of a CAD tool
 - o Design of a simple product
- Introduction to Machining and Computer Aided Manufacturing for Machining
 - o Presentation of the main process of machining
 - o Explanation of CNC machines functioning
 - o Preparation of a job on a CAM tool
 - o Realization of a simple part with machining
- Introduction of Additive Manufacturing and Computer Aided Manufacturing for Additive Manufacturing
 - o Presentation of the main processes of Additive Manufacturing
 - o Explanation of the AM machines functioning
 - o Preparation of a job with CAM tool for AM
 - o Realization of a simple part with AM
- Introduction to the control of sequential production systems
 - o Recall of the basics of automation
 - o Introduction to grafacet
 - o Simulation: Control of a simple production process with automgen tool.
- Introduction to Computer Aided Maintenance
 - o Explanation of main processes in preventive and reactive maintenance
 - o Explanation of reliability models
 - o Case studies

Course material

1. Cad/Cam Theory and Practice, McGraw-Hill Series in Mechanical Engineering
2. Introduction to Manufacturing Processes, Schey, John A

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	10 hrs	4 hrs	16 hrs	2 hrs	0 hrs

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Autumn Semester

Introduction to Optimization Methods [METOP]

LEAD PROFESSOR(S): Raphaël CHENOUIARD

Objectives

At the end of the course the students will be able to:

- Understand an optimization problem
- Model a problem as a mathematical problem
- Choose a classical optimization method
- Analyse the result of the optimization

Course contents

These lectures constitute an introduction to classical optimization methods. The main elements covered are:

- Mathematical modelling
- Linear Programming
- Optimization without constraint
- Optimization with constraint

These lectures are applied to practical examples and implemented using SciPy Python library. SciPy generic optimization functions are used, but some classical algorithms are also implemented like gradient descent or Newton algorithm.

Course material

- Numerical Optimization, Pegden, Jorge Nocedal, Stephen Wright. 2nd ed. Springer (2006).
- Introduction to Numerical Analysis, Arnold Neumaier. Cambridge University Press (2001).

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	5	8 hrs	18 hrs	4 hrs	2 hrs	0 hrs

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Autumn Semester

Production Management [PRODMANAG1]

LEAD PROFESSOR(S): Rosa ABBOU

Objectives

At the end of the course, the students will be able to:

- Understand management techniques;
- Structure and manage information systems;
- Specify the different value generating activities (purchases, logistics, production of goods and services, marketing, sales, etc.);
- Structure information on ERP.

Course contents

This course constitutes an introduction to management techniques combined with the realities of human management. The main elements covered in the course are:

- The management of information systems;
- The management of various value generating activities (purchases, logistics, production of goods and services, marketing, sales etc.);
- Human resources management.

Industrial software ERP such as SAGE will be used.

Course material

- Gideon HALEVI, Handbook of Production Management Methods. Edition Butterworth-Heinemann, 2001.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	5	8 hrs	10 hrs	12 hrs	2 hrs	0 hrs

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Autumn Semester

Cultural and Communication English [CCE1]

LEAD PROFESSOR(S): Spencer HAWKRIDGE

Objectives

Introduction to Cultural and Communicational English:

- Understand the general concepts of communication English (different levels of language, etc.)
- Build a communicational project
- Develop strategies for enhanced interaction
- Organize, lead and participate in discussions, interviews and meetings
- Behavioral skills in an inter-cultural environment:
- Strengthen engagement and level of conviction
- Develop a capacity to explain and argue
- Acquire notions of corporate culture and values
- Enhance team work

Course contents

Cultural and Communicational English: exercises to explore in practice the areas of culture and communication
 Inter-cultural project (for example, documentary project, publishing project: construct a work of fiction or of educational value and experience the complete publishing process)
 VEC (Virtual Environmental Challenge) Challenge - international competition to design an Eco-campus with participants from French and foreign universities.

