SYLLABUS

GRANDE ÉCOLE ENGINEERING PROGRAMME

SECOND YEAR — M1 LEVEL

ACADEMIC YEAR 2026–2027

English version

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Engineering Programme Syllabus: Grande École Programme

TU Title: **Design of Multiphysical Systems and PLM (Advanced)**			
Last updated: March 2026	*National TU Coordinator:* *Pascal CAESTECKER (Paris)*		*Year of Study:* Level M1
TU COSA	*Language of Instruction:* French and/or English	*Type:* UEI Mandatory	*Cycle:* 2A
ECTS credits: 6	*Student workload per TU (hours):* 150	*Including face-to-face teaching (hours):* 70	*Semester:* GIE2
Keywords: systems, multiphysics, PLM.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	X
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	

Intended learning outcomes in the CDIO framework

Outcome Group	***Learning Outcomes***	***TU-targeted Outcomes***
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	
	1.2 Core engineering fundamental knowledge	
	1.3 Advanced engineering fundamental knowledge, methods and tools	X
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	X
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	
	2.3 System thinking	
	2.4 Attitudes, thought and learning	
	2.5 Ethics, professional conduct and professional responsibilities	
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	
	3.2 Communications	
	3.3 Communications in foreign languages	
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	
	4.2 Enterprise and business context	
	4.3 Creating: from idea to business plan	
	4.4 Designing	X
	4.5 Implementing	
	4.6 Operating	
	4.7 Innovating	X
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	***Energy Engineering***	***Industrial Engineering***	***Management***
X	X	X	



Specific prerequisites

- Analysis of technical documents.
- Ability to translate a concept into a sketch.

General teaching methods

Theory classes, tutorials and project-based teaching, all contextualised through examples drawn from the lecturers' industrial experience, with an emphasis on digital tools.

Intended learning outcomes

Build and implement a collaborative design process for a multiphysical manufactured system.

ILO 1. Apply Systems Engineering principles and associated methodologies.
- Students must be able to apply a systems engineering method to a practical case.

ILO 2. Use PLM architectures (digital Systems Engineering tools) and CAD.
- Students must be able to understand the challenges of a system development cycle and to propose and implement appropriate roles and priorities.

ILO 3. Analyse multi-technology systems (mechatronics, hydraulics and pneumatics).
- For a multi-technology system, students must be able to understand, schematise and propose different architectures.

ILO 4. Apply multi-criteria decision analysis (choice of architectures, sub-architectures, components and technologies).
- Students must be able to consider and prioritise several criteria in order to make an optimal choice for the overall system.

ILO 5. Model and digitally simulate multiphysical or multi-technology systems.
- Students must be able to model a multiphysical system and its interactions with its environment, and to use digital simulation tools (multiphysics tools or coupled tools).

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1	Industrial case study: group work on a multidisciplinary case resulting in a written deliverable.	- Relevance of the engineering methodology and tools used (block diagram, SysML, preliminary sizing, component sizing, integration, validation, iterations, etc.). - Quality and quantity of the work carried out.
2	Group work requiring a digital PLM tool (Product Lifecycle Management: 3DEXPERIENCE or another tool).	- Monitoring changes in part maturity throughout the project. - Ability to adapt digital roles to the organisation. - Quality and quantity of the work carried out.
3	- Industrial case study (individual, written, 1 to 2 hours). - Design of a technical solution (group, oral, 1 hour): as a team, students develop a technical, multi-technology solution and defend their choice before a panel.	- Given a supplied schematic, ability to describe how the system operates. - Given a system description, ability to model it according to a stated objective. - Relevance of the technologies selected (fit with constraints and objectives). - Ability to carry out preliminary sizing (accuracy of calculations and simulations). - Quality of the reasoning and technical justification.
4	Design review (group oral presentation, live or video): justification of the choices made.	Justification of the criteria selected and how they are taken into account, including economic and environmental constraints.
5	Modelling and simulation work (group, oral): students develop modelling assumptions as a team and carry out simulations.	- Relevance of the modelling approach and associated assumptions. - Ability to implement the simulation. - Relevance of the critical analysis of the simulation results. - Consideration of multiphysics coupling.



Bibliographic resources

- BUDINGER, Marc. Multi-physics Modeling of Technological Systems. ISTE Editions, 2019. (Ebook).
- DEBAECKER Denis. PLM : la gestion collaborative du cycle de vie des produits = product life-cycle management. Lavoisier, 2004.
- FAISANDIER Alain, Ingénierie des systèmes complexes, Techniques de l'ingénieur, 2011.
- GALINIER Les clés de l'ingénierie des systèmes : guide décisionnel de mise en place dans mon entreprise. Cépaduès, 2017.
- MICOUIN Patrice. Model-Based Systems Engineering: Fundamentals and methods. Wiley & Sons, 2014. (Available in libraries and as an e-book).



Engineering Programme Syllabus: Grande École Programme

TU Title: **Electronics, Electrical Engineering and Automation (Advanced)**			
Last updated: March 2026	*National TU Coordinator:* *Marc REBILLAT (Paris)*		*Year of Study:* Level M1
TU EEAA	*Language of Instruction:* French and/or English	*Type:* UEF Mandatory	*Cycle:* 2A
ECTS credits: 3	*Student workload per TU (hours):* 75	*Including face-to-face teaching (hours):* 50	*Semester:* GIE2
Keywords: automation, electrical engineering, mechatronics, energy efficiency.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	X
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	

Intended learning outcomes in the CDIO framework

Outcome Group	*Learning Outcomes*	*TU-targeted Outcomes*
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	X
	1.2 Core engineering fundamental knowledge	X
	1.3 Advanced engineering fundamental knowledge, methods and tools	X
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	X
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	X
	2.3 System thinking	
	2.4 Attitudes, thought and learning	
	2.5 Ethics, professional conduct and professional responsibilities	
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	
	3.2 Communications	
	3.3 Communications in foreign languages	
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	
	4.2 Enterprise and business context	
	4.3 Creating: from idea to business plan	
	4.4 Designing	
	4.5 Implementing	
	4.6 Operating	
	4.7 Innovating	
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	*Energy Engineering*	*Industrial Engineering*	*Management*
	X		



Specific prerequisites

- Knowledge acquired in TU EEAI.
- Knowledge acquired in TU ENGI.
- Fundamentals of physics (mechanics, hydraulics, electricity, thermodynamics, etc.).
- Fundamentals of continuous-time control systems.

General teaching methods

Lectures, tutorials and practical work.

Intended learning outcomes

Analyse, model, size and control multiphysical systems while taking environmental issues into account.

ILO 1. Define specifications for sizing and controlling a system representative of industrial applications.

- Students must be able to draw up specifications for sizing and controlling a multiphysical system representative of industrial applications, taking environmental issues into account (static and dynamic performance, energy efficiency, robustness and digital constraints).

ILO 2. Model and simulate the dynamics of multiphysical systems for sizing and control purposes.

- Students must be able to model, simulate and analyse multiphysical systems (electrical, mechanical, thermal, hydraulic, etc.) under dynamic conditions. The models (state-space representation, transfer function, etc.) are used to guide the choice of subsystems for sizing and control.

ILO 3. Select a control strategy and design a digital controller for a multiphysical system in accordance with specifications.

- Students must be able to design digital controllers based on a discrete model of the multiphysical system considered (discrete state-space representation, z-domain transfer function, etc.) while taking the predefined specifications into account.

ILO 4. Identify the parameters of a dynamic model from experimental data and assess the performance of the associated control system.

- Students must be able to identify the parameters of a dynamic model from experimental measurements and integrate it into a closed-loop system in order to assess the performance of the implemented digital controller against the specifications.

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1	Combined assessment with ILO 4: three practical sessions + one oral assessment.	- Ability to draw up specifications for an energy conversion system. - Ability to draw up specifications for a control system.
2	Combined assessment with ILOs 3 and 4: 3-hour individual written test.	- Ability to model and simulate the dynamics of a multiphysical system. - Ability to use the model to size and select components. - Ability to use the model to develop the control law.
3	Combined assessment with ILOs 2 and 4: 3-hour individual written test.	- Ability to design continuous-time and discrete-time controllers. - Ability to verify that the designed controller meets the specifications.
4	Combined assessment with ILOs 1, 2 and 3: 3-hour individual written test + three practical sessions + one oral assessment.	- Appropriate application of an experimental identification method. - Ability to explain and limit discrepancies between a theoretical model and experimental measurements. - Ability to experimentally assess compliance with the specifications and the robustness of the implemented controller.

Bibliographic resources

- « Systèmes linéaires, non linéaires, à temps continu, à temps discret, représentation d'état », Y. Granjon, Dunod, 2015.
- « Du cahier des charges à la réalisation de systèmes », R. Husson, C. Lung, J.F. Aubry, J. Daafouz, D. Wolf, Dunod, 2007.
- « Commande analogique et numérique des systèmes - méthodes fréquentielle & polynomiale », Konn R., Technosup, 2010.
- « Modélisation structurée des systèmes avec les Bond Graphs », M. Vergé, Technip, 2003.
- « Modélisation et commande de la machine asynchrone », J-P. Caron & J-P. Hautier, , Technip, 1995.
- « Electrotechnique », L. Lasne, Dunod, 2008.
- « Electrotechnique », T. Wildi, De Boeck, 2005.



Source: Wikimedia Commons

- « Electrotechnique Industrielle », G. Séguier, Tec&Doc, 3ème édition, 2006.
- « Régulation Industrielle », E. Godoy, Dunod, 2019.
- « Digital control system analysis and design », C. L. Phillips, H. T., Prentice-Hall, 1989.



Engineering Programme Syllabus: Grande École Programme

***TU Title:* Energy Engineering (Advanced)**			
Last updated: March 2026	*National TU Coordinator: Pierric JOSEPH (Lille)*		*Year of Study:* Level M1
TU ENGA	*Language of Instruction:* French and/or English	*Type:* UEF Mandatory	*Cycle:* 2A
ECTS credits: 3	*Student workload per TU (hours):* 75	*Including face-to-face teaching (hours):* 40	*Semester:* GIE2
Keywords: turbomachinery, thermodynamic machines.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	X
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	

Intended learning outcomes in the CDIO framework

Outcome Group	*Learning Outcomes*	*TU-targeted Outcomes*
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	X
	1.2 Core engineering fundamental knowledge	X
	1.3 Advanced engineering fundamental knowledge, methods and tools	X
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	X
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	X
	2.3 System thinking	
	2.4 Attitudes, thought and learning	
	2.5 Ethics, professional conduct and professional responsibilities	
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	
	3.2 Communications	
	3.3 Communications in foreign languages	
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	
	4.2 Enterprise and business context	
	4.3 Creating: from idea to business plan	
	4.4 Designing	
	4.5 Implementing	
	4.6 Operating	
	4.7 Innovating	
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	*Energy Engineering*	*Industrial Engineering*	*Management*
	X		



Specific prerequisites

- TU ENGI

General teaching methods

Lectures, tutorials and practical work.

