ENGINEERING PROGRAMME

2024-2025

Year 2 / Year 3

Specialisation option

Industrial Engineering

OD GI

PROGRAMME SUPERVISOR

Raphaël CHENOUARD

Autumn Semester

Course unit	ECTS Credits	Track	Course code	Title
UE 73	12	Core course	ACTOR MADEC PROD RISK	Roles and Organization Decision-making tools and methods Sustainable production Risk management
UE 74	13	Core course	CHANE MAPIN MODEP P1GI SIGEC	Product Modelling Processes, quality and standards Enterprise Modelling and Performance Project 1 Information Systems and Knowledge Management

Spring Semester

Course unit	ECTS Credits	Track	Course code	Title
UE 83	14	Core course	CHANGE HACOPG_GI P2GI RVAL SIROP	Change Management Costing, purchasing and pricing Project 2 Value Networks Simulation and Operations Research

Roles and Organization [ACTOR]

LEAD PROFESSOR(S): Raphaël CHENOUARD

Requirements

Objectives

Provide students with an overview of key players and different organizations within enterprises and value networks.

Course contents

- Enterprise and organization theory
- Circular economy
- Product lifecycle and design
- Industrial testimony

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	10 hrs	10 hrs	10 hrs	0 hrs	2 hrs

Decision-making tools and methods [MADEC]

LEAD PROFESSOR(S): Raphaël CHENOUARD

Requirements

Objectives

Provide students the tools and methods to support decision making with regard to product design as well as for driving a value chain.

Course contents

Formulation and resolution of multi-objective optimisation problems
Evaluation of risks and the implications of decisions
Implementation of methods for multi-criteria decision making
Design of experiments

Course material

Assessment

Collective assessment: EVC 1 (coefficient 0.2)

Individual assessment: EVI 1 (coefficient 0.8)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	12 hrs	8 hrs	10 hrs	0 hrs	2 hrs

Sustainable production [PROD]

LEAD PROFESSOR(S): Yasamin ESLAMI

Requirements

Objectives

Combine the constraints of productivity with those of sustainability

Course contents

Review of production management
- Sustainable production:
    - Sustainable KPI
    -Sustainable Manufacturing
    -Lean and Green Manufacturing
    -Life Cycle Assessment (LCA) methodology and example
    - Recyclability and waste management
    - Remanufacturing
    -Maintenance

Part of the sessions of this course are given in English.

Course material

Assessment

Collective assessment: EVC 1 (coefficient 0.75)

Individual assessment: EVI 1 (coefficient 0.25)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	8 hrs	16 hrs	6 hrs	0 hrs	2 hrs

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Year 2 / Year 3 - Autumn Semester - Course Unit 73 / 93

Risk management [RISK]

LEAD PROFESSOR(S): Hervé THOMAS

Requirements

Objectives

Make students aware of the impact of their decisions on health and safety at work
Understand the risks and know how to make a decision when designing a product or service.

Course contents

Lectures:
- Risks and dependability
- Ergonomics
- Regulatory
- Product risk
- Risk management

Tutorials:
- Re-design of ergonomic workstations
- Fault tree

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	12 hrs	12 hrs	8 hrs	0 hrs	0 hrs

Product Modelling [CHANE]

LEAD PROFESSOR(S): Matthieu RAUCH

Requirements

Objectives

Within the framework of concurrent engineering, this course gives students the opportunity to acquire a broad body of knowledge from product design to production via virtual prototyping.

Course contents

1. Product modeling: Digital mock-ups - Object representation - Graphic techniques - Topological modeling - Reverse engineering in the CAD/CAM approach - Elements of industrial design and VR.
2. Rapid product development: Rapid Prototyping - Direct Manufacturing
3. Know-How Engineering: Capitalizing on know-how - Advanced CAD/CAM systems Integration of Production constraints in Design (DFM, DFA) - "Trade" CAD/CAM applications: Data Integration
4. Data Management: Technical Data Management - Product Configuration Management - PDM, PLM elements - Databases, DBMS - Technical Data Exchange - BIM - Cloud Computing
5. Applications

Course material

Machine à commande numérique, B. MERY, Hermès - CADAM Theory and Practice, I. Zeid, Mc Graw-Hill - Surface Modeling for CadCam, BK. Choi, Elsevier - Fundamentals of Computer Integrated Manufacturing, A.L. Foston, CL Smith, T. Au, Prentice Hall - La CFAO Concevoir et produire autrement, F. Piquet, JP Poitou, JC Tass, Nathan - NC Machine Programming and Software Design, CH Chang, MA Melkanoff, Prentice Hall.
Lecture notes and laboratory sessions.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	10 hrs	0 hrs	20 hrs	0 hrs	2 hrs