Course material

Written and televised press, information and digital tools, general documents, business environment and company strategies.
 Internet conferences (Ted Talks, etc.), our own educational materials on Hippocampus (Moodle).
 Our own eZoomBook template for the Intercultural project.
 VEC padlet and PMooc ('The stories we live by' - Professor Arran Stibbe lecturing on Ecolinguistics)

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	0 hrs	64 hrs	0 hrs	0 hrs	0 hrs

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Autumn Semester

Spanish Language [ESP1]

LEAD PROFESSOR(S): Marta HERRERA

Objectives

For beginners:

Practice and reinforcement of the five skills (oral and written expression and comprehension as well as interaction)

Acquisition of vocabulary and linguistic structures

Be able to talk about yourself and those around you

Be able to express oneself during daily activities

Know how to give your opinion

For advanced students:

Practice and reinforcement of the five skills (oral and written expression and comprehension as well as interaction)

Acquisition of specialised vocabulary

Be able to understand the essential content of concrete or abstract subjects including a technical discussion

Be able to communicate spontaneously and fluently

Be able to express oneself in a clear and detailed manner, to express an opinion on a topical subject

Course contents

For beginners:

Personal environment (introduce yourself, express yourself, your tastes, your character, your hobbies, etc.), your surroundings (friends, family, location, climate), your interests (sports, leisure)

Present tense (regular and irregular)

Language patterns to express habit, obligation, "gustar" and its equivalents,

Possessive adjectives

Differences between "es", "está", "hay"

Use of "por" and "para"

Adverbs and frequency patterns

Numeral adjectives

For advanced students:

Knowledge of the Hispanic world (economic, technical, cultural and social environment)

Present tense (regular and irregular)

Imperative

Past tenses

Direct / indirect style

Future tense

Conditional tense

Present and past subjunctive moods

Course material

Preparation manuals, our own tailor-made documents, written and internet press, general civilization documents, digital tools

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	0 hrs	64 hrs	0 hrs	0 hrs	0 hrs

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Autumn Semester

French Language [FLE1]

LEAD PROFESSOR(S): *Silvia ERTL*

Objectives

The objective is to familiarize the learner with the French language and French culture through an entertaining task-based communicative language teaching, focused on speaking combined with:

- Phonetics
- Self-correcting exercises on our learning platform
- Learning Lab activities
- Project work
- Tutoring

Course objectives include the acquisition and reinforcement of vocabulary, syntax, and pronunciation by both traditional means and through the use of digital resources.

Students will learn general French, develop language skills of oral and written comprehension and expression.

After completing this course (32 hours + personal work), the students will be able to communicate in spoken and written French, in a simple, but clear manner, on familiar topics in the context of study, hobbies etc. Another important goal of this course is to introduce the student to French culture. At the end of the course (2 semesters), complete beginners can achieve an A1 level and some aspects of the A2 of The Common European Framework of Reference for Languages. More advanced students may aim for B1/B2 levels.

Course contents

Full range of practical communication language exercises: reading comprehension, listening comprehension, written expression, oral expression.

Learners will be able to use the foreign language in a simple way for the following purposes:

1. Giving and obtaining factual information:
 - personal information (e.g. name, address, place of origin, date of birth, education, occupation)
 - non-personal information (e.g. about places and how to get there, time of day, various facilities and services, rules and regulations, opening hours, where and what to eat, etc.)
2. Establishing and maintaining social and professional contacts, particularly:
 - meeting people and making acquaintances
 - extending invitations and reacting to being invited
 - proposing/arranging a course of action
 - exchanging information, views, feelings, wishes, concerning matters of common interest, particularly those relating to personal life and circumstances, living conditions and environment, educational/occupational activities and interests, leisure activities and social life
3. Carrying out certain transactions:
 - making arrangements (planning, tickets, reservations, etc.) for travel, accommodation, appointments, leisure activities
 - making purchases
 - ordering food and drink

Course material

Preparation manuals, our own tailor-made documents, written and televised press, internet, general civilization documents, digital tools, our own educational materials on Hippocampus (Moodle).

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	0 hrs	64 hrs	0 hrs	0 hrs	0 hrs

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Spring Semester

Enterprise Management [ENTMGMT]

LEAD PROFESSOR(S): Farouk BELKADI

Objectives

The teaching in this course will be based mainly on serious games reflecting industrial situations. At the end of the course (32 hours + personal homework) the students will be able to:

- Understand the main principles of strategic enterprise management
- Conduct full project management approach including risk analysis and cost evaluation
- Understand and conduct lean management process

Course contents

- Introduction to Enterprise Management methods
 - o Performance Management
 - o Main processes of enterprise management
 - o Modelling and management of organizational capabilities
- Project management principles
 - o Project needs clarification and strategic decisions creation
 - o Tasks and Resources planning and organization
 - o Risk evaluation and management
 - o Operational decision and project realization
- Introduction to lean management
 - o Lean principles
 - o Process optimization through waste reduction (Muda Serious game)
 - o Process optimization through just in time management (Kanban serious game)

