

SHAKE THE FUTURE.



# MASTER OF SCIENCE, TECHNOLOGY AND HEALTH

## INDUSTRIAL ENGINEERING

## AGILE FACTORY MANAGEMENT

### YEAR 2

PROGRAMME SUPERVISORS:  
CATHERINE DA CUNHA, ALAIN BERNARD

# INDUSTRIAL ENGINEERING – AGILE FACTORY MANAGEMENT

## YEAR 2 – AUTUMN SEMESTER

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Operations Research

Multicriteria Decision Making and Decision Support

Logistics

Shop Floor Scheduling

Integrated Design and Implementation of CPPS

Production Management 2

Conferences

Project

Cultural and Communication English

French Language

# OPERATIONS RESEARCH

INDUSTRIAL ENGINEERING – AGILE FACTORY MANAGEMENT

YEAR 2 - AUTUMN SEMESTER

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LEAD PROFESSOR: Raphaël CHENOUDARD

## Objectives

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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

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

- General introduction to OR
- Graph theory and applications to OR
- Shortest path
- Maximal flow
- 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

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

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT	EXAM
English	4	8 hrs	8 hrs	8 hrs	6 hrs	2 hrs

# MULTICRITERIA DECISION MAKING AND DECISION SUPPORT

INDUSTRIAL ENGINEERING – AGILE FACTORY MANAGEMENT  
YEAR 2 - AUTUMN SEMESTER

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**LEAD PROFESSOR:** Raphaël CHENOUIARD

## Objectives

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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

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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)
- Multi-objective optimization

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

## Course material

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

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT	EXAM
English	4	8 hrs	8 hrs	8 hrs	6 hrs	2 hrs

# LOGISTICS

## INDUSTRIAL ENGINEERING – AGILE FACTORY MANAGEMENT YEAR 2 - AUTUMN SEMESTER

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**LEAD PROFESSOR:** Catherine DA CUNHA

### Objectives

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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

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The lectures aim to present the main elements of logistics:

- General introduction
- Classical problems:
  - Model
  - Tools and guarantees
- Location-allocation
- Value: its representation and its optimization
- Links with operational decisions

Practical exercises and homework will help students to apply the concepts and tools covered.

### Course material

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- 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.

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT	EXAM
English	4	8 hrs	8 hrs	8 hrs	6 hrs	2 hrs

# SHOP FLOOR SCHEDULING

INDUSTRIAL ENGINEERING – AGILE FACTORY MANAGEMENT

YEAR 2 - AUTUMN SEMESTER

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LEAD PROFESSOR: Nasser MEBARKI

## Objectives

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

- Understand the concrete scheduling problems that occur in industry
- Formalize scheduling problems
- Use scheduling software to solve these problems

## Course contents

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

- The scheduling function in the manufacturing process and its relation to the planning function
- The scheduling problem: Definitions - Performance measures - Models
- The one-machine problem
- Parallel machine problems
- Computational complexity
- Flow shop - The Johnson method
- Job shop
- Exact methods: Disjunctive graph - Mixed-integer linear programming - Branch and bound algorithms
- Heuristics: Dispatching rules - The Shifting Bottleneck Heuristic
- Predictive scheduling, reactive scheduling, proactive-reactive scheduling

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

## Course material

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

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT	EXAM
English	4	8 hrs	4 hrs	12 hrs	6 hrs	2 hrs

# INTEGRATED DESIGN AND IMPLEMENTATION OF CPPS

INDUSTRIAL ENGINEERING – AGILE FACTORY MANAGEMENT  
YEAR 2 – AUTUMN SEMESTER

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LEAD PROFESSOR: Olivier CARDIN

## Objectives

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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

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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

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- 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.

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

# PRODUCTION MANAGEMENT 2

INDUSTRIAL ENGINEERING – AGILE FACTORY MANAGEMENT

YEAR 2 – AUTUMN SEMESTER

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LEAD PROFESSOR: Rosa ABBOU

## Objectives

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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

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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,
- contains fundamental concepts in project management,
- builds case studies with continuing compounded information.

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

## Course material

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- 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.

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



# CULTURAL AND COMMUNICATION ENGLISH

INDUSTRIAL ENGINEERING – AGILE FACTORY MANAGEMENT

YEAR 2 – AUTUMN SEMESTER

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LEAD PROFESSOR: Spencer HAWKRIDGE

## Objectives

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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

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

Field-related or inter-cultural project (for example, construct content for inter-cultural teambuilding activities; example WIOBOX website etc).

## Course material

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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).

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

# FRENCH LANGUAGE

## INDUSTRIAL ENGINEERING – AGILE FACTORY MANAGEMENT

### YEAR 2 – AUTUMN SEMESTER

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LEAD PROFESSOR: Silvia ERTL

#### Objectives

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

#### Course contents

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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.

### Course material

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

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT	EXAM
French	4	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

# CONFERENCES

## INDUSTRIAL ENGINEERING – AGILE FACTORY MANAGEMENT

### YEAR 2 – AUTUMN SEMESTER

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**LEAD PROFESSOR:** Catherine DA CUNHA

#### Objectives

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This course aims to introduce the research context. The students will attend research events: conference sessions, PhD defenses, 'HDR' (Authorisation to supervise research) defenses etc. The students will:

- Understand how research is organised (research structures and funding)
- Learn how to summarise a research presentation

#### Course contents

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The exact content of the course will depend on the research events held in Nantes during the course. The topics selected will be in line with those addressed in the other courses of the Master.

#### Course material

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- 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.

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT	EXAM
English	1	20 hrs	0 hrs	0 hrs	0 hrs	0 hrs

# PROJECT

INDUSTRIAL ENGINEERING – AGILE FACTORY MANAGEMENT  
YEAR 2 – AUTUMN SEMESTER

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LEAD PROFESSOR: Catherine DA CUNHA

## Objectives

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## Course contents

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## Course material

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LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT	EXAM
English	1	0 hrs	0 hrs	0 hrs	0 hrs	0 hrs

INDUSTRIAL ENGINEERING – AGILE FACTORY MANAGEMENT  
YEAR 2 - SPRING SEMESTER

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Master Thesis / Internship

# MASTER THESIS / INTERNSHIP

INDUSTRIAL ENGINEERING – AGILE FACTORY MANAGEMENT

YEAR 2 - SPRING SEMESTER

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LEAD PROFESSOR: Catherine DA CUNHA

## Objectives

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- 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

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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

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- 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.

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