
MASTER OF SCIENCE, TECHNOLOGY AND HEALTH

2022-2023

YEAR 2

INDUSTRIAL ENGINEERING

AGILE FACTORY MANAGEMENT

PROGRAMME SUPERVISOR(S):

Catherine DA CUNHA



YEAR 2 - Autumn Semester

CORE COURSES

Course code	Title	ECTS Credits
CPPS	Integrated Design and Implementation of CPPS	4
LOGIS	Logistics	4
MDMDS	Multicriteria Decision Making and Decision Support	5
OR	Operations Research	4
PM2	Production Management 2	5
PROJCONF	Project & Conferences	2
SCHE	Shop Floor Scheduling	4

LANGUAGE COURSES

Course code	Title	ECTS Credits
CCE3	Cultural and Communication English	2
ESP3	Spanish Language	2
FLE3	French Language	2

YEAR 2 - Spring Semester

CORE COURSES

Course code	Title	ECTS Credits
THESIS	Internship / Thesis project	30

Master Programme - Industrial Engineering - Agile Factory Management

YEAR 2 - Autumn Semester

Integrated Design and Implementation of CPPS [CPPS]

LEAD PROFESSOR(S): Catherine DA CUNHA / Olivier CARDIN

Objectives

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

- Express the main characteristics and benefits of cyber-physical production systems
- Model a heterarchical manufacturing control architecture
- Integrate the basics of holonic paradigms
- Implement a cyber-physical production system using multi-agent technologies

Course contents

The lectures aim to introduce the following concepts:

- Systems of cyber-physical production systems;
- Heterarchical manufacturing control;
- Holonic manufacturing systems;
- Emerging behavior and bio-inspired systems;
- Cloud Manufacturing.

After an introduction lecture, practical classes will lead to a development project in full autonomy using an automated, robotized and emulated manufacturing system.

Course material

- Trentesaux, D., 2009. Distributed control of production systems. *Engineering Applications of Artificial Intelligence, Distributed Control of Production Systems* 22, 971–978.
- Cardin, O., Ounnar, F., Thomas, A., Trentesaux, D., 2017. Future Industrial Systems: Best Practices of the Intelligent Manufacturing and Services Systems (IMS2) French Research Group. *IEEE Transactions on Industrial Informatics* 13, 704–713.
- *Multiagent Systems*, 2013. G. Weiss, 2nd ed. MIT Press, Cambridge, MA, USA.
- Monostori, L., 2014. Cyber-physical Production Systems: Roots, Expectations and R&D Challenges. *Procedia CIRP, Variety Management in Manufacturing Proceedings of the 47th CIRP Conference on Manufacturing Systems* 17, 9–13.

Assessment

Individual assessment: EVI 1 (coefficient 1)

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

Master Programme - Industrial Engineering - Agile Factory Management

YEAR 2 - Autumn Semester

Logistics [LOGIS]

LEAD PROFESSOR(S): Catherine DA CUNHA

Objectives

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

- Understand the challenges of logistics
- Identify the issues with value networks
- Master the tools to address them.

Course contents

The lectures aim to present the main elements of logistics:

- General introduction
- Classical problems:
- Value: its representation and its optimization
- Data mining: Links with operational decisions

Practical exercises and homework will help students to apply the concepts and tools covered (eg. VSM, clustering,...).

Course material

- APICS publications
- Agrawal, D.K (2007). Distribution and Logistics Management – A Strategic Marketing Approach, MacMillan India Ltd, New Delhi.
- Rushton, A. et al. 2010. The handbook of logistics & distribution management. Kogan Page.
- Montreuil, B. 2011. Toward a Physical Internet: meeting the global logistics sustainability grand challenge. Logistics Research , Volume 3, Issue 2-3, pp 71-87

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	8 hrs	14 hrs	8 hrs	2 hrs	0 hrs

Master Programme - Industrial Engineering - Agile Factory Management

YEAR 2 - Autumn Semester

Multicriteria Decision Making and Decision Support [MDMDS]

LEAD PROFESSOR(S): Raphaël CHENOUIARD

Objectives

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

- Understand decision problems
- Use some decision-making methods to choose a solution among others
- Solve multi-objective decision problems

Course contents

These lectures aim to present the main elements of multi-criteria decision making and decision support methods and tools:

- Introduction to decision theory
- Multicriteria decision methods (AHP, ELECTRE)
- Design of experiments
- Multi-objective optimization

Practical exercises and homework will help students to apply the learned concepts and methods.