Intended learning outcomes

Understand, model and analyse the operation of a fluid energy system and its components, with a view to improving energy efficiency and reducing environmental impacts.

ILO 1. Calculate energy balances for the various components and for an energy system as a whole. Plot the associated thermodynamic cycles in order to analyse energy efficiency (including waste heat). Distinguish the different modes of heat transfer and the different flow regimes in energy systems.

- Students must be able to understand energy flows within complex systems, from primary energy consumption through to the final service delivered, while recognising the underlying energy losses and their causes. They must be proficient in standard representations of thermodynamic machines (T-s and P-V diagrams) for common thermodynamic machines and be able to consider improvement solutions such as cogeneration and energy recovery.

ILO 2. Analyse the internal operation and performance of turbomachinery in order to carry out sizing that meets a set of specifications.

- Students must be able to conduct a multi-criteria analysis and propose a machine (pump, fan) suited to the need expressed in the specifications, drawing on the following concepts: driven or driving machine, velocity triangles, similarity principles for compressible and incompressible flow, stability and operating limits. Where appropriate, they should be able to propose improvements.

ILO 3. Analyse and describe the operation of a thermodynamic machine.

- Students must understand how energy components (transferring work or heat) combine to operate thermodynamic machines (e.g. engines, heat pumps, fuel cells). They must be able to calculate local and overall efficiencies and have an understanding of chemical reactions and their associated impacts.

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1	Combined assessment of ILOs 1 to 3: 2- to 3-hour individual written case study and two practical sessions (turbomachinery and thermodynamic machines).	- Accuracy of reasoning and orders of magnitude. - Correct use of thermodynamic diagrams. - Knowledge of methods for calculating efficiencies and performance ratios.
2	Combined assessment of ILOs 1 to 3: 2- to 3-hour individual written case study and two practical sessions (turbomachinery and thermodynamic machines).	- Ability to identify the key energy-related points in the specifications. - Ability to select assumptions appropriate to the component being modelled. - Correct choice of machine type and associated directions of energy transfer. - Sound analysis of results using standard orders of magnitude.
3	Combined assessment of ILOs 1 to 3: 2- to 3-hour individual written case study and two practical sessions (turbomachinery and thermodynamic machines).	- Ability to identify the inputs and outputs of an energy system. - Ability to produce a coherent overall energy balance. - Well-reasoned and realistic comparison of energy or power values. - Understanding of how energy balances affect system energy efficiency.

Bibliographic resources

- CLEYEN Olivier. Thermodynamique de l'ingénieur. Lulu, 2021.
- PLUVIOSE Michel. Machine à fluides. Ellipses, 2010.
- PLUVIOSE Michel. Conversion d'énergie par turbomachines. Ellipses, 2009.
- BERNARD Jacques. Turbomachines à fluides compressibles. Ellipses, 2020.



- LALLEMAND André. Thermomécanique des milieux fluides. Ellipses, 2018.



Engineering Programme Syllabus: Grande École Programme

***TU Title:* Mathematics and Computing (Advanced)**			
Last updated: March 2026	*National TU Coordinator:* *Alain ETIENNE (Metz)*		*Year of Study:* Level M1
TU MINA	*Language of Instruction:* French and/or English	*Type:* UEF Mandatory	*Cycle:* 2A
ECTS credits: 3	*Student workload per TU (hours):* 75	*Including face-to-face teaching (hours):* 30	*Semester:* GIE2
Keywords: databases, optimisation, statistics.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	X
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	

Intended learning outcomes in the CDIO framework

Outcome Group	*Learning Outcomes*	*TU-targeted Outcomes*
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	X
	1.2 Core engineering fundamental knowledge	X
	1.3 Advanced engineering fundamental knowledge, methods and tools	X
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	X
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	
	2.3 System thinking	
	2.4 Attitudes, thought and learning	
	2.5 Ethics, professional conduct and professional responsibilities	
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	
	3.2 Communications	
	3.3 Communications in foreign languages	
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	
	4.2 Enterprise and business context	
	4.3 Creating: from idea to business plan	
	4.4 Designing	X
	4.5 Implementing	
	4.6 Operating	
	4.7 Innovating	
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	*Energy Engineering*	*Industrial Engineering*	*Management*
X	X	X	



Specific prerequisites

- TU MINI.

General teaching methods

- Lectures, tutorials, practical work and mini-projects.
- This TU may include Machine Learning approaches to provide an introduction to artificial intelligence and big data.

Intended learning outcomes

Process structured data and apply optimisation methods to support decision-making.

ILO 1. Identify, structure, formalise, extract and analyse data (statistics, queries or signals) from a technical system in order to draw actionable conclusions.

- At the end of this module, students will be able to:
  - Identify and structure the data for a technical problem by breaking down an information system (e.g. databases or data flows).
  - Extract and prepare relevant data using queries (e.g. SQL, NoSQL) or sequential processing (e.g. filtering, sampling, signal transformation), applying good practices such as cleaning and normalisation.
  - Analyse data to identify trends, correlations or predictive models (e.g. regression, classification, hypothesis testing), using appropriate tools, models and methods.
  - Visualise and interpret results to support technical decision-making, clearly communicating the associated limitations and uncertainties.

ILO 2. Design, implement and assess optimisation algorithms to solve technical problems by identifying suitable objective functions, constraints and methods.

- At the end of this module, students will be able to:
  - Formalise an optimisation problem (constrained or unconstrained, continuous or discrete) by identifying the objective function, decision variables and relevant constraints.
  - Select and apply an appropriate algorithmic method (e.g. gradient methods, metaheuristics, linear/non-linear programming) to find the extremum of a function, justifying its suitability for the problem.
  - Implement the solution using a programming language (e.g. Python) and assess its performance (e.g. convergence, robustness).
  - Interpret the results in a technical context and propose possible improvements (e.g. parameter tuning, reformulation of the problem).

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1	The assessment methods are specified by the TU coordinator at the start of the teaching sequence; for these two ILOs they may take the following form: - Individual and/or group practical assessment (practical work or mini-projects), in the form of an oral presentation or report. - Individual assessment in the form of a test (written or computer-based where technically possible).	- Relevance of data modelling (appropriate identification and structuring, e.g. schema, queries, preprocessing) and choice of analysis methods (e.g. statistics, signal processing) suited to the problem. - Functionality and robustness of the processing pipeline (handling missing, noisy or inconsistent data). - Quality of the implementation (efficiency of the data structures and algorithms used). - Relevant analysis, interpretation of results and conclusions, with discussion of uncertainties and limitations (e.g. bias, statistical assumptions).
2	The assessment methods are specified by the TU coordinator at the start of the teaching sequence; for these two ILOs they may take the following form: - Practical assessment (practical work or mini-projects), individual and/or group, [source text incomplete: “sous for”].	- Accuracy and relevance of the modelling (correct identification of the objective function, variables and constraints, and clear, sound assumptions). - Rigorous justification of the selected method (e.g. gradient method, metaheuristic, linear programming) according to the problem, taking its specific features into account (convexity, constraints, data size). - Quality of the implementation. - Critical analysis of the results in the technical context (consistency,



		plausibility) and identification of the limitations of the algorithm or model (e.g. parameter sensitivity, convergence, computation time).

Bibliographic resources

- NOCEDAL Jorge, WRIGHT Stephen J. Numerical optimization. Springer, 2006.
- CORRIOU Jean-Pierre. Méthodes numériques et optimisation : Théorie et pratique pour l'ingénieur. Lavoisier, 2010.
- GODOC Eric, BISSON Anne-Christine. SQL : les fondamentaux du langage. Editions ENI, 2017 (ebook).
- MACKENZIE Adrian. Optimization: Theory and Practice. White Press Academics, 2018. (Ebook).



Engineering Programme Syllabus: Grande École Programme

***TU Title:* Advanced Industrial Management and Operations Control**			
Last updated: March 2026	*National TU Coordinator: Thecle ALIX (Bordeaux)*		*Year of Study:* Level M1
TU GIPA (ex OREXA)	*Language of Instruction:* French and/or English	*Type:* UEI Mandatory	*Cycle:* 2A
ECTS credits: 3	*Student workload per TU (hours):* 75	*Including face-to-face teaching (hours):* 40	*Semester:* GIE2
Keywords: problem solving, continuous improvement.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	X
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	

Intended learning outcomes in the CDIO framework

Outcome Group	*Learning Outcomes*	*TU-targeted Outcomes*
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	
	1.2 Core engineering fundamental knowledge	X
	1.3 Advanced engineering fundamental knowledge, methods and tools	
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	X
	2.3 System thinking	
	2.4 Attitudes, thought and learning	
	2.5 Ethics, professional conduct and professional responsibilities	
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	
	3.2 Communications	
	3.3 Communications in foreign languages	
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	
	4.2 Enterprise and business context	
	4.3 Creating: from idea to business plan	
	4.4 Designing	
	4.5 Implementing	
	4.6 Operating	X
	4.7 Innovating	
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	*Energy Engineering*	*Industrial Engineering*	*Management*
X	X	X	



Specific prerequisites

- TUs GICI and GIPI.

General teaching methods

Knowledge inputs, tutorials and case studies, all contextualised through examples drawn from the lecturers' industrial experience or based on the ELF platforms.

Intended learning outcomes

Integrate a continuous improvement approach within an organisation: analyse an industrial situation and use appropriate continuous improvement tools to propose actions aimed at sustainable performance, risk control and the integration of human factors.

ILO 1. Use appropriate analysis tools to diagnose an industrial situation and identify opportunities for improving performance.

- Students must be able to implement an approach such as DMAIC, 8D or A3, using Six Sigma tools (Ishikawa, FMEA, R&R, design of experiments, etc.) and Lean Manufacturing tools (VSM, Kanban, etc.), while integrating CSR objectives.