ENGINEERING - OD GI

Year 2 / Year 3 - Autumn Semester - Course Unit 74 / 94

Processes, quality and standards [MAPIN]

LEAD PROFESSOR(S): Hervé THOMAS

Requirements

Objectives

OPTIMIZE THE PRODUCTION OF A PART :
- Know how to define a manufacturing study project.
- Generate machining trajectories in CAM.
- Define operating strategies and parameters to optimize machining time and the quality of machined surfaces.

Course contents

Design a moldable object in epoxy resin: goodies, jewelry, key rings, etc.
Model the counter-mold of the product.
Define the counter-mold manufacturing process.
Generate machining paths in CAM to machine the counter-mold.
Machine the counter-mold.
Make the mold of the product in silicone.
Make the product in epoxy resin.
Optimize costs for producing 200 parts.

Course material

Assessment

Collective assessment: EVC 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	4 hrs	12 hrs	16 hrs	0 hrs	0 hrs

ENGINEERING - OD GI
Year 2 / Year 3 - Autumn Semester - Course Unit 74 / 94

Enterprise Modelling and Performance [MODEP]

LEAD PROFESSOR(S): Raphaël CHENOUARD

Requirements

Objectives

At the end of the course, students will be able to:
- Understand the main concepts related to business organization
- Conduct an operational analysis of the company's processes and resources
- Build design and improvement models for a company, incorporating various perspectives and performance simulation

This course contributes to Sustainable Development Goal 12, "Responsible Consumption and Production," by teaching students how to design and assess business models from a sustainable development perspective. Moreover, the process-based approach is commonly used as a key step in product life cycle assessment studies.

Course contents

- Introduction to Business Organization
  - o Defining the company as a system
  - o Different perspectives for analyzing the company (structural, operational, interactional, decisional, etc.)
- Business Modeling Concepts
  - o Concepts of task, activity, and process
  - o Concepts of actors and roles
  - o Concept of performance
  - o Examples of process model applications
- Process Modeling with the IDEF0-SADT Method
  - o Principles of IDEF0 modeling
  - o Building an IDEF model
- Process Modeling with BPMN (Business Process Model Notation)
  - o Modeling principles and BPMN notations
  - o Creation and validation of BPMN diagrams
  - o Process simulation using the Bizagi tool
- Decision Modeling with the GRAI Method
  - o Key concepts: Decision levels and centers, functional and temporal views
  - o Modeling tools: GRAI grid and networks
- Introduction to UML for Describing Business Structure
  - o Class diagrams
  - o Use case diagrams for role representation

Course material

Entreprise modelling - F. Vernadat
Spring University course 'Entreprise modelling', Mines d'Albi Carmaux, 2002
Modélisation UML
Modélisation BPMN

Assessment

Individual assessment: EVI 1   (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	14 hrs	16 hrs	0 hrs	0 hrs	2 hrs

Project 1 [P1GI]

LEAD PROFESSOR(S): Raphaël CHENOUARD

Requirements

Objectives

Apply theoretical knowledge to real industrial issues.

Course contents

Project conducted in collaboration with an industrial partner.

Course material

Assessment

Collective assessment: EVC 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	1	0 hrs	0 hrs	0 hrs	32 hrs	0 hrs

Information Systems and Knowledge Management [SIGEC]

LEAD PROFESSOR(S): Raphaël CHENOUARD

Requirements

Objectives

At the end of the course, students will be able to:
- Understand the role of information systems within a company and their main functions
- Operate the main functions of an ERP system
- Understand the principles of knowledge-based reasoning for decision support

This course contributes to Sustainable Development Goal 9, "Industry, Innovation and Infrastructure," and Goal 12, "Responsible Consumption and Production," by explaining to students how digitization can help optimize industrial processes and resources, while also emphasizing the importance of managing human expertise to solve everyday problems.