Course material

- Saat. Fundamentals of Decision Making and Priority Theory with the Analytic Hierarchy Process (1994).
- Deb. Multi-Objective Optimization using Evolutionary Algorithms. Wiley, 2001.

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	5	8 hrs	12 hrs	8 hrs	4 hrs	0 hrs

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YEAR 2 - Autumn Semester

Operations Research [OR]

LEAD PROFESSOR(S): Raphaël CHENOUIARD

Objectives

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

- Understand concrete optimization problems that occur in industry
- Formalize optimization models
- Solve these models with a relevant method and tool(s)

Course contents

The lectures aim to present the main elements of operations research:

- General introduction to OR
- Graph theory and applications to OR
 - o Shortest path
 - o Maximal flow
 - o Travelling salesman problem
- Dynamic programming
- Tree-based search algorithms (B&B)
- Metaheuristics (SA, GA, PSO)

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

Course material

- Hillier and Lieberman. Introduction to Operations Research, Mc Graw Hill, 1990.
- Appa, Pitsoulis and Williams. Handbook on modelling for discrete optimization. Springer, 2006.

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	8 hrs	14 hrs	8 hrs	2 hrs	0 hrs

Master Programme - Industrial Engineering - Agile Factory Management

YEAR 2 - Autumn Semester

Production Management 2 [PM2]

LEAD PROFESSOR(S): Catherine DA CUNHA / Rosa ABBOU

Objectives

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

- Show the relationship between project planning and implementation,
- Expand analytical techniques using the latest standard ERP software,
- Apply fundamental concepts in project management.

Course contents

The course covers the tools and techniques most suited for modern project management. From budgeting to scheduling and control, the course:

- shows the relationship between project planning and implementation,
- expands analytical techniques using the latest standard software,
- covers fundamental concepts in project management,
- builds case studies with constantly updated information.

Industrial software ERP such as SAGE and SAP will be used.

Course material

- Gideon HALEVI, Handbook of Production Management Methods. Edition Butterworth-Heinemann, 2001.
- Avraham SHTUB, Karni REUVEN, ERP: The Dynamics of Supply Chain and Process Management. Business & Management, 2009.

Assessment

Individual assessment: EVI 1 (coefficient 1)

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 - Agile Factory Management

YEAR 2 - Autumn Semester

Project & Conferences [PROJCONF]

LEAD PROFESSOR(S): Yasamin ESLAMI

Objectives

This course aims to introduce the research context in form of conducting a literature review.

by the end of this course, the students will be able to:

- Understand what research is and how different it is from search
- Utilize databases for research like Scopus, google scholar,...
- Form a research question
- Validate and justify a research gap in the literature
- Conduct a literature review

Course contents

The content of the course and the literature review will depend on the student's interest and the master's theme.

The course will be divided into two main steps:

- Formulate the search statement
- Building a literature review on what they have found

Course material

- Michaelson, H. B. (1990). How to write & publish Engineering Papers and Reports. Oryx Press, 4041 N. Central at Indian School, Phoenix, AZ 85012.
- Gastel, B., & Day, R. A. (2016). How to write and publish a scientific paper. ABC-CLIO.