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	12 hrs	18 hrs	0 hrs	2 hrs	0 hrs

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Spring Semester

Innovation Engineering [INNOV]

LEAD PROFESSOR(S): Guy CAVEROT

Objectives

At the end of the course (30 hours + personal work) the students will be able to:

- Understand and practice a customer-oriented and a value-driven process to assess a business opportunity
- Conduct activities associated with business planning and business modelling
- Assess the underlying dimensions of a business plan
- Leverage the tools and methodologies of strategic communication

Course contents

These introductory lectures aim to present a set of methods and tools used in the development of a business opportunity and how such development projects are managed and drive innovation. Based on active learning techniques, students will be tasked with conducting an entrepreneurial project. The concepts will be introduced as part of the process of business modelling of the innovation. At the end of the course, students will tackle the strategic communication of their entrepreneurial project by putting together a pitch and a business plan.

The following items will be presented in detail:

- Introduction to innovation engineering
- Value creation behind a business opportunity: from a problem to a value creation process
- Prototyping a solution
- Business model
 - o Monetizing a value proposition
 - o The business system behind the value proposition
- R&D roadmapping
- Financial plans and need for funds
- Strategic communication
 - o Pitch Communication
 - o Business Plan Structure

Course material

- "Guide to Business Plan Writing," Gate2Growth supported by European Commission
- Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers
- Value Proposition Design: How to Create Products and Services Customers Want
- Other resources will be available on Moodle

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	12 hrs	16 hrs	0 hrs	4 hrs	0 hrs

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Spring Semester

Introduction to Research [IR2]

LEAD PROFESSOR(S): Farouk BELKADI

Objectives

Discovery of research via literature survey, conferences and journal papers.

Course contents

4 hours lecture classes will introduce the main basics to know about the mission and the work of researcher (What is research, its activities and missions)

Based on a proved experience of the teacher, students will learn how to do literature survey on scientific domain and how to disseminate the research results on various types of supports.

Students will attend, where it is possible, locally held research conferences.

Students will realize a literature survey and present a poster/resentation on one topic of their interest.

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	2	4 hrs	4 hrs	0 hrs	16 hrs	0 hrs

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Spring Semester

Advanced Simulation [SIMU2]

LEAD PROFESSOR(S): Farouk BELKADI

Objectives

At the end of the course (30 hours + personal work) the students will be able to:

- Simulate random phenomena in discrete-event simulation
- Analyse the results of a stochastic simulation
- Understand the basics of Multi-agent simulations
- Design multi-agents systems and evaluate their performance on given scenarios

Course contents

These lectures are split into two separate courses.

First one extends the lectures of Discrete-event simulation given in Autumn semester. It aims at introducing the concepts of stochastic simulation, and involves two main questioning:

- How are random phenomena modelled in discrete-event simulation?
- How are meant to be analysed the results of a stochastic simulation?

The second course introduces a separate approach of complex discrete-event systems simulation: the Multi-agent approach.

The following questions will be answered:

- What are the main pillars of Multi-agent simulation?
- What is the best design methodology of multi-agent models?

After an introduction lecture, practicals will lead to a mini-project in full autonomy. Industrial software such as Rockwell Arena, Netlog or Anylogic shall be used.

Course material

1. Introduction to Simulation Using SIMAN, Pegden, C.D., Sadowski, R.P., Shannon, R.E., 2nd ed. McGraw-Hill, Inc., New York, NY, USA (1995)
2. Stochastic simulation: algorithms and analysis, Asmussen, S., Glynn, P. W., Vol. 57. Springer Science & Business Media (2007)
3. Multiagent Systems, G. Weiss, 2nd ed. MIT Press, Cambridge, MA, USA (2013)
4. The big book of simulation modeling: multimethod modeling with AnyLogic 6, Borshchev, A., AnyLogic North America (2013).

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	10 hrs	8 hrs	12 hrs	2 hrs	0 hrs

Management and Socio-Organizational Aspects for Industrial Engineering [Sociol]

LEAD PROFESSOR(S): *Simon ROUSSEAU*

Objectives

The purpose of this course is to explain the main factors impacting the behavior of the firm from a socio-organizational perspectives.