Course contents

- Introduction to Information Systems
  - o Definition
  - o Types of information systems
- Main Functions of ERP
  - o Production management functions using the SAGE tool
  - o Introduction to other common functions
- Introduction to PLM (Product Lifecycle Management)
- Principles of Knowledge Management
  - o Definitions and distinctions between data – information – knowledge
  - o Typology of knowledge
  - o Knowledge management processes
- Introduction to Knowledge Engineering
  - o Meta-modeling and ontology
  - o Building an ontology using the Protégé tool
  - o Reasoning within the ontology using a rule engine
- Knowledge-Based Decision Support
  - o Principles of fuzzy logic
  - o Application of fuzzy logic for decision-making in socio-economic contexts

Course material

Assessment

Individual assessment: EVI 1   (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	12 hrs	6 hrs	12 hrs	0 hrs	2 hrs

Change Management [CHANGE]

LEAD PROFESSOR(S): Thomas LECHEVALLIER

Requirements

Objectives

A project is a collective and individual adventure. All the actors participating will be confronted with changes, and the acceptance or not of these will strongly influence the success of the project.
The objective of the course is to give simple and reliable methods allowing to lead the change with respect when one is in the position of project leader.
The learning will begin by questioning the certainties on the expected benefits of the change, then give step-by-step analysis tools to lead and carry the change.

Course contents

- 6h CM presentation of change management methods
- 3x2h TD in writing a change management deliverable on a chosen project (per group of students)
- 2x2h TP of presentation of the deliverable (by group of students) to all the students of the course with a shared analysis time

Course material

Administration industrielle et générale (1916) Henri Fayol

Kanter R, M Stein B.A, jick T.D., The challenge of organizational Change : How companies experience it and guide it, Free Press New york, 1992
Kanter R, M., Evolve! : succeeding in the digital culture of tomorow, Harvard Business school Press, cambridge, 2001
Kanter R, M., Change Pasters : Innovation an entrepreneurship in American corporation, Simon & schuster, New York city, 1983

Kotter J., Leadeing Change, Harvard Business school Press, 1996

Morgan G., Riding the waves of Change, Imaginization Inc, 1988

S. Covey, the 7 habits of highly efficient people

Michel crozier, Pouvoir et organisation, Archives européennes de sociologie, vol. 5, no 1, pages 52–64

Assessment

Collective assessment: EVC 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	12 hrs	20 hrs	0 hrs	0 hrs	0 hrs

Year 2 / Year 3 - Spring Semester - Course Unit 103 / 83

Costing, purchasing and pricing [HACOPG_GI]

LEAD PROFESSOR(S): Catherine DA CUNHA

Requirements

Objectives

Understand the economic dimension of value chains.

Course contents

- Purchasing
- Costing
- Pricing
- Negotiation

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	8 hrs	18 hrs	4 hrs	0 hrs	2 hrs

Project 2 [P2GI]

LEAD PROFESSOR(S): Raphaël CHENOUARD

Requirements

Objectives

Apply theoretical knowledge to real industrial issues.

Course contents

Project undertaken in collaboration with an industrial partner.

Course material

Assessment

Collective assessment: EVC 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	2	0 hrs	0 hrs	0 hrs	48 hrs	0 hrs

Year 2 / Year 3 - Spring Semester - Course Unit 103 / 83

Value Networks [RVAL]

LEAD PROFESSOR(S): Catherine DA CUNHA

Requirements

Methods and tools for decision support

Objectives

Identify the issues with value networks and master the tools to address them.

Course contents

- Scheduling
- Location/allocation
- Logistics
- Physical internet
This course contributes to the Sustainable Development Goal 12 "responsible consumption and production" by increasing the knowledge of the students about global production systems, their KPI, and improvement levers.

Course material

ASLOG 2008/2009 : L'état de l'art de la logistique globale des entreprises en France
Montreuil B., R.D. Meller & E. Ballot (2012). Physical Internet Foundations, In: Service
Orientation in Holonic and Multi Agent Manufacturing and Robotics, edited by T. Borangiu
et al., Springer
O'Brien, C., 2013. Fifty years of shifting paradigms. International Journal of Production Research
51, 6740–6745. doi:10.1080/00207543.2013.852267

Assessment

Collective assessment: EVC 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	10 hrs	12 hrs	8 hrs	0 hrs	2 hrs

Simulation and Operations Research [SIROP]

LEAD PROFESSOR(S): Raphaël CHENOUARD

Requirements

Objectives

Provide students with the major principles of discrete-event simulation, flow simulation and value network optimization.

Course contents

- Discrete-event and flow simulation
- Introduction to operations research
- Graph algorithms and linear programming
- Constraint programming
- Meta-heuristics

Course material

Assessment

Collective assessment: EVC 1 (coefficient 0.4)

Individual assessment: EVI 1 (coefficient 0.6)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	8 hrs	12 hrs	10 hrs	0 hrs	2 hrs