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	2	0 hrs	0 hrs	0 hrs	24 hrs	0 hrs

Master Programme - Industrial Engineering - Agile Factory Management

YEAR 2 - Autumn Semester

Shop Floor Scheduling [SCHE]

LEAD PROFESSOR(S): Catherine DA CUNHA / Maroua NOUIRI

Objectives

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

- Understand tangible scheduling problems that occur in industry
- Formalize scheduling problems in different types of shop floor (single machine, parallel machine, flow shop, job shop, flexible job shop, etc.)
- Use dispatching rules to solve simple scheduling problems (SPT, LPT, EDD, WSPT, etc)
- Use Moore algorithm, Johnson's algorithm, etc.
- Use scheduling software (LEKIN) to solve these problems
- Schedule in the face of uncertainty (machine breakdowns, new job arrivals, etc.)

Course contents

The lecture aim to present the main elements of shop floor scheduling Problem:

- The scheduling function in the manufacturing process and its relation to the planning function
- The scheduling problem: Definitions - Performance measures - Models
- Scheduling problem classification (Single Machine floor, Parallel machine, Flow shop, Job Shop, Flexible Job SHop)
- Tools and techniques to solve scheduling problem
- Flow shop - The Johnson method
- Heuristics: Dispatching rules (SPT, LPT, WSPT,)
- Computational complexity
- Scheduling in the face of uncertainty: Predictive scheduling, reactive scheduling, proactive-reactive scheduling

Practical exercises and homework will help students to apply the methods learned through various case studies.

Course material

- Scheduling, Theory, Algorithms, and Systems, Michael Pinedo, 2012, Springer
- Ordonnancement, Patrick Esquirol et Pierre Lopez, 1999, Economica.

Assessment

Individual assessment: EVI 1 (coefficient 1)

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

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YEAR 2 - Autumn Semester

Cultural and Communication English [CCE3]

LEAD PROFESSOR(S): David TROYA

Objectives

Team-building and Communicational English:

- Understand the general concepts of team-building
- Build a team-building project
- Understand and nurture the creative process
- Enhance self-belief and self-empowerment

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
Field-related or inter-cultural project.

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).

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	2	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

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YEAR 2 - Autumn Semester

Spanish Language [ESP3]

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	2	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Master Programme - Industrial Engineering - Agile Factory Management

YEAR 2 - Autumn Semester

French Language [FLE3]

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, 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. Those who already completed the first year of the French course will be prepared for working in a French business environment.

Course contents

Two different tracks are proposed: track 1 for students newly arrived at Centrale Nantes and track 2 for students who have completed the first year of the French course. Track 1:

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

Track 2:

This track follows on directly from the first-year French course, developing and completing the concepts studied thus far. The main themes are: housing, health and work. These topics will help prepare students for their future work environment. For example, housing is explored in the form of a search for accommodation upon arrival in a new city. Special workshops for CVs and cover letters, elevator pitches and job interviews.

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	2	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Master Programme - Industrial Engineering - Agile Factory Management

YEAR 2 - Spring Semester

Internship / Thesis project [THESIS]

LEAD PROFESSOR(S): Catherine DA CUNHA

Objectives

- Be exposed to and adapt to an industrial or research environment
- Put in practice the scientific and technical skills acquired in the previous semesters
- Strengthen interpersonal and communication skills
- Be part of or manage a project
- Organize tasks, analyze results and build deliverables

Course contents

Students should be pro-active and career-oriented in the search for their thesis/internship. The topics are validated by the program supervisor to ensure an adequate Master level. The thesis/internship is evaluated through the submission of a written report and an oral defense.

Course material

- Turabian Kate Larimore, Booth Wayne Clayton, Colomb Gregory G., Williams Joseph M., & University of Chicago press. (2013). A manual for writers of research papers, theses, and dissertations: Chicago style for students and researchers (8th edition.). Chicago (Ill.) London: University of Chicago Press.
- Bui Yvonne N. How to Write a Master's Thesis. 2nd ed. Thousand Oaks, Calif: Sage, 2014.
- Evans David G., Gruba Paul, et Zobel Justin. How to Write a Better Thesis. 3rd edition. Carlton South, Vic: Melbourne University Press, 2011.

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	30	0 hrs	0 hrs	0 hrs	0 hrs	0 hrs