ILO 2. Define and manage the action plan and milestones for a continuous improvement initiative.

- Students must be able to define the key success conditions for managing an improvement initiative from methodological, organisational and managerial perspectives.

ILO 3. Sustain the improvement actions implemented by fostering continuous progress.

- Students must be able to deploy techniques and tools for formalising processes (work standards, etc.) and monitoring them (control charts, etc.), as well as sustainable continuous improvement approaches (Kaizen, etc.).

ILO 4. Adopt a management approach suited to leading a participative continuous improvement process.

- Students must be able to understand the human and organisational drivers of a participative improvement process. They learn to encourage everyone's contribution, identify motivational levers, organise collective work and create the conditions for lasting commitment.

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1	Individual written assessment (case study, implementation of a method); one individual assessment and one group assessment.	- The analysis and action plan draw on industrial engineering principles. - Additional information is researched. - The request is correctly understood. - The response to the specifications is supported by sound reasoning. - Proposals in the case study are clear. - The tools and techniques used are appropriate and justified. - The approach is structured. - The limitations of the approach are addressed. - Methods taught or covered in class are implemented. - Ability to synthesise and present results. - CSR is integrated into the approach.
2	Individual written assessment (case study, implementation of a method); one individual assessment and one group assessment.	- The analysis and action plan draw on industrial engineering principles. - Additional information is researched. - The request is correctly understood. - The response to the specifications is supported by sound reasoning. - Proposals in the case study are clear. - The tools and techniques used are appropriate and justified. - The approach is structured. - The limitations of the approach are addressed. - Methods taught or covered in class are implemented. - Ability to synthesise and present results. - CSR is integrated into the approach.



3	Individual written assessment (case study, implementation of a method); one individual assessment and one group assessment.	- The analysis and action plan draw on industrial engineering principles. - Additional information is researched. - The request is correctly understood. - The response to the specifications is supported by sound reasoning. - Proposals in the case study are clear. - The tools and techniques used are appropriate and justified. - The approach is structured. - The limitations of the approach are addressed. - Methods taught or covered in class are implemented. - Ability to synthesise and present results. - CSR is integrated into the approach.
4	Individual written assessment (case study, implementation of a method); one individual assessment and one group assessment.	- The analysis and action plan draw on industrial engineering principles. - Additional information is researched. - The request is correctly understood. - The response to the specifications is supported by sound reasoning. - Proposals in the case study are clear. - The tools and techniques used are appropriate and justified. - The approach is structured. - The limitations of the approach are addressed. - Methods taught or covered in class are implemented. - Ability to synthesise and present results. - CSR is integrated into the approach.

Bibliographic resources

- BALLE & BALLE, The Gold Mine (Le roman du Lean), l'harmattan, 2015.
- LIKER, The Toyota Way, Tata McGraw-Hill, 2004.
- GOLDRATT, Le but : Un processus de progrès permanent, AFNOR, 2006.
- BEUNON, SECHET, Manager la performance industrielle, Gereso, 2019 (e-book).



Engineering Programme Syllabus: Grande École Programme

***TU Title:* Optimising a Multi-technology System for Industry 4.0 (Advanced)**			
Last updated: Sept. 2021	*National TU Coordinator:* *Julien GOMAND (Aix-en-Provence)*		*Year of Study:* Level M1
TU RESA	*Language of Instruction:* French and/or English	*Type:* UEI Mandatory	*Cycle:* 2A
ECTS credits: 6	*Student workload per TU (hours):* 150	*Including face-to-face teaching (hours):* 70	*Semester:* GIE2
Keywords: system, optimisation, digital twin, data analysis.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	X
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	

Intended learning outcomes in the CDIO framework

Outcome Group	*Learning Outcomes*	*TU-targeted Outcomes*
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	
	1.2 Core engineering fundamental knowledge	X
	1.3 Advanced engineering fundamental knowledge, methods and tools	
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	X
	2.3 System thinking	
	2.4 Attitudes, thought and learning	
	2.5 Ethics, professional conduct and professional responsibilities	
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	
	3.2 Communications	
	3.3 Communications in foreign languages	
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	X
	4.2 Enterprise and business context	
	4.3 Creating: from idea to business plan	
	4.4 Designing	
	4.5 Implementing	X
	4.6 Operating	
	4.7 Innovating	
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	*Energy Engineering*	*Industrial Engineering*	*Management*
X	X	X	



Specific prerequisites

- TUs REPI, RESI and EEAI.

General teaching methods

Theory classes, tutorials and project-based teaching, all contextualised through examples drawn from the lecturers' industrial experience, with an emphasis on digital tools.

Intended learning outcomes

Optimise the performance of a multi-technology system for Industry 4.0 using physical analysis, instrumentation and data processing.

ILO 1. Model and analyse system operation to determine the influential variables, using digital models.
ILO 2. Select the measurable influential variables of the system and develop the instrumentation (i.e. connected Industry 4.0).
ILO 3. Process and analyse measured and digital data to monitor and control system behaviour (e.g. design of experiments, AI) and identify sources of non-compliance.
ILO 4. Develop a digital twin by jointly processing digital and measured data and their uncertainties.

Teaching unit (TU) description:
The teaching programme will be based on a multi-technology system and its implementation (manufacturing, energy production, transport, etc.). The programme will cover:
- Instrumentation.
- Modelling physical behaviour using digital models.
- System modelling and control.
- The digital twin concept.

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1		
2		
3		
4		

The assessment methods will be specified by the TU coordinator at the start of the teaching sequence.

Bibliographic resources

- GROUT Michel, SALAUN Patrick, Instrumentation industrielle, Dunod, 2020 (e-book).
- JULIEN Nathalie, MARTIN Éric, L'usine du futur : stratégies et déploiement : industrie 4.0, De l'IOT aux jumeaux numériques, Dunod, 2018 (e-book).
- VALENTIN Michael, Hyper-manufacturing: l'après lean, Dunod, 2020 (e-book).



Engineering Programme Syllabus: Grande École Programme

***TU Title:* Advanced Design, Modelling and Simulation of Systems and Products**			
Last updated: March 2026	*National TU Coordinator:* *Arnaud KREMER (Angers)*		*Year of Study:* Level M1
TU COPA	*Language of Instruction:* French and/or English	*Type:* UEI Mandatory	*Cycle:* 2A
ECTS credits: 6	*Student workload per TU (hours):* 150	*Including face-to-face teaching (hours):* 80	*Semester:* GIM2
Keywords: design, modelling, optimisation.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	X
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	

Intended learning outcomes in the CDIO framework

Outcome Group	*Learning Outcomes*	*TU-targeted Outcomes*
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	
	1.2 Core engineering fundamental knowledge	
	1.3 Advanced engineering fundamental knowledge, methods and tools	X
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	X
	2.3 System thinking	X
	2.4 Attitudes, thought and learning	
	2.5 Ethics, professional conduct and professional responsibilities	
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	
	3.2 Communications	
	3.3 Communications in foreign languages	
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	
	4.2 Enterprise and business context	
	4.3 Creating: from idea to business plan	
	4.4 Designing	X
	4.5 Implementing	
	4.6 Operating	
	4.7 Innovating	X
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	*Energy Engineering*	*Industrial Engineering*	*Management*
X	X	X	



Specific prerequisites

- Analysis of technical documents.
- Ability to translate a concept into a sketch.

General teaching methods

Lectures, tutorials and practical work.

Intended learning outcomes

Design, model and optimise a product or mechanical system by integrating its technical functions, geometric constraints, physical interactions with the environment and environmental impacts (optimisation methods, digital simulation tools, life-cycle assessment approach, etc.).

ILO 1. Optimise products or systems using simulation tools after carrying out CAD design/modelling.

- Students must be able to design/model the product or system and implement optimisation methods and tools to achieve defined objectives (e.g. topology optimisation, parametric optimisation, numerical design of experiments, geometric optimisation).

ILO 2. Model and analyse the environmental impacts of the system using Life Cycle Assessment (LCA) in order to conduct an eco-design approach.

- Students must be able to define the scope of the system to be analysed, build the life-cycle inventory and assess environmental impacts, including use-phase and end-of-life scenarios, in accordance with ISO 14044.

ILO 3. Apply tolerancing to a part or system in order to ensure all identified functions are fulfilled.

- For a system or part within a mechanism, students must be able to identify the technical functions to be fulfilled, define the functional specification drawing for each part and establish geometric closure chains (dimension chains).

ILO 4. Model and simulate mechanical products or systems.

- Students must be able to model a mechanical product or system and its physical interactions with its environment, and to use digital simulation tools.

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1	Group work resulting in a written report.	- Modelling is consistent with the objectives and specifications. - Ability to implement the simulation. - Relevance of the critical analysis of the simulation results.
2	Industrial case study (individual, written, 1 hour).	- Justification of the study assumptions and understanding of the interactions between the relevant phenomena. - Relevance of the approach implemented and of the data used and collected. - Ability to analyse results and relate them to the system studied. - Ability to propose ways of reducing impacts (e.g. recyclability).
3	Industrial case study (individual, written, 1 to 2 hours) and design of a technical solution (group, report): as a team, students develop the tolerancing of a part or system.	- Consistency between tolerancing and the technical functions to be fulfilled. - Accuracy of the required technical functions. - Compliance with applicable tolerancing standards. - Relevance of translating geometric closure chains into specifications.
4	Modelling and simulation task (group, oral): as a team, students develop modelling assumptions, select behavioural models and carry out the associated simulation.	- Relevance of the model and associated assumptions. - Ability to implement the simulation. - Relevance of the critical analysis of the simulation results. - Quality of the sensitivity analysis.



Bibliographic resources

- Les méthodes d'analyse environnementales.



Engineering Programme Syllabus: Grande École Programme

***TU Title:* Materials (Advanced)**			
Last updated: March 2026	*National TU Coordinator:* *Myriam Dumont (Lille)*		*Year of Study:* Level M1
TU MATA	*Language of Instruction:* French and/or English	*Type:* UEF Mandatory	*Cycle:* 2A
ECTS credits: 3	*Student workload per TU (hours):* 75	*Including face-to-face teaching (hours):* 40	*Semester:* GIM2
Keywords: material behaviour, damage, thermal, thermomechanical and surface treatments.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	X
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	

Intended learning outcomes in the CDIO framework

Outcome Group	*Learning Outcomes*	*TU-targeted Outcomes*
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	X
	1.2 Core engineering fundamental knowledge	X
	1.3 Advanced engineering fundamental knowledge, methods and tools	X
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	X
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	X
	2.3 System thinking	
	2.4 Attitudes, thought and learning	
	2.5 Ethics, professional conduct and professional responsibilities	
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	
	3.2 Communications	
	3.3 Communications in foreign languages	
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	
	4.2 Enterprise and business context	
	4.3 Creating: from idea to business plan	
	4.4 Designing	
	4.5 Implementing	
	4.6 Operating	
	4.7 Innovating	
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	*Energy Engineering*	*Industrial Engineering*	*Management*
X			



Specific prerequisites

TU MATI, in particular:
- Different classes of materials.
- Crystallography and crystal defects.
- Binary phase diagrams (particularly Fe-C), fundamentals of diffusion and plasticity.
- Characterisation of materials and their mechanical properties.

General teaching methods

Lectures, tutorials and practical work.

Intended learning outcomes

Take material behaviour (microstructural changes and their impact on mechanical properties) into account during manufacturing and in-service performance of a metal part.

ILO 1. Explain the microstructural transformations responsible for changes in mechanical properties during a manufacturing and/or recycling process, and select an appropriate treatment according to the desired properties.

- Students must be able to describe and explain the microstructural transformations responsible for changes in mechanical properties during a manufacturing and/or recycling process. They must be able to propose a thermal, thermomechanical or surface treatment and specify the conditions to be applied (temperature, duration, etc.) to achieve the targeted properties.

ILO 2. Characterise material failure and damage modes and relate them to the mechanical and/or environmental changes experienced by the material.

- Students must know the main material damage and degradation mechanisms, taking loading conditions and induced residual stresses into account.

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1	Individual written test + practical work assessed in small groups.	- Ability to explain changes in mechanical properties based on microstructural transformations. - Ability to analyse the specifications. - Ability to select a relevant decision-support tool (e.g. phase diagram, TTT or CCT diagram). - Ability to propose a heat-treatment sequence. - Rigour of the technical argument and relevance of the conclusions.
2	Individual written test + practical work assessed in small groups.	- Ability to identify the damage mode in relation to the applied loading. - Ability to use relevant resources (Wöhler curves, Paris law, potential-pH diagrams, fractography, etc.). - Accuracy of analytical calculations (command of the mathematical relationships and solutions). - Rigour of the technical argument (clear explanation supported by relevant resources).

Bibliographic resources

- ASHBY Michael F., JONES David R. H. Matériaux 1 : Propriétés, applications et conception. Dunod, 2020.
- ASHBY Michael F., JONES David R. H. Matériaux 2 : Microstructures et procédés de mise en œuvre. Dunod, 2014.
- DORLOT Jean-Marie, BAILON Jean-Paul. Des Matériaux. École Polytechnique de Montréal, 2002.
- MAEDER Gérard, BARRALIS Jean. Précis de métallurgie. AFNOR, Nathan, 2005.
- GOURGUES-LORENZON Anne-Françoise, HAUDIN Jean-Marc. Matériaux pour l'ingénieur. Presses des Mines, 2010 (ebook).
- W.D. CALLISTER, Sciences et génie des matériaux, Modulo, 2001.



Engineering Programme Syllabus: Grande École Programme

TU Title: **Mechanics of Deformable Solids (Advanced)**			
Last updated: March 2026	*National TU Coordinator:* *Franck MOREL (Angers)*		*Year of Study:* Level M1
TU MDSA	*Language of Instruction:* French and/or English	*Type:* UEF Mandatory	*Cycle:* 2A
ECTS credits: 3	*Student workload per TU (hours):* 75	*Including face-to-face teaching (hours):* 50	*Semester:* GIM2
Keywords: mechanics of solids.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	X
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	

Intended learning outcomes in the CDIO framework

Outcome Group	*Learning Outcomes*	*TU-targeted Outcomes*
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	X
	1.2 Core engineering fundamental knowledge	X
	1.3 Advanced engineering fundamental knowledge, methods and tools	X
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	X
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	X
	2.3 System thinking	
	2.4 Attitudes, thought and learning	
	2.5 Ethics, professional conduct and professional responsibilities	
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	
	3.2 Communications	
	3.3 Communications in foreign languages	
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	
	4.2 Enterprise and business context	
	4.3 Creating: from idea to business plan	
	4.4 Designing	
	4.5 Implementing	
	4.6 Operating	
	4.7 Innovating	
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	*Energy Engineering*	*Industrial Engineering*	*Management*
X			



Specific prerequisites

- TU MDSI.
- TU MATI: knowledge acquired in plasticity.
- TU EEAI: knowledge acquired in Fourier analysis.
- Differential equations and complex numbers.

General teaching methods

Lectures, tutorials and practical work.

Intended learning outcomes

Design high-performance mechanical systems by taking plasticity and vibration criteria into account, while addressing technological, societal and environmental challenges and validating results through comparison with experimental measurements.

ILO 1. Recognise the limits of a linear model and classify the main sources of non-linearity. Apply the fundamental concepts of elastoplasticity (irreversibility, plasticity threshold) to the calculation of deformable media.

- At the end of this course, students must be able to:
  - Identify the different sources of non-linearity (material, geometry, contact).
  - Understand and interpret the physical phenomena associated with plasticity (strain hardening, anisotropy, plasticity criteria).
  - Carry out elastoplastic sizing of a simple 1D system and analyse the results obtained, taking the relevant challenges into account.
  - Interpret three-dimensional elastoplastic behaviour using the appropriate quantities.

ILO 2. Explain the concepts governing the vibratory behaviour of systems and apply them to the modelling, analysis and dynamic calculation of a deformable system or structure. Perform this calculation analytically in simple cases (systems with a small number of degrees of freedom, straight beams) or numerically using an existing tool.

- Students must be able to define and explain the fundamental concepts of system vibration behaviour (natural frequencies, mode shapes, free vibrations, forced vibrations, etc.) and apply them to the modelling and modal analysis of a deformable system or structure. Taking the relevant challenges into account, they must be able to carry out vibration-dynamics sizing in simple cases (systems with a small number of degrees of freedom, straight beams) or numerically using an existing modal-analysis tool.

ILO 3. Use structural instrumentation to verify analytical or numerical sizing while critically assessing the results obtained.

- Students must be able to use measurements obtained from instrumentation sensors on mechanical structures. They must be able to interpret the results and compare them with calculation assumptions and analytical or numerical sizing results, while critically assessing any discrepancies (measurement uncertainty, model limitations, assembly errors, etc.).

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1	Individual analytical study of one or more simple elastoplastic mechanical problems.	- Command of the fundamental concepts: understanding of key plasticity concepts (strain, stress, elastic/plastic behaviour). - Relevant and consistent use of constitutive laws in relation to the model assumptions. - Analytical solution: accuracy, rigour and ability to handle simple 1D or 3D cases appropriately. - Logical structure of the approach, and precise use of language and notation.
2	Individual analytical study of one or more vibration-dynamics mechanical problems.	- Clear, well-supported explanations of the concepts and principles of vibration (dynamic) analysis for a discrete or continuous system. - Correct application in calculations and accuracy of analytical developments, with rigorous use of methods and principles for solving a dynamic problem. - Analytical and critical ability: comparison of analytical results, experimental measurements and numerical simulations, with discussion



		and interpretation of discrepancies.
3	Experimental study on an instrumented structure using measurements of mechanical quantities, followed by presentation and interpretation of the results and comparison with an analytical or numerical calculation, in the form of a written technical report or small-group oral technical presentation.	- Quality and reliability of measurements (usable, reproducible data, taking uncertainties or sources of error into account). - Ability to compare experimental results with the model (correctly relate measurements to theoretical or numerical calculations and explain any differences). - Critical assessment of results (ability to question discrepancies and consider explanatory hypotheses such as model limitations, measurement errors, assembly conditions, etc.). - Clarity and rigour of the presentation (structured presentation, command of technical vocabulary, good written or oral communication, compliance with expected formats).

Bibliographic resources

- LEMAITRE Jean, CHABOCHE Jean-Louis, BENALLAL Ahmed. Mécanique des matériaux solides. Dunod, 2020. (Ebook).
- FRANÇOIS Dominique, PINEAU André, ZAOUI André. Comportement mécanique des matériaux. Tomex : Élasticité et plasticité. Hermes, 2009.
- CHAIGNE Antoine, DE LANGRES Emmanuel. Dynamique des vibrations. Ed. De l'École polytechnique, 2008.
- COMBES Bertrand. Vibrations des structures pour l'ingénieur et le technicien. Ellipses, 2009.
- LALANNE Christian. Vibrations et chocs mécaniques. Tomes 1 à 6. Hermès, 1999-2004.



Engineering Programme Syllabus: Grande École Programme

TU Title: **Advanced Industrial Management and Design**			
Last updated: March 2026	*National TU Coordinator:* *Thècle ALIX (Bordeaux)*		*Year of Study:* Level M1
TU GICA (ex ORIA)	*Language of Instruction:* French and/or English	*Type:* UEI Mandatory	*Cycle:* 2A
ECTS credits: 3	*Student workload per TU (hours):* 75	*Including face-to-face teaching (hours):* 30	*Semester:* GIM2
Keywords: flow simulation, human interactions, ERP.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	X
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	

Intended learning outcomes in the CDIO framework

Outcome Group	***Learning Outcomes***	***TU-targeted Outcomes***
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	
	1.2 Core engineering fundamental knowledge	X
	1.3 Advanced engineering fundamental knowledge, methods and tools	
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	X
	2.3 System thinking	
	2.4 Attitudes, thought and learning	
	2.5 Ethics, professional conduct and professional responsibilities	
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	
	3.2 Communications	
	3.3 Communications in foreign languages	
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	
	4.2 Enterprise and business context	
	4.3 Creating: from idea to business plan	
	4.4 Designing	
	4.5 Implementing	
	4.6 Operating	X
	4.7 Innovating	
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	***Energy Engineering***	***Industrial Engineering***	***Management***
		X	



Specific prerequisites

- TUs GICI and GIPI.

General teaching methods

Knowledge inputs, tutorials and case studies, all contextualised through examples drawn from the lecturers' industrial experience or based on the ELF platforms.

Intended learning outcomes

Manage the physical and information flows associated with a production system by integrating technical, economic, environmental and societal constraints (TEDS), in order to ensure competitive, sustainable production suited to current challenges.

ILO 1. Model and simulate the production system (e.g. SADT/VSM/MIFA).
- Students must be able to map the production system using a modelling language consistent with the modelling objectives.

ILO 2. Manage physical flows within the production system (just-in-time, replenishment).
- Students must be able to select an appropriate production-control model taking account of the company's strategic objectives, available information, required accuracy and complexity.

ILO 3. Plan production and required capacity over short-, medium- and long-term horizons.
- Students must be able to implement more comprehensive S&OP and Master Production Schedule processes than those already covered in first-year TU ORHI.

ILO 4. Implement an information system for production-system management (e.g. introduction to ERP and MES).
- Students must be able to select and implement a management solution according to requirements.

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1	Individual written assessment (case study, implementation of a method); one individual assessment and one group assessment.	- The analysis and action plan draw on industrial engineering principles. - Additional information is researched. - The request is correctly understood. - The response to the specifications is supported by sound reasoning. - Proposals in the case study are clear. - The tools and techniques used are appropriate and justified. - The approach is structured. - The limitations of the approach are addressed. - Methods taught or covered in class are implemented. - Ability to synthesise and present results. - CSR is integrated into the approach.
2	Individual written assessment (case study, implementation of a method); one individual assessment and one group assessment.	- The analysis and action plan draw on industrial engineering principles. - Additional information is researched. - The request is correctly understood. - The response to the specifications is supported by sound reasoning. - Proposals in the case study are clear. - The tools and techniques used are appropriate and justified. - The approach is structured. - The limitations of the approach are addressed. - Methods taught or covered in class are implemented. - Ability to synthesise and present results. - CSR is integrated into the approach.
3	Individual written assessment (case study, implementation of a method); one individual assessment and one group assessment.	- The analysis and action plan draw on industrial engineering principles. - Additional information is researched. - The request is correctly understood.



		- The response to the specifications is supported by sound reasoning. - Proposals in the case study are clear. - The tools and techniques used are appropriate and justified. - The approach is structured. - The limitations of the approach are addressed. - Methods taught or covered in class are implemented. - Ability to synthesise and present results. - CSR is integrated into the approach.
4	Individual written assessment (case study, implementation of a method); one individual assessment and one group assessment.	- The analysis and action plan draw on industrial engineering principles. - Additional information is researched. - The request is correctly understood. - The response to the specifications is supported by sound reasoning. - Proposals in the case study are clear. - The tools and techniques used are appropriate and justified. - The approach is structured. - The limitations of the approach are addressed. - Methods taught or covered in class are implemented. - Ability to synthesise and present results. - CSR is integrated into the approach.

Bibliographic resources

- DHOUIBI, HEDI, Modélisation et simulation des systèmes automatisés de production. Edilivre-Aparis, 2016.
- PILLET, MARTIN-BONNEFOUS, BONNEFOUS, et al. Gestion de production : Les fondamentaux et les bonnes pratiques. Eyrolles, 2020 (ebook).
- JAVEL. Organisation et gestion de la production : cours avec exercices corrigés. Dunod, 2010 (ebook).
- GELINIER, CLAVER. Gestion de flux en entreprise: modélisation et simulation. Hermes Science Publications, 1996.
Kanban : l'approche en flux pour l'entreprise agile.
- PERNOT, MORISSEAU. Kanban : l'approche en flux pour l'entreprise agile. Dunod, 2019.



Engineering Programme Syllabus: Grande École Programme

***TU Title:* Advanced Mechanical Manufacturing**			
Last updated: March 2026	*National TU Coordinator: Agnès FABRE (Aix-en-Provence)*		*Year of Study:* Level M1
TU REPA	*Language of Instruction:* French and/or English	*Type:* UEI Mandatory	*Cycle:* 2A
ECTS credits: 6	*Student workload per TU (hours):* 150	*Including face-to-face teaching (hours):* 70	*Semester:* GIM2
Keywords: manufacturing route, material/process interaction, NDT.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	X
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	X
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	

Intended learning outcomes in the CDIO framework

Outcome Group	*Learning Outcomes*	*TU-targeted Outcomes*
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	
	1.2 Core engineering fundamental knowledge	
	1.3 Advanced engineering fundamental knowledge, methods and tools	X
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	X
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	X
	2.3 System thinking	
	2.4 Attitudes, thought and learning	
	2.5 Ethics, professional conduct and professional responsibilities	
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	
	3.2 Communications	
	3.3 Communications in foreign languages	
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	
	4.2 Enterprise and business context	
	4.3 Creating: from idea to business plan	
	4.4 Designing	
	4.5 Implementing	X
	4.6 Operating	
	4.7 Innovating	
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	*Energy Engineering*	*Industrial Engineering*	*Management*
X	X	X	



Specific prerequisites

- All intended learning outcomes from TUs REPI, RESI, COPI, COSI, ORHI, SGEI, MATI and MDSI.

General teaching methods

Theory classes, tutorials and practical teaching through projects or practical work, all contextualised by examples drawn from industrial relations, with emphasis on a combined simulation (specialist software)/experimental approach.

Intended learning outcomes

Build and optimise the manufacturing process for a manufactured product.

ILO 1. Select a manufacturing route that achieves a technical, economic and environmental compromise, and model the manufacturing and inspection routes.

- Students must be able to establish a complete manufacturing route, including conformity checks against technical, economic and environmental constraints, and simulate it using specialist tools to assess its relevance.

ILO 2. Implement and instrument a manufacturing system to identify the sensitivity of products and materials to manufacturing parameters through advanced physical interpretation.

- A group of students must be able, with support, to implement a manufacturing system in order to validate the selected manufacturing route. With support, the group will conduct an experiment to identify the sensitivity of products and materials to manufacturing parameters through advanced physical interpretation. Students will develop an advanced understanding of the physical phenomena involved in the process and be able to provide technical leadership.

ILO 3. Model processes and material behaviour for simulation in order to optimise the behaviour of the final product (multi-process chaining, simulation-test correlation).

- Students must be able to select relevant process-modelling software (material, mechanical, energy behaviour, etc.) and implement it for a specific simulation and optimisation case (multi-process chaining, simulation-test correlation).

ILO 4. Identify and use inspection methods (metrology and non-destructive testing - NDT).

- Students will be able to identify important specifications, select appropriate inspection methods (metrology and NDT) and propose corrective actions when a measurement is outside tolerance.

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1	- Group project carried out as practical work, with group and/or individual assessment. - Written case study in the form of an individual test. - Practical work on an ELF cell, with group and/or individual assessment.	- Relevance of the selected manufacturing route (evidence of understanding of theoretical, scientific and technical concepts, justified technical choices and explanation of the proposed analysis). - Relevance of the proposed solution in relation to the imposed constraints (ability to analyse specifications, justify choices, challenge choices and provide high-quality technical reasoning).
2	- Group project carried out as practical work, with group and/or individual assessment. - Written case study in the form of an individual test. - Practical work on an ELF cell, with group and/or individual assessment.	- Relevance of the implementation approach and project organisation. - Clarity of the technical documents provided. - Relevance of the selected experimental protocol. - Justification of the arguments. - Analysis of results (demonstrating the ability to analyse a manufacturing process in detail). - Demonstration of the ability to use concepts acquired in mechanics and materials TUs to analyse a process. - Demonstration of the ability to account for variation in the sensors used in relation to their technological principle. - Demonstration of the ability to synthesise experimental results and identify the most essential elements.
3	- Group project carried out as practical work, with group and/or individual assessment. - Written case study in the form of an individual	- Justification of assumptions and associated reasoning (relevance of the project implementation approach, ability to use technical vocabulary correctly and appropriately).



	test. - Practical work on an ELF cell, with group and/or individual assessment.	- Ability to identify parameters influencing experimental and numerical results. - Ability to identify material parameters affecting process parameters. - Critical analysis of results (ability to challenge calculation results and use them appropriately to optimise process parameters). - Ability to synthesise information.
4	- Group project carried out as practical work, with group and/or individual assessment. - Written case study in the form of an individual test. - Practical work on an ELF cell, with group and/or individual assessment.	- Selection of specifications and relevance of the physical reasoning used to justify the presence of defects in products. - Well-reasoned selection of inspection methods for a given technical and economic context. - Presentation of measurements, quality of their analysis and discussion of their validity. - Corrective actions proposed where necessary.

Bibliographic resources

- Arts et Métiers (ouvrage collectif), Usinage des pièces mécaniques – Théorie et pratique, Edition Eyrolles, 2021.
- KALPAKJIAN Serope, SCHMID Steven R. Manufacturing engineering and technology.7Ème éd. Pearson éducation centre, 2013.
- Travail des matériaux – Assemblage : Maîtrisez les techniques de soudage, d'usinage, de collage ou encore les procédés d'impression 3D. Techniques de l'ingénieur- Ressources documentaires Mécanique.
- TROTIGNON, Jean-Pierre [et al.]. Précis de construction mécanique - Tome 2. AFNOR, Nathan, 2006.



Engineering Programme Syllabus: Grande École Programme

***TU Title:* Management Sciences in Society (Advanced)**			
Last updated: March 2026	*National TU Coordinator: Xavier NOIROT (Cluny)*		*Year of Study:* Level M1
TU SGSA	*Language of Instruction:* French and/or English	*Type:* UEF Mandatory	*Cycle:* 2A
ECTS credits: 3	*Student workload per TU (hours):* 75	*Including face-to-face teaching (hours):* 30	*Semester:* GIM2
Keywords: economics, business management, employment law, occupational health and safety, interpersonal communication, critical thinking.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	X

Intended learning outcomes in the CDIO framework

Outcome Group	*Learning Outcomes*	*TU-targeted Outcomes*
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	
	1.2 Core engineering fundamental knowledge	
	1.3 Advanced engineering fundamental knowledge, methods and tools	
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	
	2.3 System thinking	
	2.4 Attitudes, thought and learning	
	2.5 Ethics, professional conduct and professional responsibilities	X
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	X
	3.2 Communications	
	3.3 Communications in foreign languages	
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	X
	4.2 Enterprise and business context	X
	4.3 Creating: from idea to business plan	
	4.4 Designing	
	4.5 Implementing	
	4.6 Operating	X
	4.7 Innovating	
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	*Energy Engineering*	*Industrial Engineering*	*Management*
			X



Specific prerequisites

- TU SGSI.

General teaching methods

Lectures, tutorials, case studies and simulations.
THE TOTAL FOR ALL MODULES MUST NOT EXCEED 30 HOURS OF FACE-TO-FACE TEACHING, DISTRIBUTED AS FOLLOWS:
- Management, ethics and organisation module: 8 to 12 hours.
- Management decision-making module: 12 to 16 hours.
- Occupational Health and Safety module: 6 to 8 hours.

Intended learning outcomes

Act as a responsible engineer within the organisation, drawing on tools, methods and concepts from the humanities, social sciences and management sciences in order to act knowledgeably and responsibly in a changing world, particularly in response to the challenges of ecological transition and sustainable development (TEDS).

ILO 1. Propose appropriate organisational arrangements for a company or team to ensure performance and motivation while integrating an ethical approach.

- Students must be able to analyse a company using interpretative frameworks from organisation theory in order to propose improvements.

ILO 2. Use management accounting tools (cost accounting) to diagnose a situation and support operational management decisions.

- Students must be able to use one or more methods to assess the costs and profitability of a project and/or investment.

ILO 3. Integrate occupational health and safety and/or industrial risk analysis into company operations and project management.

- Students must be able to integrate occupational health and safety and/or industrial risk considerations into design activities and process management, and assess their impact on organisational performance.

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1	Case study.	- Analyse the situation using appropriate tools and interpretative frameworks. - Justify choices and recommendations with appropriate arguments.
2	Case study.	- Justify the results. - Support the diagnosis and proposed measures with sound reasoning.
3	Case studies and/or practical cases.	- Analyse the situation presented using appropriate interpretative frameworks. - Identify and formulate solutions suited to the context. - Justify choices and recommendations with appropriate arguments.

Bibliographic resources

- CHARREIRE PETIT Sandra, HUAULT Isabelle. Les grands auteurs en management. EMS, 2017. (E-book).
- HOUNOUNOU Albéric. 100 Fiches pour comprendre le management. Bréal, 2019.
- SIEGWART Jean-Luc et al. Mesure et analyse des performances. Nathan, 2011.
- GRANDGUILLOT Francis et Béatrice. Analyse financière. Collection Gualino Les Zoom's. Lextenso éditions, 2020.
- FLAUS Jean-Marie. Analyse des risques des systèmes de production industriels et de services. Éditions Lavoisier, 2013. (E-book).
- DAB William. La Santé et le travail : 10 étapes pour une prévention efficace dans l'entreprise. 2E éd. Arnaud Franel Éditions, 2018. (E-book).



Engineering Programme Syllabus: Grande École Programme

***TU Title:* Business Life in English**			
Last updated: March 2026	*National TU Coordinator: Oliver WATTS (Metz)*		*Year of Study:* Level M1
TU AN7	*Language of Instruction:* French and/or English	*Type:* UEL Mandatory	*Cycle:* 2A
ECTS credits: 2	*Student workload per TU (hours):* 50	*Including face-to-face teaching (hours):* 20	*Semester:* S7
Keywords: professional integration, international environment.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	X

Intended learning outcomes in the CDIO framework

Outcome Group	*Learning Outcomes*	*TU-targeted Outcomes*
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	
	1.2 Core engineering fundamental knowledge	
	1.3 Advanced engineering fundamental knowledge, methods and tools	
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	
	2.3 System thinking	
	2.4 Attitudes, thought and learning	X
	2.5 Ethics, professional conduct and professional responsibilities	
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	X
	3.2 Communications	X
	3.3 Communications in foreign languages	X
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	
	4.2 Enterprise and business context	
	4.3 Creating: from idea to business plan	
	4.4 Designing	
	4.5 Implementing	
	4.6 Operating	
	4.7 Innovating	
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	*Energy Engineering*	*Industrial Engineering*	*Management*
			X



Specific prerequisites

- Common European Framework of Reference for Languages: B2.

General teaching methods

- Tutorials (groups of 24).
- Work in class groups, small groups (4 to 6) or individually, depending on the learning objectives.
- Role-playing and simulation of work-related situations (e.g. meetings, recruitment).

Intended learning outcomes

Communicate in English in the international business world.

ILO 1. Describe in English how a company operates.

- Students must be able to describe in English how a company operates, including its activities, projects and organisation chart (key positions, functions, responsibilities and interactions), as well as the business sector in which it operates. Students must be able to structure and deliver an oral presentation in English clearly, fluently and in a manner suited to their audience. They must manage their speaking time, intonation and body language and interact effectively with their audience. They must also be able to answer questions in a well-reasoned and professional manner and create visual support suited to the context.

ILO 2. Interact appropriately in English within a multicultural team.

- Simulation of work-related situations (negotiation, role-playing, meetings, etc.).

ILO 3. Continue to develop a career plan in preparation for entering the world of work in France or abroad.

- Following the first-year work placement and before the international mobility period and second-year internship, develop oral and written communication skills related to job interviews and cover letters.

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1	Individual or group presentation of a company in English, lasting 5 to 10 minutes per student, followed by questions and reactions.	- Ability to describe company life and operations in a concise, clear and accessible way. - Use of precise, technical vocabulary to describe the company (and the first-year placement if it was carried out in that company). - Grammatical and syntactic accuracy (well-constructed sentences, no major errors). - Structure and deliver a clear, fluent presentation suited to the audience. - Effective management of speaking time, intonation, body language and interaction with the audience. - Well-reasoned and professional responses to questions. - Creation of visual support suited to the audience.
2	Group oral task simulating a professional communication situation (negotiation, role-playing, meeting, etc.), with 5 to 10 minutes of individual speaking time.	- Quality of the contribution and ideas. - Ability to speak continuously and interactively. - Use of specific and general vocabulary appropriate to the situation.
3	Oral and written communication activities related to job interviews and cover letters, as part of formative assessment with precise, individualised feedback from the lecturer.	- Accuracy and relevance of vocabulary (activities, positions, company culture). - Relevance, clarity and originality of ideas; compliance with instructions; effective use of voice (for the interview); use of varied structures and appropriate, varied vocabulary.

Bibliographic resources

- Resources provided by the lecturer.



Engineering Programme Syllabus: Grande École Programme

***TU Title:* Student Career Guidance 2A 1/2**			
Last updated: March 2026	*National TU Coordinator:* *Bertrand KRAUSER (Metz)*		*Year of Study:* Level M1
TU APE7	*Language of Instruction:* French and/or English	*Type:* UEA Mandatory	*Cycle:* 2A
ECTS credits: 1	*Student workload per TU (hours):* 25	*Including face-to-face teaching (hours):* 11	*Semester:* S7
Keywords: professional identity, career plan, professional integration.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	X

Intended learning outcomes in the CDIO framework

Outcome Group	*Learning Outcomes*	*TU-targeted Outcomes*
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	
	1.2 Core engineering fundamental knowledge	
	1.3 Advanced engineering fundamental knowledge, methods and tools	
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	
	2.3 System thinking	
	2.4 Attitudes, thought and learning	X
	2.5 Ethics, professional conduct and professional responsibilities	X
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	
	3.2 Communications	X
	3.3 Communications in foreign languages	
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	X
	4.2 Enterprise and business context	X
	4.3 Creating: from idea to business plan	
	4.4 Designing	
	4.5 Implementing	
	4.6 Operating	
	4.7 Innovating	
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	*Energy Engineering*	*Industrial Engineering*	*Management*
			X



Specific prerequisites

- TUs APE5 and APE6.
- Learning agreement/contract.

General teaching methods

- 10 hours of group sessions with approximately 25 students + 1 hour of individual interview.
- External lecturers use facilitation techniques drawn from the professional world, with an emphasis on interaction.

Intended learning outcomes

Engage with the professional world and make the most of professional experiences.

ILO 1. Develop a professional network.

- Meet professionals and record contacts using a digital tool.

ILO 2. Prepare for meetings with professionals.

- Develop a professional vision and assess its consistency with one's background and personality.

ILO 3. Use professional experiences to reflect on one's professional identity.

- Analyse the learning gained from the first-year work placement.

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1	Create a professional contacts file to be developed independently over time.	Personal initiatives to meet professionals, or participation in events offered through other School schemes.
2	Simulations and work-related scenarios.	Present oneself while clearly expressing one's professional identity.
3	First-year work-placement report and presentation reflecting critically on the experience.	Review of the S6 work placement using the dedicated assessment grid.

Bibliographic resources

- TEAM common knowledge base - National APE TU team.
- ONISEP. Découvrir les métiers (http://www.Onisep.Fr/Decouvrir-les-metiers).
- France Travail - Les fiches métiers : Répertoire Opérationnel des Métiers et des Emplois (https://www.Francetravail.Org/opendata/repertoire-operationnel-des-meti.Html?Type=article).
- SYNTEC INGÉNIERIE (https://www.Syntec-AXingenierie.Fr/).
- AVENIR INGENIERIE (https://avenir-ingenierie.Fr/).
- CONCEPTEURS D'AVENIR (https://www.Concepteursdavenirs.Fr/decouvrir-les-metiers).
- OPIIEC (https://www.Opiiec.Fr/cartographie_des_metiers).
- IESF (https://www.Iesf.Fr/).
- Société des ingénieurs et scientifiques de France - annuaire.



Engineering Programme Syllabus: Grande École Programme

TU Title: **Oral and Written Communication in a Foreign Language 2A 1/2**			
Last updated: March 2026	*National TU Coordinator:* *Julia Camarero (Paris)*		*Year of Study:* Level M1
TU LVS7	*Language of Instruction:* French and/or the chosen foreign language	*Type:* UEL Mandatory	*Cycle:* 2A
ECTS credits: 1	*Student workload per TU (hours):* 25	*Including face-to-face teaching (hours):* 20	*Semester:* S7
Keywords: professional integration, international environment.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	X

Intended learning outcomes in the CDIO framework

Outcome Group	***Learning Outcomes***	***TU-targeted Outcomes***
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	
	1.2 Core engineering fundamental knowledge	
	1.3 Advanced engineering fundamental knowledge, methods and tools	
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	
	2.3 System thinking	
	2.4 Attitudes, thought and learning	X
	2.5 Ethics, professional conduct and professional responsibilities	
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	X
	3.2 Communications	X
	3.3 Communications in foreign languages	X
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	
	4.2 Enterprise and business context	
	4.3 Creating: from idea to business plan	
	4.4 Designing	
	4.5 Implementing	
	4.6 Operating	
	4.7 Innovating	
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	***Energy Engineering***	***Industrial Engineering***	***Management***
			X



Specific prerequisites

- Level A, basic user: introductory/breakthrough level (A1) and intermediate/waystage level (A2).
- Level B, independent user: threshold level (B1) and upper-intermediate/independent level (B2).
- Level C, proficient user: effective operational proficiency (C1) and mastery (C2).

*Depending on the assigned group.

General teaching methods

- Tutorials (groups of 24).
- Work in class groups, small groups (4 to 6) or individually, depending on the learning objectives.
- Role-playing and simulation of work-related situations (e.g. meetings, recruitment).

Intended learning outcomes

Prepare to operate in an international professional and/or academic environment.

ILO 1. Communicate and interact in a multicultural work environment.

- Develop oral and written expression and comprehension skills appropriate to the student's language level (arguing a point of view, understanding the main points of current-affairs documents, etc.). Deepen knowledge in order to raise awareness of verbal and non-verbal cultural differences.

ILO 2. Develop a career plan and prepare to enter the professional and/or academic world abroad.

- Task-based approach structured around communicative activities, aimed at developing the skills required to integrate into professional and academic environments internationally. Activities are adapted to the group's level and progress.

ILO 3. Operate in an international environment, particularly with regard to its scientific, technical and organisational aspects.

- Develop oral and written language skills through presentations, debates and scientific or technical projects, using a task-based approach. Gradually acquire methods for scientific writing and enrich specialised vocabulary. Activities are adapted to the group's level and progress.

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1	- Oral expression: individual interview (guided conversation) + prepared oral production (3- to 20-minute presentation + answers to questions). - Written production: functional, narrative or argumentative text (depending on level) + practical task: letter, message, report, article or memo.	Oral assessment criteria: - Intelligibility - Vocabulary - Grammar - Fluency - Interaction Written assessment criteria: - Compliance with the task instructions. - Vocabulary - Grammar / spelling. - Coherence / cohesion. - Readability - Argumentation (advanced level).
2	- Oral expression: individual interview (guided conversation) + prepared oral production (presentation + answers to questions), 3 to 20 minutes. - Written production: functional, narrative or argumentative text (60 to 300 words).	Oral assessment criteria: - Intelligibility - Vocabulary - Grammar - Fluency - Interaction Written assessment criteria: - Compliance with the task instructions. - Vocabulary - Grammar / spelling.



		- Coherence / cohesion. - Readability - Argumentation (advanced level).
3	- Oral expression: individual interview (guided conversation) + prepared oral production (presentation + answers to questions), 5 to 20 minutes. - Written production: functional, narrative or argumentative text (60 to 300 words).	Oral assessment criteria: - Intelligibility - Vocabulary - Grammar - Fluency - Interaction Written assessment criteria: - Compliance with the task instructions. - Vocabulary - Grammar / spelling. - Coherence / cohesion. - Readability - Argumentation (advanced level).

Bibliographic resources

- Resources provided by the lecturer.



Engineering Programme Syllabus: Grande École Programme

***TU Title:* Project 2A 1/2 (Advanced)**			
Last updated: Sept. 2021	*National TU Coordinator: Anne MOREL (DGAF)*		*Year of Study:* Level M1
TU PJ7	*Language of Instruction:* French and/or English	*Type:* UEP Mandatory	*Cycle:* 2A
ECTS credits: 3	*Student workload per TU (hours):* 75	*Including face-to-face teaching (hours):* 18	*Semester:* S7
Keywords: project management: initiate, plan, execute, monitor, control.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	X

Intended learning outcomes in the CDIO framework

Outcome Group	*Learning Outcomes*	*TU-targeted Outcomes*
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	
	1.2 Core engineering fundamental knowledge	
	1.3 Advanced engineering fundamental knowledge, methods and tools	
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	
	2.3 System thinking	X
	2.4 Attitudes, thought and learning	X
	2.5 Ethics, professional conduct and professional responsibilities	X
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	X
	3.2 Communications	X
	3.3 Communications in foreign languages	
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	
	4.2 Enterprise and business context	
	4.3 Creating: from idea to business plan	
	4.4 Designing	
	4.5 Implementing	
	4.6 Operating	
	4.7 Innovating	
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	*Energy Engineering*	*Industrial Engineering*	*Management*
X	X	X	X



Specific prerequisites

- Validation of TUs PJ5 and PJ6, or equivalent validated experience.

General teaching methods

Students work in project teams.

Intended learning outcomes

Develop an approach and use formalised tools to manage a simple multidisciplinary project, drawing on and developing the knowledge and skills required for its successful completion.

ILO 1. Select a project management approach and tools suited to the project.
ILO 2. Implement the selected approach and tools.
ILO 3. Complete the project and present its results and the approach followed.

Teaching unit (TU) description:
- TU PJ7 may be organised as the first part of work that will continue in TU PJ8.
- The project, developed by a School teaching team or potentially proposed by a student team, is carried out over the semester as supervised independent work.

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1		
2		
3		

Assessment by the teaching team:
- Relevance of the approach adopted.
- Implementation of the associated tools.
- Overall conduct of the TU during dedicated sessions and team operation (e.g. attendance, perseverance, autonomy, allocation of roles).
- Application of knowledge within the project.

Bibliographic resources

- Guide du corpus des connaissances en management de projet (Guide PMBOK) - (ISBN 978-1933890654), Chapitres 1 à 6.
- Gestion de Projet. Techniques de l'Ingénieur référence : T7700 Vx. Janvier 1997.
- Drecq V. (2017), « Pratiques de management de projet – 46 outils et techniques pour prendre la bonne décision », Éditions Dunod, 2017.
- Maders H-P. Et alii (2016), Les fiches outils du chef de projet : 100 fiches opérationnelles, Eyrolles.



Engineering Programme Syllabus: Grande École Programme

TU Title: **Culture, Science and Society in English**			
Last updated: March 2026	*National TU Coordinator:* *Oliver WATTS (Metz)*		*Year of Study:* Level M1
TU AN8	*Language of Instruction:* French and/or English	*Type:* UEL Mandatory	*Cycle:* 2A
ECTS credits: 2	*Student workload per TU (hours):* 50	*Including face-to-face teaching (hours):* 20	*Semester:* S8
Keywords: professional integration, international environment.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	X

Intended learning outcomes in the CDIO framework

Outcome Group	*Learning Outcomes*	*TU-targeted Outcomes*
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	
	1.2 Core engineering fundamental knowledge	
	1.3 Advanced engineering fundamental knowledge, methods and tools	
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	
	2.3 System thinking	
	2.4 Attitudes, thought and learning	X
	2.5 Ethics, professional conduct and professional responsibilities	
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	X
	3.2 Communications	X
	3.3 Communications in foreign languages	X
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	
	4.2 Enterprise and business context	
	4.3 Creating: from idea to business plan	
	4.4 Designing	
	4.5 Implementing	
	4.6 Operating	
	4.7 Innovating	
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	*Energy Engineering*	*Industrial Engineering*	*Management*
			X



Specific prerequisites

- Common European Framework of Reference for Languages: B2.

General teaching methods

- Tutorials (groups of 24).
- Work in class groups, small groups (4 to 6) or individually, depending on the learning objectives.
- Role-playing and simulation of work-related situations (e.g. meetings, recruitment).

Intended learning outcomes

Acquire a sound command of and use the vocabulary of engineering sciences and management in an international environment.

ILO 1. Present a concept orally, develop an argument and defend one's ideas.

- Students must be able to describe a technical product, production systems and manufacturing processes, and explain how they operate.

ILO 2. Identify and understand the issues facing different stakeholders - social, technical, economic and environmental - in a CSR context, and be able to formulate hypotheses.

- Students must be able to integrate reflection on CSR-related issues into their engineering approach.

ILO 3. Continue to develop a career plan in preparation for entering the world of work in France or abroad.

- Before the international mobility period and second-year internship, develop oral and written communication skills related to job interviews and cover letters.

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1	Group project culminating in an oral presentation on an innovative technology or project.	- Ability to use and demonstrate command of technical vocabulary. - Ability to adapt language to a technical or non-technical audience.
2	Individual or group oral presentation on the CSR approach of one or more companies (5 to 10 minutes per student).	- Ability to analyse the actions of the companies discussed. - Ability to present the points discussed in a coherent and logical manner. - Ability to express oneself in English fluently and accurately. - Ability to take other people's viewpoints into account.
3	Oral and written communication activities related to job interviews and cover letters, as part of formative assessment with precise, individualised feedback from the lecturer.	- Accuracy and relevance of vocabulary (activities, positions, company culture). - Relevance, clarity and originality of ideas; compliance with instructions; effective use of voice (for the interview); use of varied structures and appropriate, varied vocabulary.

Bibliographic resources

- Resources provided by the lecturer.



Engineering Programme Syllabus: Grande École Programme

***TU Title:* Student Career Guidance 2A 2/2**			
Last updated: March 2026	*National TU Coordinator:* *Bertrand KRAUSER (Metz)*		*Year of Study:* Level M1
TU APE8	*Language of Instruction:* French and/or English	*Type:* UEA Mandatory	*Cycle:* 2A
ECTS credits: 1	*Student workload per TU (hours):* 25	*Including face-to-face teaching (hours):* 11	*Semester:* S8
Keywords: professional identity, career plan, professional integration.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	X

Intended learning outcomes in the CDIO framework

Outcome Group	*Learning Outcomes*	*TU-targeted Outcomes*
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	
	1.2 Core engineering fundamental knowledge	
	1.3 Advanced engineering fundamental knowledge, methods and tools	
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	
	2.3 System thinking	
	2.4 Attitudes, thought and learning	X
	2.5 Ethics, professional conduct and professional responsibilities	X
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	
	3.2 Communications	X
	3.3 Communications in foreign languages	
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	X
	4.2 Enterprise and business context	X
	4.3 Creating: from idea to business plan	
	4.4 Designing	
	4.5 Implementing	
	4.6 Operating	
	4.7 Innovating	
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	*Energy Engineering*	*Industrial Engineering*	*Management*
			X



Specific prerequisites

- TU APE7.
- Learning agreement/contract.

General teaching methods

- 10 hours of group sessions with approximately 25 students + 1 hour of individual interview.
- External lecturers use facilitation techniques drawn from the professional world, with an emphasis on interaction.

Intended learning outcomes

Reach out to professionals with a defined objective.

ILO 1. Take an active role in shaping one's career path and making decisions.

- Take a position on identified professional issues (social, societal, environmental, ethical, etc.).

ILO 2. Adjust one's thinking and action plan.

- Deepen knowledge of the professional environment and interact with professionals.

ILO 3. Optimise communication tools.

- Follow good communication practices and be able to persuade in a multicultural context.

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1	Learning activity.	- Persuasively present one's actions and/or approach while reflecting critically on the experience. - Compliance with the Charter signed at the start of the year.
2	Active participation in activities and work-related scenarios during individual and/or group work in collective sessions and during the individual interview.	Ability to establish an action plan to bring the project to completion. Participate in and/or organise professional meetings and comply with the Charter signed at the start of the year.
3	Update self-presentation tools (CV, letters, pitches).	Update communication tools by adding new experiences, progress and practical work.

Bibliographic resources

- TEAM common knowledge base - National APE TU team.
- ONISEP. Découvrir les métiers (http://www.Onisep.Fr/Decouvrir-les-metiers).
- France Travail - Les fiches métiers : Répertoire Opérationnel des Métiers et des Emplois (https://www.Francetravail.Org/opendata/repertoire-operationnel-des-meti.Html?Type=article).
- SYNTEC INGÉNIERIE (https://www.Syntec-AXingenierie.Fr/).
- AVENIR INGENIERIE (https://avenir-ingenierie.Fr/).
- CONCEPTEURS D'AVENIR (https://www.Concepteursdavenirs.Fr/decouvrir-les-metiers).
- OPIIEC (https://www.Opiiec.Fr/cartographie_des_metiers).
- IESF (https://www.Iesf.Fr/).
- Société des ingénieurs et scientifiques de France - annuaire.



Engineering Programme Syllabus: Grande École Programme

TU Title: **Oral and Written Communication in a Foreign Language 2A 2/2**			
Last updated: March 2026	*National TU Coordinator:* *Julia Camarero (Paris)*		*Year of Study:* Level M1
TU LVS8	*Language of Instruction:* French and/or the chosen foreign language	*Type:* UEL Mandatory	*Cycle:* 2A
ECTS credits: 1	*Student workload per TU (hours):* 25	*Including face-to-face teaching (hours):* 20	*Semester:* S8
Keywords: professional integration, international environment.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	X

Intended learning outcomes in the CDIO framework

Outcome Group	***Learning Outcomes***	***TU-targeted Outcomes***
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	
	1.2 Core engineering fundamental knowledge	
	1.3 Advanced engineering fundamental knowledge, methods and tools	
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	
	2.3 System thinking	
	2.4 Attitudes, thought and learning	X
	2.5 Ethics, professional conduct and professional responsibilities	
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	X
	3.2 Communications	X
	3.3 Communications in foreign languages	X
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	
	4.2 Enterprise and business context	
	4.3 Creating: from idea to business plan	
	4.4 Designing	
	4.5 Implementing	
	4.6 Operating	
	4.7 Innovating	
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	***Energy Engineering***	***Industrial Engineering***	***Management***
			X



Specific prerequisites

- Level A, basic user: introductory/breakthrough level (A1) and intermediate/waystage level (A2).
- Level B, independent user: threshold level (B1) and upper-intermediate/independent level (B2).
- Level C, proficient user: effective operational proficiency (C1) and mastery (C2).

*Depending on the assigned group.

General teaching methods

- Tutorials (groups of 24).
- Work in class groups, small groups (4 to 6) or individually, depending on the learning objectives.
- Role-playing and simulation of work-related situations (e.g. meetings, recruitment).

Intended learning outcomes

Prepare to operate in an international professional and/or academic environment.

ILO 1. Further strengthen communication and interaction in a multicultural work environment.

- Develop oral and written expression and comprehension skills appropriate to the student's language level (arguing a point of view, understanding the main points of current-affairs documents, etc.). Deepen knowledge to raise awareness of verbal and non-verbal cultural differences. Activities are adapted to the group's level and progress.

ILO 2. Develop a career plan and prepare to enter the professional and/or academic world abroad.

- Task-based approach structured around communicative activities, aimed at developing the skills required to integrate into professional and academic environments internationally. Activities are adapted to the group's level and progress.

ILO 3. Operate in an international environment, particularly with regard to its scientific, technical and organisational aspects.

- Develop oral and written language skills through presentations, debates and scientific or technical projects, using a task-based approach. Gradually acquire methods for specialised writing and enrich specialised vocabulary. Activities are adapted to the group's level and progress.

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1	- Oral expression: individual interview (guided conversation) + prepared oral production (presentation + answers to questions), 5 to 20 minutes. - Written production: functional, narrative or argumentative text (60 to 300 words).	Oral assessment criteria: - Intelligibility - Vocabulary - Grammar - Fluency - Interaction Written assessment criteria: - Compliance with the task instructions. - Vocabulary - Grammar / spelling. - Coherence / cohesion. - Readability - Argumentation (advanced level).
2	- Oral expression: individual interview (guided conversation) + prepared oral production (presentation + answers to questions), 5 to 20 minutes. - Written production: functional, narrative or argumentative text (60 to 300 words).	Oral assessment criteria: - Intelligibility - Vocabulary - Grammar - Fluency - Interaction Written assessment criteria: - Compliance with the task instructions. - Vocabulary - Grammar / spelling.



		- Coherence / cohesion. - Readability - Argumentation (advanced level).
3	- Oral expression: individual interview (guided conversation) + prepared oral production (presentation + answers to questions), 5 to 20 minutes. - Written production: functional, narrative or argumentative text (60 to 300 words).	Oral assessment criteria: - Intelligibility - Vocabulary - Grammar - Fluency - Interaction Written assessment criteria: - Compliance with the task instructions. - Vocabulary - Grammar / spelling. - Coherence / cohesion. - Readability - Argumentation (advanced level).

Bibliographic resources

- Resources provided by the lecturer.



Engineering Programme Syllabus: Grande École Programme

***TU Title:* Project 2A 2/2 (Advanced)**			
Last updated: Sept. 2021	*National TU Coordinator:* *Anne MOREL (DGAF)*		*Year of Study:* Level M1
TU PJ8	*Language of Instruction:* French and/or English	*Type:* UEP Mandatory	*Cycle:* 2A
ECTS credits: 3	*Student workload per TU (hours):* 75	*Including face-to-face teaching (hours):* 18	*Semester:* S8
Keywords: project lifecycle management: initiate, plan, execute, monitor, control and close a project.			

RNCP 39305 competency blocks linked to this TU

1. Analyse and develop products, systems, goods and services with mechanical, energy and industrial components throughout all stages of their life cycle.	
2. Imagine, design and formalise manufactured products, production systems, and company goods and services.	
3. Manufacture, produce and inspect, within an integrated approach, manufactured products, parts, industrial production systems, and company goods and services.	
4. Organise and optimise industrial production scheduling and management, and the organisation of services.	
5. Foster the development of human, technological, organisational, linguistic and intercultural capabilities, for oneself and one's team, in order to support industrial and socio-environmental changes in organisations.	X

Intended learning outcomes in the CDIO framework

Outcome Group	*Learning Outcomes*	*TU-targeted Outcomes*
Disciplinary knowledge and reasoning	1.1 Knowledge of basic sciences	
	1.2 Core engineering fundamental knowledge	
	1.3 Advanced engineering fundamental knowledge, methods and tools	
Personal and professional skills and attributes	2.1 Analytic reasoning and problem solving	
	2.2 Scientific methods: experimentation, investigation and knowledge discovery	
	2.3 System thinking	X
	2.4 Attitudes, thought and learning	X
	2.5 Ethics, professional conduct and professional responsibilities	X
Interpersonal skills: Teamwork and communication	3.1 Teamwork and collaboration	X
	3.2 Communications	X
	3.3 Communications in foreign languages	
Create, design, implement, operate, innovate and undertake in a Corporate Social Responsibility context	4.1 External, societal and environmental context	
	4.2 Enterprise and business context	
	4.3 Creating: from idea to business plan	
	4.4 Designing	
	4.5 Implementing	
	4.6 Operating	
	4.7 Innovating	
	4.8 Engineering entrepreneurship	

Training Pillars

Mechanical Engineering	*Energy Engineering*	*Industrial Engineering*	*Management*
X	X	X	X



Specific prerequisites

- TUs PJ5, PJ6 and PJ7, or equivalent validated experience.

General teaching methods

Students work in project teams.

Intended learning outcomes

Manage a multidisciplinary project within a continuous-improvement framework, using metrics and drawing on and developing the knowledge and skills required for its successful completion.

ILO 1. Build and use monitoring indicators.
ILO 2. Anticipate and manage project risks.
ILO 3. Carry out a lessons-learned review for continuous improvement and present the findings.

Teaching unit (TU) description:
- The project, developed by a School teaching team or potentially proposed by a student team, is carried out over the semester as supervised independent work.
- TU PJ8 may preferably be organised as a continuation of the work carried out in TU PJ7.

General assessment methods and criteria

ILO	*Assessment method*	*Assessment criteria*
1		
2		
3		

Assessment by the teaching team:
- Relevance of the selected indicators.
- Anticipation of risks associated with the project.
- Continuous improvement approach.
- Overall conduct of the TU during dedicated sessions and team operation (attendance, perseverance, autonomy, allocation of roles, etc.).
- Application within the project of academic knowledge and the chosen technical or scientific approach.
- Project report and oral presentation.

Bibliographic resources

- Guide du corpus des connaissances en management de projet (Guide PMBOK) - (ISBN 978-1933890654), Chapitres 1 à 6, 8 et 11.
- Gestion de Projet. Techniques de l'Ingénieur référence : T7700 Vx. Janvier 1998.
- Drecq V. (2017), « Pratiques de management de projet – 46 outils et techniques pour prendre la bonne décision », Éditions Dunod, 2018.
- Maders H-P. Et alii (2016), Les fiches outils du chef de projet : 100 fiches opérationnelles, Eyrolles.