The first part (Management systems) introduces concepts and methods to analyze the internal and external environment of an organization. Tools like SWOT and PESTEL will be studied to show how they help managers make decisions in complex socio-economic contexts.

In the second part (socio-organizational aspects), some fundamental behavioral science concepts will be reviewed to illustrate how they can be effectively used in organizations. Through the course, students will gain an understanding of individuals and how they behave within organizations and how groups work together. Issues and dilemmas faced by organizations in these areas will be explained.

Course contents

The aim of this course is to introduce the following items:

- External analysis of the enterprise in its socio-economic environment
- Internal Analysis of the enterprise through the consideration of human factors and skills management
- Understanding of the relationship with the client through marketing strategies
- consideration of socio-environmental sustainability

Management Systems:

- Understand strategy and strategic management
- Explore concepts and methods of scanning the external and internal environment of a firm: (PESTEL, SWOT, Porter's Five +1 Forces, etc.)
- Understand how to explore and exploit a firm's capacities
- Acquire knowledge about alternative strategies to acquire and maintain competitive advantages
- Acquire knowledge, within the strategic management process, about choices at both corporate and business levels
- Understand and analyze the deployment of strategic choices: implementation, assessment and controlling actions

Socio-Organizational Aspects:

- Understand the socio-organizational aspects involved in the main processes of rationalizing production systems.
- Mastering the sociological and economic dimension of the processes of rationalizing production systems.
- Understand the theories, frameworks and concepts used to explain how and why individuals and groups act the way they do in organizations
- Learning concepts, methodology, and issues of some main Organization Science Models.

Exercises will be completed during and between classes.

Course material

Organization of the firm:

- Mc Shane S. L., Von Glinow M. A., Organizational Behavior, Mc Graw-Hill, 4th Edition, 2008
- Henry Mintzberg (1989). Mintzberg on Management: Inside Our Strange World of Organizations

- Crozier, Michel & Friedberg, Erhard. *Actors and Systems* (Chicago: University of Chicago Press, 1980).
- March J.G. and Simon, H.A. (1958), *Organizations*, New York: Wiley, 1958.
- Peter Drucker, *The Age of Discontinuity*, Heineman, 1968
- Walter Natemeyer , Paul Hersey, *Classics of Organizational Behavior* (1995), Fourth edition, Waveland Press, 2011

Management Control Systems:

- Belkadi et al., (2017) PSS Pattern concept for knowledge representation in design process of industrial product-service systems, *Procedia CIRP*
- Berliner C. and Brimson J. (1988). *Cost management for today's advanced manufacturing, the CAM-I conceptual design*, Harvard Business School Press.
- Johnson H.T. (1992) *Relevance regained, from Top-down control to Bottom-up empowerment*, Free Press
- Johnson H.T. and Kaplan R.S. (1987) *Relevance lost: the rise and fall of management accounting*, Boston, Harvard Business School Press
- Malmi T. and Brown D. (2008). « Management Control systems as a package – Opportunities, challenges and research directions», *Management Accounting Research*, vol. 19, N°4, p. 287-300.
- Vargo S. and Lusch R. (2008). « Service-dominant logic: continuing the evolution », *Journal of the Academy of marketing Science*, vol. 36, n° 1, p. 1-10.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	16 hrs	12 hrs	0 hrs	4 hrs	0 hrs

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Spring Semester

Summer School [SSCHOOL]

LEAD PROFESSOR(S): Catherine DA CUNHA

Objectives

The school is a three-week course hosted partly by SUPSI in Lugano and partly by POLIMI in Milan. The school is addressed primarily to students attending all the programs of the EIT

Manufacturing double degree master, but it is also open to external participants with an engineering background

During the summer school three different kinds of activities, linked by the common reference theme of sustainable manufacturing, can be identified:

- (i) provision of models, tools and frameworks to develop entrepreneurial and innovation ideas,
- (ii) company's testimonials and visits;
- (iii) team work on the challenges launched by the consortium participants and preparation of pitches.

Course contents

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	5	0 hrs	0 hrs	0 hrs	0 hrs	0 hrs

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Spring Semester

Statistics and Data Analysis [STAD]

LEAD PROFESSOR(S): Mathieu RIBATET

Objectives

The aim of this course is to provide the students with the necessary mathematical tools to address the fields of reliability under the framework of survival analysis. At the end of the lecture, students will fully understand the main statistical approaches for modelling "time to event" data with right censoring and will be able to apply to conduct a whole statistical analysis of their data.

Course contents

- Remainder on statistics
- Specificities : skewness, censoring
- Non parametric estimation
- Cox-proportional hazards model
- Conclusion with a whole statistical analysis

Course material

[1] D. Collett. Modelling Survival Data in Medical Research. Chapman and Hall/CR, 3rd edition, 2014.

[2] J. P. Klein and M. L. Moeschberger. Survival analysis. Springer-Verlag, 2nd edition, 2003.

[3] D. G. Kleinbaum and M. Klein. Survival analysis: A self learning text. Springer-Verlag, New-York, 3rd edition, 2012.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	5	12 hrs	18 hrs	0 hrs	2 hrs	0 hrs

System Engineering [SYSENG]

LEAD PROFESSOR(S): Farouk BELKADI

Objectives

At the end of the course (30 hours + personal work) the students will be able to:

- Understand the principles of system engineering, main processes and standards
- Conduct requirement collection and traceability
- Create SysML models within a system engineering perspective
- Conduct Model Based System Engineering approach with SysML

Course contents

These introductory lectures aim to present the main methods and tools of Systems Engineering as used in industry for the development of new complex systems. The course commences with an introduction to the main foundations of systems engineering, summarizing its main processes and presenting the potential organizations working on SE standards. After this introduction, SysML language is explored to illustrate how this modelling tool is used along the SE process. The following elements will be covered:

- Introduction to the concept of system and system of systems
 - o What is a system? What is a system of systems
 - o System analysis foundations with the concept of facet:
 - Core features; system lifecycle; business models and system decomposition
 - The design process and the concept of facet
- Systems Engineering (SE)
 - o Definition of systems engineering
 - Definitions from the standards
 - Main characteristics of SE
 - o Overview of main SE processes
 - Processes from the standards
 - Key Systems Engineering methods (V-cycle, Waterfall, incremental, etc.)
 - o Requirement management and functional analysis
 - The concept of requirement?
 - The requirement engineering and management process
 - From requirement engineering to functional analysis
 - o Design of systems architecture:
 - Concepts of functional (logical) and physical architecture.
 - Function allocation and design matrix
 - Modular architecture and Interface management
 - The RFLP approach
- System design and analysis with SysML language
 - o Main concepts of SysML
 - o Requirements management: Requirement diagram, Use Case diagram,
 - o Behavior analysis: Sequence diagram, State-Transition diagram, activity diagram
 - o Structure definition: Bloc definition diagram, Internal bloc diagram
 - o Connection between diagrams within a MBSE perspective
- Deploying a Model Based Systems Engineering (MBSE) approach
 - o What is MBSE?
 - o Practice and mini project on Eclipse Papyrus software

- Analyzing the system behaviour
 - Shifting from Parametric model to simulation model
 - Do simulation with OpenModelica tool

Practical exercises and homework will help students to apply the learned modelling languages to several case studies. A presentation from an industrial partner is planned to discover the current industrial practices. A mini-project is also planned as a collaborative development project of an information system dealing with real industrial use cases.

Course material

- Kossiakoff, A., Sweet, W. N., Seymour, S. J., & Biemer, S. M. (2011). Systems engineering principles and practice (Vol. 83). John Wiley & Sons.
- Systems Engineering Fundamentals. DEFENSE ACQUISITION UNIVERSITY PRESS, FORT BELVOIR, VIRGINIA 22060-5565
- Mark Austin Introduction to Systems Engineering, ENES 489P Hands-On Systems Engineering Projects. Institute for Systems Research, University of Maryland, College Park
- Roland Renier, Raphaël Chenouard. De sysml à modelica: aide à la Formalisation de modèles de Simulation en conception. 12ème Colloque National AIP PRIMECA Le Mont Dore - 29 March to 1 April 2011
- Hubert Kadima. Méthodes et outils d'ingénierie de systèmes mécatroniques fiables; Journée Gdr MACS du 03.05.2010 – SupMéca Paris

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	12 hrs	12 hrs	4 hrs	4 hrs	0 hrs

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Spring Semester

Cultural and Communication English [CCE2]

LEAD PROFESSOR(S): Spencer HAWKRIDGE

Objectives

Interview techniques and communicational English:

- Understand the general concepts of interactive communication
- Build a media project
- Acquire interview techniques
- Understand the process of sourcing and checking facts and figures
- Understand issues related to plagiarism
- Create a bibliography
- Behavioral skills in an inter-cultural environment:
- Strengthen self-confidence and capacity for interaction
- Develop active listening and reformulation skills
- Develop networking skills

Course contents

Cultural and Communicational English: exercises to explore in practice the areas of culture and communication.

Media project (for example: prepare, conduct and promote interviews for a radio programme: L'Heure Centralienne (<http://www.euradionantes.eu/emission/l-heure-centralienne>), with the contribution of professors, PhD students, industrial partners, industry players at fairs, etc.

Course material

Written and televised press, information and digital tools, general documents business environment and company strategies. Internet conferences (Ted Talks, etc.), our own educational materials on Hippocampus (Moodle). Our own eZoomBook template for the Intercultural project.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Spring Semester

Spanish Language [ESP2]

LEAD PROFESSOR(S): Marta HERRERA

Objectives

For beginners:

Practice and reinforcement of the five skills (oral and written expression and comprehension as well as interaction)

Acquisition of vocabulary and linguistic structures

Be able to talk about yourself and those around you

Be able to express oneself during daily activities

Know how to give your opinion

For advanced students:

Practice and reinforcement of the five skills (oral and written expression and comprehension as well as interaction)

Acquisition of specialised vocabulary

Be able to understand the essential content of concrete or abstract subjects including a technical discussion

Be able to communicate spontaneously and fluently

Be able to express oneself in a clear and detailed manner, to express an opinion on a topical subject

Course contents

For beginners:

Personal environment (introduce yourself, express yourself, your tastes, your character, your hobbies, etc.), your surroundings (friends, family, location, climate), your interests (sports, leisure)

Present tense (regular and irregular)

Language patterns to express habit, obligation, "gustar" and its equivalents,

Possessive adjectives

Differences between "es", "está", "hay"

Use of "por" and "para"

Adverbs and frequency patterns

Numeral adjectives

For advanced students:

Knowledge of the Hispanic world (economic, technical, cultural and social environment)

Present tense (regular and irregular)

Imperative

Past tenses

Direct / indirect style

Future tense

Conditional tense

Present and past subjunctive moods

Course material

Preparation manuals, our own tailor-made documents, written and internet press, general civilization documents, digital tools

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Master Programme - Industrial Engineering - EIT Manufacturing

YEAR 1 - Spring Semester

French Language [FLE2]

LEAD PROFESSOR(S): *Silvia ERTL*

Objectives

The objective is to familiarize the learner with the French language and French culture through an entertaining task-based communicative language teaching, focused on speaking combined with:

- Phonetics
- Self-correcting exercises on our learning platform
- Learning Lab activities
- Project work
- Tutoring

Course objectives include the acquisition and reinforcement of vocabulary, syntax, and pronunciation by both traditional means and through the use of digital resources.

Students will learn general French, develop language skills of oral and written comprehension and expression.

After completing this course (32 hours + personal work), the students will be able to communicate in spoken and written French, in a simple, but clear manner, on familiar topics in the context of study, hobbies etc. Another important goal of this course is to introduce the student to French culture. At the end of the course (2 semesters), complete beginners can achieve an A1 level and some aspects of the A2 of The Common European Framework of Reference for Languages. More advanced students may aim for B1/B2 levels.

Course contents

Full range of practical communication language exercises: reading comprehension, listening comprehension, written expression, oral expression.

Learners will be able to use the foreign language in a simple way for the following purposes:

1. Giving and obtaining factual information:
 - personal information (e.g. name, address, place of origin, date of birth, education, occupation)
 - non-personal information (e.g. about places and how to get there, time of day, various facilities and services, rules and regulations, opening hours, where and what to eat, etc.)
2. Establishing and maintaining social and professional contacts, particularly:
 - meeting people and making acquaintances
 - extending invitations and reacting to being invited
 - proposing/arranging a course of action
 - exchanging information, views, feelings, wishes, concerning matters of common interest, particularly those relating to personal life and circumstances, living conditions and environment, educational/occupational activities and interests, leisure activities and social life
3. Carrying out certain transactions:
 - making arrangements (planning, tickets, reservations, etc.) for travel, accommodation, appointments, leisure activities
 - making purchases
 - ordering food and drink

Course material

Preparation manuals, our own tailor-made documents, written and televised press, internet, general civilization documents, digital tools, our own educational materials on Hippocampus (Moodle).

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs