

DIPLOMATION PREREQUISITES

COMMITMENT & RESPONSIBILITIES					
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS	
COMMITMENT & RESPONSIBILITIES					
INTERNATIONAL					
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS	
INTERNATIONAL		300			
TOEIC					
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS	
TOEIC		60			

A&M - YEAR 3

SEMESTER 5 (September - January)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
AUTOMATION AND ELECTRONICS	6	Automation 1	<p>Description :</p> <p>Chapter 1: Generalities and examples, the notion of regulation, the notion of the closed loop, the specifications loads, pose a regulation problem through an example.</p> <ul style="list-style-type: none"> - Chapter 2: Study of signals, modeling (knowledge model and a behavior model), place transform, transfer function, block diagram. - Chapter 3: Temporal analysis (Fdt of order 1, Fdt of order 2 ...), map of poles and zeros, graphic modeling. - Chapter 4: The classical control laws (PI, PD, PID, AvancePH, RetardPH ...), empirical methods of synthesis of correctors, methods of synthesis not compensation of the poles. - Chapter 5: Summary of correctors by pole placement, reference system, Evans location. - Chapter 6: Synthesis of correctors by frequency approach, frequency analysis of the behavior of a process (Places of Bode, Black, Nichols, Nyquist....) <p>Practical work :</p> <p>TP1: Direct current machine speed regulation.</p> <p>TP2: Single column level control</p>	<p>Lectures : 22h00</p> <p>Tutorials : 6h00</p> <p>Lab Work : 8h00</p>
		Fundamentals of Electronics	<p>Description :</p> <p>The contributions of this module "Bases of Electronics" will be made through a lecture, and labworks. The understanding of the functioning of each component is supported by its semiconductor design aspect as well as by regular exercises and applications.</p> <ul style="list-style-type: none"> - Introduction to the design of semiconductor components: technologies and manufacturing principles, doping, limits and constraints due to miniaturization, resources and energies needed, approach of micro and nanotechnologies. - Operation and use of diodes, LEDs and photodiodes, BIP and FET transistors, operational amplifier, DAC & ADC : structure, characteristic electrical quantities, thermal aspects (thermal Ohm's law and thermal limits), classical applications, PWM commands for switching components and use in concrete assemblies. - Reading and analysis of diagrams, identifications of the role of components and functions performed. 	<p>Lectures : 22h00</p> <p>Tutorials : 6h00</p> <p>Lab Work : 8h00</p>
MECHANICAL DESIGN	2	CAD	<p>Description :</p> <p>CAD is a digital tool which assists the mechanical designer in his daily work. The mechanical designer:</p> <ul style="list-style-type: none"> • Designs mechanical systems, • Projects (draws), • Sizes the mechanical components, • Defines the technological characteristics, • Specifies the technical features, • Guides the production department. <p>Each session includes a theoretical part and a practical part.</p> <p>The theoretical part allows the student to improve his knowledge in the following areas:</p> <ul style="list-style-type: none"> • Use of CAD software: brings together the computer tools that make it possible to carry out a geometric modeling of an object in order to be able to simulate tests with a view to manufacturing, • Use of PLM software: corresponds to all the processes, technologies, software and methods put in place to properly manage the life cycle of a product. <p>The practical part allows the student to apply his knowledge through a team project comprising the following phases:</p> <ul style="list-style-type: none"> • Discovery of the main functions of the CAD tool and configuration of the 3D model, • Complete modeling of the project proposed by the teacher, • Integration of CAD data into the PLM, • Creation of definition plans for each part, and overall drawings, • Writing of a complete mechanical design report. 	<p>Lab Work : 8h00</p>

SEMESTER 5 (September - January)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		Design	<p>Description :</p> <p>Mechanical design is at the heart of the professional practice of an engineer. Based on specifications, the designer's objective is to quickly and efficiently arrive at an optimized pre-project. The mechanical designer:</p> <ul style="list-style-type: none"> • Designs mechanical systems, • Projects (draws), • Sizes the mechanical components, • Defines the technological characteristics, • Specifies the technical features, • Guides the production department. <p>Each session includes a theoretical part and a practical part.</p> <p>The theoretical part allows the student to improve his knowledge in the following areas:</p> <ul style="list-style-type: none"> • Tribology (friction, wear and lubrication of mechanical contacts), • Functional quotation, dimensional and geometric tolerancing, • Mechanical connections (pivot, embedding, helical and slide), • Power transmission (gears, pulley/belt, constant velocity joints). <p>The practical part allows the student to apply his knowledge through a team project comprising the following phases:</p> <ul style="list-style-type: none"> • Analysis of the initial need and development of the Functional Specifications (CDCF), • Production of kinematic diagrams, equivalence classes and linkage graphs, • Realization of sketches and first diagrams of principles, • Carrying out the sizing of the main components and mechanical parts, • Creation of definition plans for each part, and overall drawings, • Writing of a complete mechanical design report. 	Tutorials : 20h00
ENERGY 1	6	Electrical Circuits	<p>Description :</p> <ul style="list-style-type: none"> - Basic electrical circuits, current and power calculation methods ; - Basic magnetic circuits, fundamental parameters, calculation methods including the influence of air gaps, losses, different technologies ; - Different electrical components, conductors, resistances, capacitors, coils, magnetic materials, dielectric materials, characteristics and applications. - Single phase electrical system, characteristics and operating principle, power calculation method (Boucherot method), reactive power compensation, electrical lines and cables ; - Three phase electrical system, characteristics and operating principle, order of magnitude of frequencies, voltages and powers ; - Three phase loads, coupling methods, star connection, delta connection, parameters calculations such as voltage, current and power ; - Unbalanced three phase loads, neutral current calculation and the voltage between the common point and the neutral ; - Measurement of active and reactive power in a three phase system ; - Introduction to transformers and Kapp's model. 	<p>Lectures : 16h00</p> <p>Tutorials : 4h00</p> <p>Lab Work : 8h00</p>

SEMESTER 5 (September - January)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		Fluid Mechanics	<p>Description :</p> <p>Scope of industrial Fluid Mechanics.</p> <p>Presentation of various kinds of fluids (liquids and gas, physical properties of fluids, etc.).</p> <p>Presentation of various kinds of industrial flows.</p> <p>Kinematics concepts: Lagrange and Euler approaches, total derivative, streamlines, streaklines and pathlines.</p> <p>Presentation of basic / governing equations of mass, momentum and energy.</p> <p>Presentation of these equations through their reduced formulations and analysis of their application conditions. Presentation of Euler, Navier-Stokes and Generalized Bernoulli Equations.</p> <p>Industrial implementations of these governing equations to simple flows (streamtube of steady state flow of incompressible viscous fluid).</p> <p>Minor (/ local) and major (/ friction) head losses formulations for viscous flows.</p> <p>Presentation of head losses adding (/ coupling) laws: series coupling and parallel coupling head losses – Presentation of Electrical analogy</p> <p>Study of hydraulic networks and sizing of pumping systems and hydroelectric energy setups. Implementations of Generalized Bernoulli equation – Duty point concept: selection of a pumping system adapted to a required flow rate in an existing hydraulic network.</p> <p>Boundary layer concept. Drag and lift forces - Implementations to aeronautics.</p> <p>Modeling a complex physical phenomenon through dimensional analysis (Vaschy-Buckingham theorem). Using similarity analysis in order to adjust established analytical models via experimental investigation on scaled models: defining experimental conditions on scaled model and transferring obtained results from scaled model to unity scale prototype.</p>	<p>Lectures : 31h00</p> <p>Tutorials : 15h00</p> <p>Lab Work : 12h00</p>
STUDENT LIFE COMMITMENT	3	STUDENT LIFE INVOLVEMENT	Description :	
COMMITMENT & RESPONSIBILITIES 1	0	Student Life Commitment	<p>Description :</p> <p>This teaching unit is divided into 2 parts:</p> <p>1. Agreement to actively promote ECAM during a minimum of 2 ½ days, including participation in open-house events at ECAM, information sessions at high schools, or study fairs.</p> <p>2. Agreement to commit to a third party for community work during a minimum period of 25 hours. Each of the activities will start with a training and information session directly linked with the planned mission and followed up through the reporting by the associations.</p> <p>These actions will be reviewed through an oral group report. This report will highlight the students' learning experience in a previously unknown environment. It will also highlight transferable skills and competencies developed during this experience.</p>	<p>Lectures : 1h00</p> <p>Tutorials : 16h00</p>

SEMESTER 5 (September - January)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
HUMANITIES 1	2	International Openness	<p>Description :</p> <p>"MODULES</p> <p>SUSTAINABLE DEVELOPMENT - history and sociology to help grasp the scale of the ecological challenge. Interaction with other societal issues will be highlighted and will provide the keys to understanding the contemporary world and the positions of different notable players.</p> <p>PHILOSOPHY AND SCIENCES - retrace the joint history of philosophy and science. It will be shown to what extent these two disciplines share a common goal: to understand the world and explain it. The reference to historical philosophers will be analyzed. Questions relating to the scholastic period will be approached before describing the revolutionary work carried out by Descartes and Kant. With modern times, the advent of political science will be presented. Questions about technology in the light of the industrial revolution, will be raised, and this until the recent ethical debates which relate in particular to the transhumanism and the future of man in such a context.</p> <p>GEOPOLITICS – analysis of geopolitical conflicts through the observation of the phenomena of nationalism, fundamentalism, fanaticism and terrorism within a globalization coupled with fragmentation and exclusion.</p> <p>ETHICS - asking through the prism of the human sciences, the questions of responsibility which are raised in engineering. The skills acquired relate to the ethical issues of scientific progress, decryption of the levels of responsibility, the processes and consequences of innovation, and will allow the adoption of a critical attitude on the basis of commitments and choices.</p> <p>CULTURES AND RELIGIONS – integration of the idea that, in an increasingly international environment, the consideration of religious and cultural diversity becomes a major issue. Students will be invited to discover other ways of believing, in connection with other ways of living and think about the world.</p> <p>SOCIOLOGY AND ANTHROPOLOGY - Through the study of several fields (family, gender, nature and culture, institution, power, work, organization, science ...) students will understand how anthropologists and sociologists construct their knowledge to better understand the complexity of the social world in which we live.</p> <p>PSYCHOLOGY AND PSYCHANALYSIS – exploration of certain modes of relationship and mechanisms of groups through perspectives from psychological and psychoanalytic fields. The observation of the models of power and authority, historical events and current events ..., will acquire the tools of understanding of certain mechanisms involved in human relations.</p> <p>"</p>	Tutorials : 21h00
STUDENT LIFE INVOLVEMENT	2	Student Life Commitment	Description :	
FOREIGN LANGUAGE 1	2	English 1	<p>Description :</p> <p>2 hour lessons every week.</p> <p>Expanded vocabulary and tests</p> <p>Revision of grammar points</p> <p>Strategies, techniques and practice papers to prepare for the TOEIC (lower-level groups)</p> <p>Assigned presentations (individual and in pairs) on international current affairs</p> <p>CV writing workshop</p> <p>Task-based practice of language appropriate for professional and social settings.</p> <p>Written assignment related to engineering themes.</p>	Tutorials : 24h00
		A&M-EENG LV2-EC1	Description :	
INDUSTRIAL MANAGEMENT	3	Industrial Organization 1	<p>Description :</p> <p>"• Schools of organization</p> <ul style="list-style-type: none"> • PDCA, QOQCC P, PARETO, 5M, 5P & action plan. • Industrial Planning courses 1, 2 & 3 • Technical database (Nomenclatures and ranges) • Hourly rate, cost price calculation • The MRP2 system with its 3 levels • From the PIC (Industrial & Commercial Plan), determination of the PDP (Master Production Plan), calculation of charge and introduction to CBN (Calculation of net needs) <p>"</p>	<p>Lectures : 6h00</p> <p>Tutorials : 6h00</p>

SEMESTER 5 (September - January)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		Manufacturing 1	<p>Description :</p> <ul style="list-style-type: none"> - CAM approach learning (CAD/CAM Files Export/Import, choice of programming reference system, machining strategies, cutting conditions, tool path generation and machining simulation) - Discovering machining methods and setting up CNC machine tools for milling and turning. - Tri-dimensional control of mechanical parts (Introduction to the measuring system, analysis of geometric tolerances, definition of reference systems, elaboration and completion of control ranges on tri-dimensional measuring machines). 	Lab Work : 8h00
		Methods 1	<p>Description :</p> <ol style="list-style-type: none"> 1. Transformation processes of primary molded parts. <ul style="list-style-type: none"> - Foundry: the main molding processes (fusion and elaboration of metals, sand casting, shell, lost wax, under pressure) and a few rules applying to mold design and part contours - Main processes and equipment for transforming metals: ingot casting, hot rolling, cold rolling, hot forging, drop forging, smelting, sintering, welding (MIG, TIG, etc), cutting, forming. - Main processes and equipment for transforming plastics: properties and common types of plastics, different types of plastic parts, injection, extrusion, blow-molding, rotomolding, calendaring, compression, thermoforming, contact molding, projection and filament winding. 2. Dimensional and geometric metrology: Principal measurement and verification instruments, resolutions, measurable tolerance interval, adjustment standards, geometrical tolerance, etc. 3. Functional dimensioning: Analysis of an assembly drawing and calculation of condition dimensions. 4. Manufacturing analysis: Isostatism; drafting of range machining; determine and analyze geometric, technological and economic constraints; select the type of process for the fabrication. 	<p>Lectures : 8h00</p> <p>Tutorials : 16h00</p>
MECHANICAL DESIGN UPGRADE	2	Design for Beginners	<p>Description :</p> <ol style="list-style-type: none"> "1) Basic elements, rules and standards of industrial design 2) Mechanical connections <ol style="list-style-type: none"> 2.1 Embedding links 2.2 Pivot connections 2.3 Helical Connections 2.4 Slide Links: constructive solutions and sizing 2.5 Ball Joints: constructive solutions 3) Classification of materials and designation of alloys 4) Dimensional tolerances, fits and functional dimensioning 5) Sealing and lubrication 	Tutorials : 54h00
		CAD for beginners	<p>Description :</p> <p>"The student will acquire the knowledge of the CAD tool necessary for the definition and use of a digital model and know how to use this comp Classes :</p> <ul style="list-style-type: none"> • Through the Creo software, discovery of the main functions allowing the modeling of a part (extrusion, revolution, sweeping, smoothing ...) and parameterization of a digital model for easy use. • Creation of a 3D assembly of a mechanical system by numerical modeling and interference analysis. • Creation of 2D plans (definition drawing and overall drawing). • Integration of CAD data into a server ensuring the lifecycle management of a PLM product (Product Life Management). 	Lab Work : 24h00

SEMESTER 5 (September - January)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
MATHEMATICS and ALGORITHMS	3	Mathematics	<p>Description :</p> <p>Six points are addressed:</p> <ul style="list-style-type: none"> - units, - digital applications, - derivatives, - limited developments, - Differential equations, - Fresnel representation and complex numbers. <p>For each of these points, students work autonomously from course materials and worksheets for which corrections are given. These work sessions are scheduled in the timetable. A teacher is present during these sessions to answer students' questions.</p>	<p>Lectures : 1h00</p> <p>Tutorials : 10h00</p>
		Java & Algorithms	<p>Description :</p> <p>The concepts of object-oriented programming, algorithms and data structures will be implemented in Java during practical work. This course alternates between Object-Oriented Programming and Algorithms:</p> <ul style="list-style-type: none"> - Introduction, classes, objects - Algorithms: conditions, loops, methods - Construction, instantiation - Tables, lists - Search tree - Hashtables - UML : class diagrams 	<p>Lectures : 13h00</p> <p>Lab Work : 20h00</p>
MATERIALS AND STRUCTURES	6	Strength of Materials	<p>Description :</p> <p>The presentation of the methods of calculation used in Resistance of the Materials is made in the form of lectures and exercises, concerning the following points:</p> <ul style="list-style-type: none"> - writing of equilibrium equations and calculation of bond reactions in the case of isostatic structures, - plots of the load diagrams along the average fiber of a beam, - Application of stress calculation formulas in the case of stressed beams in tension / compression, bending, shearing and torsion. <p>This presentation is supplemented by a course on strain gauge strain measurement, which is applied during a lab session.</p> <p>There are two practical works :</p> <ul style="list-style-type: none"> - Gauge measurements: normal and tangential stress measurements, special gauge assemblies, - dimensioning: use of the resistance of materials to pre-dimension a structure, verification of design using finite element calculation software, highlighting the importance of design choices and modeling choices of boundary conditions. 	<p>Lectures : 22h00</p> <p>Lab Work : 8h00</p>
		Solid Mechanics	<p>Description :</p> <p>"Classes are given in the form of lectures and practical exercises done in tutorials. Practical works on an industrial finite element calculation software (ANSYS) make it possible to become familiar with a calculation model and illustrate the concepts seen in class; one session is notably devoted to the modeling of a pressurized cylinder in order to introduce the assumptions used for the calculation of thin vessels. Contents:</p> <p>Stress tensor: definition, normal stress and shear stress, local equilibrium equations, Mohr circles (3D and plane elasticity) principal stresses and maximum shear..</p> <p>Tensor of infinitesimal strain: expression, physical meaning (normal strain and shear strain), Mohr circles, strain gauges.</p> <p>Constitutive law, isotropic linear elasticity (Hooke's law), thermal strains.</p> <p>Design criteria: yield stress criterion (von Mises, Tresca) , failure criterion (Rankine), ...</p>	<p>Lectures : 14h00</p> <p>Tutorials : 6h00</p> <p>Lab Work : 8h00</p>

SEMESTER 5 (September - January)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		Materials for Engineers	<p>Description :</p> <p>Courses:</p> <ul style="list-style-type: none"> - Theoretical contributions are made in the form of lectures and application exercises carried out in class or in self-training. The courses introduce the main properties of the materials, the notions of materials microstructure and present the microstructure relations – properties – processes. - Course content: material life cycle; material families; material properties; atomic organization and microstructure; mechanical behaviour and properties: elasticity, viscoelasticity, plasticity, rupture; effect of temperature on materials: thermal dependence of properties, glass transition, fragile-ductile transition, creep, thermal shocks. -Tutorials: Tutorials illustrate and apply the concepts develop in lectures. They are focus on the comparison of the characteristics and properties of the 3 major families of materials, the determination and manipulation of the thermomechanical properties and the study of process. Lab practice: They allow learning to measure, compare and interpret the thermal and mechanical properties of materials 	<p>Lectures : 16h00</p> <p>Tutorials : 6h00</p> <p>Lab Work : 8h00</p>
SEMESTER 5	30			
SEMESTER 6 (January - June)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
ADVANCED SOFTWARE & HARDWARE 1	4	Advanced Software Development	<p>Description :</p> <p>Each student will be able to choose a language among those proposed.</p> <p>Example of languages which could be:</p> <ul style="list-style-type: none"> - Android - PHP - HTML / CSS - nodeJs <p>Course Syllabus :</p> <ul style="list-style-type: none"> - Principles of the Client-Server approach - Frontend and Backend development - Concepts and syntax related to the chosen languages - Exercises <p>The second part of the course consists of a project. This will make it possible to implement a real application.</p>	Lab Work : 16h00
		Advanced Electronics	<p>Description :</p> <p>The Advanced electronics teaching unit will consist of lectures, tutorials, and laboratory sessions. More complete functions will be studied through the association of standard electronic components: Thyristor and TRIAC on AC networks, sinusoidal oscillators, astable multi-vibrators, ADC and DAC converters, sample and hold circuits, instrumentation amplifiers, linear and switch-mode power supplies, inverters and thyristors.</p> <p>Reading and analysis of graphics and circuits, with different complexity levels. These exercises are based on technical documentation from industrial and domestic applications.</p>	<p>Lectures : 30h00</p> <p>Tutorials : 6h00</p> <p>Lab Work : 8h00</p>

SEMESTER 6 (January - June)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
INNOVATION PROJECT 1	2	Entrepreneurship 1	<p>Description :</p> <p>"Developing the skills of public speaking and professional written expression: through theoretical contributions and role plays, the Communication course will give students the basics as well as oral and written communication techniques applied to project management and the day-to-day management of teams.</p> <p>The basics of oral communication: knowing how to lead a meeting, pitch your project, manage a phone call.</p> <p>The basics of written communication: knowing how to write messages, emails, reports, meeting reports</p> <p>Understanding communication</p> <p>Why do you communicate?</p> <p>How is a message transformed?</p> <p>Prepare to speak</p> <p>Ask yourself the right questions.</p> <p>Define a goal.</p> <p>Choose and organize your ideas.</p> <p>Structure your intervention.</p> <p>Succeed in speaking</p> <p>Capturing attention</p> <p>Strongly argue your speech: Strengthen the impact of messages</p> <p>Choose a lively expression: gain clarity</p> <p>Illustrate your words with visual aids: Giving life to the intervention</p> <p>Conclude according to the objective of your intervention</p> <p>Adapt your behavior to the audience: Express yourself with conviction</p> <p>To know how to listen</p> <p>Communicate well in writing</p> <p>Why and how to communicate effectively in writing?</p> <p>What are the different written communication media for the manager?</p> <p>How to write correctly and effectively?</p> <p>Feedback from entrepreneurs.</p> <p>"</p>	Tutorials : 20h00
		creativity	<p>Description :</p> <p>Creativity is a skill that requires work and discipline. This course allows students to meet entrepreneurs from the region. This course also allows them to discover creativity tools and techniques in order to identify, collectively, an innovative idea of a mechatronic product/service that could lead to the creation of a company thereafter. The aim is to make students aware of entrepreneurship.</p> <p>Supervised by entrepreneurs from the region, the module is structured around 3 highlights:</p> <ol style="list-style-type: none"> 1. Divergent phase of creativity in which students produce many ideas, 2. Convergent phase of creativity in which students select the most innovative idea in order to detail it and investigate its potential, 3. Phase of publication, communication and pitch of the chosen idea in front of a jury in order to test the concept and convince fictitious investors. 	<p>Lectures : 2h00</p> <p>Tutorials : 4h00</p> <p>Project : 4h00</p>
		bibliographic search	<p>Description :</p> <p>Know the different types of documents, the tools to find them.</p> <p>Know how to cite sources and write a bibliography.</p> <p>Know the notion of plagiarism.</p>	<p>Lectures : 1h00</p> <p>Lab Work : 2h00</p>

SEMESTER 6 (January - June)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		eco innovation	<p>Description :</p> <p>The purpose of this course is to guide students in their general eco-design approach. Ecodesign is the systematic integration of environmental aspects from the design and development of products with the aim of reducing negative environmental impacts throughout their life cycle. This early stage approach to a design process aims to find the best balance between environmental, social, technical and economic requirements in product design and development. The "NF X 30-264 Environmental management" standard helps to set up an eco-design approach.</p> <p>Students will have a reflection in the upstream phases of the design, via generic questions and qualitative evaluations. The following strategy will be detailed:</p> <ul style="list-style-type: none"> • Aim for a high degree of functionality, • Ensure safe use, • Identify usage scenarios and their drifts, • Eco design centered on use, • Use less energy and material when using, • Use the resources implemented as intensively as possible, • Use the resources implemented for as long as possible, • Reuse the materials implemented, • Source with other materials/components. 	Lectures : 2h00
		Entrepreneurship 1	<p>Description :</p> <p>Feedback from entrepreneurs.</p>	Tutorials : 2h00
		Methods 2	<p>Description :</p> <p>"Digitally Controlled Machine Tools (MOCN): Operative part, control part (DCN), kinematics & definition of axes, frames of reference & machining origins, typology of MOCNs.</p> <ul style="list-style-type: none"> - MOCN programming: Organization & structure of a CNC program, presentation of the main functions of the ISO code. - CAD / CAM approaches: Export & Import of CAD / CAM files, selection criteria for programming references, geometry of parts to be machined & choice of machining strategies, cutting conditions, generation of toolpaths and 2D simulation & 3D of the machining program. 	Tutorials : 12h00
INDUSTRIAL DESIGN AND MANAGEMENT	3	CAD 2	<p>Description :</p> <p>CAD is a digital tool which assists the mechanical designer in his daily work. The mechanical designer:</p> <ul style="list-style-type: none"> • Designs mechanical systems, • Projects (draws), • Sizes the mechanical components, • Defines the technological characteristics, • Specifies the technical features, • Guides the production department. <p>Each session includes a theoretical part and a practical part.</p> <p>The theoretical part allows the student to improve his knowledge in the following areas:</p> <ul style="list-style-type: none"> • Use of CAD software: brings together the computer tools that make it possible to carry out a geometric modeling of an object in order to be able to simulate tests with a view to manufacturing, • Use of PLM software: corresponds to all the processes, technologies, software and methods put in place to properly manage the life cycle of a product. <p>The practical part allows the student to apply his knowledge through a team project comprising the following phases:</p> <ul style="list-style-type: none"> • Discovery of the main functions of the CAD tool and configuration of the 3D model, • Complete modeling of the project proposed by the teacher, • Integration of CAD data into the PLM, • Creation of definition plans for each part, and overall drawings, • Writing of a complete mechanical design report. 	Lab Work : 8h00

SEMESTER 6 (January - June)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		Design (Upgrade 2)	<p>Description :</p> <p>This course is reserved for students who have little or no design before their arrival in the Arts and Crafts course.</p> <p>The content of this course is a continuation of the Design 1 Upgrade program:</p> <ol style="list-style-type: none"> 1) Motion transmission function <ol style="list-style-type: none"> 1.1 Transmission without transformation of motion without modification of angular speed Couplings, clutches, torque limiters and brakes 1.2 Transmission without transformation of motion with modification of angular speed Gears and pulley systems 1.3 Transmission with motion transformation Screw, nut, eccentric, crank rod, cam, rack and pinion system 2) Preliminary design, functional analysis and development of functional specifications 3) Analyze plans 	Tutorials : 28h00
		Industrial Organization 2	<p>Description :</p> <p>"• The Stock function Zero unnecessary stock, calculation of safety stock, supply policy: Variable date / Fixed Qty, Fixed date / Fixed Qty, Fixed Qty / Fixed date, Fixed date / Variable Qty, Noria, Variable date / Variable Qty. • VSM (value Score Mapping) Takt time, Lead Time, cycle time. • The KANBAN method (drawn flows) • Factory locations • Time determination & ergonomics standard • Workstation analysis methodology & workstation robotization elements. "</p>	<p>Lectures : 6h00</p> <p>Tutorials : 6h00</p>
		Health, Safety and Environment	<p>Description :</p> <p>Definitions and content of OHS-QVT policies</p> <ul style="list-style-type: none"> o Focus on prevention o Health insurance figures (occupational accidents, occupational diseases and causes) o Focus on MSDs o What cost for the company <p>Identify the economic and competitive challenges of eco-design</p> <ul style="list-style-type: none"> o The regulatory and normative context o Customer requests, eco-responsible purchases o Other incentives: financial institutions, competitors, NGOs <p>Assimilate the fundamentals of eco-design</p> <ul style="list-style-type: none"> o Global consideration of the environment: multi-criteria o "Life cycle" approach o Ecological quality of products o Innovation and eco-design o Transversality of the approach: mobilize stakeholders in the company and beyond o Identify the environmental assessment tools adapted to the company o Relevance and field of validity of the different tools: Life Cycle Analysis (LCA), derived methods, energy content, etc. o Simplified practice of an LCA tool o Practice of eco-innovation oriented creativity tools <p>Films, videos and quizzes for dynamic and fun animation to interest students and give meaning to the subject matter which is truly essential for everyone.</p>	Tutorials : 8h00
COMMITMENT & RESPONSIBILITIES	0	Social Commitment & Responsibility	<p>Description :</p> <p>This teaching unit is divided into 2 parts:</p> <ol style="list-style-type: none"> 1. Agreement to actively promote ECAM during a minimum of 2 ½ days, including participation in open-house events at ECAM, information sessions at high schools, or study fairs. 2. Agreement to commit to a third party for community work during a minimum period of 25 hours. Each of the activities will start with a training and information session directly linked with the planned mission and followed up through the reporting by the associations. <p>These actions will be reviewed through an oral group report. This report will highlight the students' learning experience in a previously unknown environment. It will also highlight transferable skills and competencies developed during this experience.</p>	<p>Tutorials : 2h00</p> <p>Project : 40h00</p>

SEMESTER 6 (January - June)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
ENERGY 2	4	Applied Thermodynamics	<p>Description :</p> <p>The application of thermodynamic principles to the study of thermal machinery is taught in masterclasses. Class exercises are performed in the following areas:</p> <ul style="list-style-type: none"> - Review of fluids and fluids transformations, concept of work and heat, and finally the first and second principle. - Positive displacement compressors, turbo-compressors: description of the main types of machines, the thermodynamic cycle and powers at stake. - Vapor-compression refrigerating units: technology, refrigerants, operating cycle. - Internal combustion engines: Otto and Diesel cycles, efficiency and practical aspects (engine components, combustion, polluting gas emissions) - Gas turbines and turbojet engines Brayton cycle, influence of irreversibility on thermal efficiency. - Steam power plants: Hirn and Rankine study on cycles. 	<p>Lectures : 10h00</p> <p>Tutorials : 10h00</p> <p>Lab Work : 8h00</p>
		Electrical machines	<p>Description :</p> <p>Introduction to rotating machines: definition of an electromechanical converter, illustration, general description of machines, reminder of electromagnetic laws (Laplace, Lenz-Faraday) demonstration of the creation of an electromotive force and a torque in a simplified structure.</p> <p>The direct current machine: description, particularity of design of the electrical contacts by brush-collectors. Reversibility of the machine. Separate excitation, shunt and series modes: description of the circuit model and plot of torque and speed characteristics as a function of armature voltage and current.</p> <p>The synchronous machine: description, comparison of a wound rotor machine with permanent magnets. Demonstration of obtaining the circuit model. Description of different models of the synchron machine: linear, Behn-Eschenburg and Potier. Implementation of synchronous machines: connection to the network.</p> <p>The Induction machine: description, Demonstration of obtaining the circuit model. Plot of the torque-slip and speed torque characteristic.</p> <p>Openness to the use of electric machines in energy production. Conference on the adequacy of primary energy - type of turbine - type of electrical machine</p> <p>Tutorials :</p> <ul style="list-style-type: none"> - Study of direct current and asynchronous motors in railway traction, the case of TGV - Comparison of linear and Behn-Eschenburg models for the calculation of an operating point of a synchronous alternator. <p>Practical work:</p> <ul style="list-style-type: none"> - Coupled system of a DC motor and a synchronous alternator - Study of the MAS characteristics 	<p>Lectures : 14h00</p> <p>Tutorials : 4h00</p> <p>Lab Work : 8h00</p>
STUDENT LIFE COMMITMENT 2	3	STUDENT LIFE COMMITMENT	Description :	
HUMANITIES 2	2	Preparation for the Applied Engineering Internship	<p>Description :</p> <ul style="list-style-type: none"> • Understand the professional environment: the company, its typologies, its main functions, its organization, its current issues, its different professions, market trends, business sectors. • Build and know how to confirm your professional project. • Update and mark up your research documents (CV, LM, etc.). • Prospect, make yourself visible, deploy the networking approach, prepare for the different recruitment methods. 	<p>Lectures : 6h00</p> <p>Tutorials : 8h00</p>

SEMESTER 6 (January - June)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		Self Awareness 1	Description : "Understanding of the psychic functioning of the individual to allow a better knowledge of oneself. This knowledge will ultimately facilitate the deployment of managerial responsibilities. Understanding of the different stages of development from child to adult (Freud's topical 1 and 2), of the construction of the personality (the different structures such as neuroses, psychoses, borderline states). Understanding of the psychic functioning of a group, its phases of development and its defense mechanisms."	Tutorials : 6h00
		Interculturalit y	Description : "Knowledge and understanding of intercultural issues. Exploration of cultural perceptions, analysis of the concepts of culture shock, ethnocentrism, stereotypes. Contribution of crossed looks. Understanding of the importance of preparation for intercultural encounter. First approach of the realities to discover. Presentation of the soft skills to be implemented. Understanding of relationships with others, relationships at work, relationships with the world in a different context." "	Tutorials : 6h00
STUDENT LIFE INVESTMENT 2	2	STUDENT LIFE INVOLVEMENT	Description :	
FOREIGN LANGUAGE 2	3	English 2	Description : 2 hour lessons every week. Expanded vocabulary and tests Revision of grammar points Strategies, techniques and practice papers to prepare for the TOEIC (lower-level groups) Assigned presentations (individual and in pairs) on technical subjects Task-based practice of language appropriate for professional and social settings. Be able to ask and field questions related to scientific and technical subjects Written assignment related to engineering themes (scientific poster for higher-level groups)	Tutorials : 24h00

SEMESTER 6 (January - June)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		Second Foreign Language	<p>Description :</p> <p>2 hour lessons every week.</p> <p>Expanded vocabulary</p> <p>Revision of grammar points</p> <p>Improvement of phonological control</p> <p>Language skills according to different CEFR level groups:</p> <p>A1</p> <p>Can establish basic social contact by using the simplest everyday polite forms of: greetings and farewells; introductions; saying please, thank you, sorry etc.</p> <p>A2/B1</p> <p>Has a repertoire of basic language, which enables him/her to deal with everyday situations with predictable content, though he/she will generally have to compromise the message and search for words.</p> <p>Can produce brief everyday expressions in order to satisfy simple needs of a concrete type: personal details, daily routines, wants and needs, requests for information.</p> <p>Can use basic sentence patterns and communicate with memorised phrases, groups of a few words and formulae about themselves and other people, what they do, places, possessions etc.</p> <p>Has a limited repertoire of short memorised phrases covering predictable survival situations; frequent breakdowns and misunderstandings occur in non-routine situations.</p> <p>Has enough language to get by, with sufficient vocabulary to express him/herself with some hesitation and circumlocutions on topics such as family, hobbies and interests, work, travel, and current events, but lexical limitations cause repetition and even difficulty with formulation at times.</p> <p>B2</p> <p>Can express him/herself clearly and without much sign of having to restrict what he/she wants to say.</p> <p>Has a sufficient range of language to be able to give clear descriptions, express viewpoints and develop arguments without much conspicuous searching for words, using some complex sentence forms to do so.</p> <p>Has a sufficient range of language to describe unpredictable situations, explain the main points in an idea or problem with reasonable precision and express thoughts on abstract or cultural topics such as music and films.</p> <p>C1</p> <p>Can select an appropriate formulation from a broad range of language to express him/herself clearly, without having to restrict what he/she wants to say.</p>	Tutorials : 18h00

SEMESTER 6 (January - June)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		Second Foreign Language	<p>Description :</p> <p>2 hour lessons every week.</p> <p>Expanded vocabulary</p> <p>Revision of grammar points</p> <p>Improvement of phonological control</p> <p>Language skills according to different CEFR level groups:</p> <p>A1</p> <p>Can establish basic social contact by using the simplest everyday polite forms of: greetings and farewells; introductions; saying please, thank you, sorry etc.</p> <p>A2/B1</p> <p>Has a repertoire of basic language, which enables him/her to deal with everyday situations with predictable content, though he/she will generally have to compromise the message and search for words.</p> <p>Can produce brief everyday expressions in order to satisfy simple needs of a concrete type: personal details, daily routines, wants and needs, requests for information.</p> <p>Can use basic sentence patterns and communicate with memorised phrases, groups of a few words and formulae about themselves and other people, what they do, places, possessions etc.</p> <p>Has a limited repertoire of short memorised phrases covering predictable survival situations; frequent breakdowns and misunderstandings occur in non-routine situations.</p> <p>Has enough language to get by, with sufficient vocabulary to express him/herself with some hesitation and circumlocutions on topics such as family, hobbies and interests, work, travel, and current events, but lexical limitations cause repetition and even difficulty with formulation at times.</p> <p>B2</p> <p>Can express him/herself clearly and without much sign of having to restrict what he/she wants to say.</p> <p>Has a sufficient range of language to be able to give clear descriptions, express viewpoints and develop arguments without much conspicuous searching for words, using some complex sentence forms to do so.</p> <p>Has a sufficient range of language to describe unpredictable situations, explain the main points in an idea or problem with reasonable precision and express thoughts on abstract or cultural topics such as music and films.</p> <p>C1</p> <p>Can select an appropriate formulation from a broad range of language to express him/herself clearly, without having to restrict what he/she wants to say.</p>	Tutorials : 18h00

SEMESTER 6 (January - June)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		LV3	<p>Description :</p> <p>2 hour lessons every week.</p> <p>Expanded vocabulary</p> <p>Revision of grammar points</p> <p>Improvement of phonological control</p> <p>Language skills according to different CEFR level groups:</p> <p>A1</p> <p>Can establish basic social contact by using the simplest everyday polite forms of: greetings and farewells; introductions; saying please, thank you, sorry etc.</p> <p>A2/B1</p> <p>Has a repertoire of basic language, which enables him/her to deal with everyday situations with predictable content, though he/she will generally have to compromise the message and search for words.</p> <p>Can produce brief everyday expressions in order to satisfy simple needs of a concrete type: personal details, daily routines, wants and needs, requests for information.</p> <p>Can use basic sentence patterns and communicate with memorised phrases, groups of a few words and formulae about themselves and other people, what they do, places, possessions etc.</p> <p>Has a limited repertoire of short memorised phrases covering predictable survival situations; frequent breakdowns and misunderstandings occur in non-routine situations.</p> <p>Has enough language to get by, with sufficient vocabulary to express him/herself with some hesitation and circumlocutions on topics such as family, hobbies and interests, work, travel, and current events, but lexical limitations cause repetition and even difficulty with formulation at times.</p> <p>B2</p> <p>Can express him/herself clearly and without much sign of having to restrict what he/she wants to say.</p> <p>Has a sufficient range of language to be able to give clear descriptions, express viewpoints and develop arguments without much conspicuous searching for words, using some complex sentence forms to do so.</p> <p>Has a sufficient range of language to describe unpredictable situations, explain the main points in an idea or problem with reasonable precision and express thoughts on abstract or cultural topics such as music and films.</p> <p>C1</p> <p>Can select an appropriate formulation from a broad range of language to express him/herself clearly, without having to restrict what he/she wants to say.</p>	Tutorials : 18h00
ADVANCED MATERIALS AND STRUCTURES 1	4	Metallic Materials	<p>Description :</p> <p>"Different means to give a metallic material specific properties and knowing how to explain the mechanisms / parameters controlling these properties.</p> <p>Processes that allow their properties to change both in the mass and on the surface.</p> <p>Mechanical resistance, modification of surface conditions, resistance to wear, etc.</p> <p>Laboratory work :</p> <ul style="list-style-type: none"> - Heat treatment of aluminum alloys (4h) - Hardenability of different steel grades - Jominy test. (4h) - Design and realization of a low pressure carburizing cycle (4h). - Control of nitrided parts (4h). 	<p>Lectures : 14h00</p> <p>Lab Work : 16h00</p>

SEMESTER 6 (January - June)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		Polymer Materials	<p>Description :</p> <p>Courses (14h):</p> <p>The learning will be complementary compared to the learning provided in the common core.</p> <p>We will deal with the different means to give a polymer material specific properties, while knowing how to explain the mechanisms/parameters controlling these properties. In particular, we will be able to control the influences of the formulation and the conditions of elaboration on the final properties of the material, while being able to control and follow the modification of the materials.</p> <p>We will focus, for example, on ways to provide a conduction property to this class of intrinsically nonconductor materials, or to understand and improve the biodegradation or recycling of plastic materials.</p> <p>Practical work (16h) : Two main parts:</p> <p>Polymer materials (2*4h): the two main classes of polymer materials will be studied :</p> <ul style="list-style-type: none"> - thermoplastics - thermosets (including the mechanical properties of composite materials) <p>The influence of formulations and processing conditions will be compared with the final properties of the material.</p> <p>Project (2*4h):</p> <p>A two-session project will make it possible to implement the general skills acquired, on a particular theme. This project should make it possible to:</p> <ul style="list-style-type: none"> - Exercise faculties of increase in competence on a little-known subject - Propose a study compatible with the imperatives of time and feasibility with the available equipment - Design and carry out the necessary samples - Carry out the planned tests, use the results and present the study in the form of a report. <p>One subject will be dealt with among three proposed subjects.</p>	<p>Lectures : 14h00</p> <p>Lab Work : 16h00</p>

SEMESTER 6 (January - June)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
MATERIALS AND STRUCTURES : APPLICATIONS	7	Structural Analysis	<p>Description :</p> <p>The course is divided into two parts.</p> <p>A section "Strength of Materials" which exposes through courses and exercises, the physical parameters which influence the behavior of a structure.</p> <p>This part contains the following chapters:</p> <ul style="list-style-type: none"> - calculations of displacements in beam structures, - study of the particularities of hyperstatic structures compared to isostatic structures, - introduction to plastic calculation, notions of plastic adaptation and plastic ruin, - introduction to elastic instabilities and geometric nonlinearities, example of buckling of compressed beams. <p>A section " Finite Element analysis" which exposes through courses and comparisons of results of calculations, the parameters of analysis whose choices must be reasoned.</p> <p>This part contains the following chapters:</p> <ul style="list-style-type: none"> - Finite Element method: notion of approximation and influence of the mesh, - types of elements, - boundary conditions - analysis options. <p>Practical work is associated with each of these parts.</p> <p>The practical work associated with the "Strength of Materials" part includes experimental verifications, in addition to finite element simulations. These practical works are:</p> <ul style="list-style-type: none"> - equations of a nonlinear problem (flexible elastic loaded transversely), resolution of the equations, experimental verification of the results, use of finite element calculation software in order to reproduce the observed phenomena, - experimental study of the buckling of a compressed beam in different loading cases, use of finite element calculation software in order to reproduce the observed phenomena. <p>The practical work associated with the "Finite Element Analysis" part aims to enable students to use calculation software recognized in the industry (ANSYS) by themselves, to make them discover the extent of the possibilities of this software and to make them aware of the risks of modeling errors. These TPs are:</p> <ul style="list-style-type: none"> - discovery of the finite element method: principle of approximation and influence of the mesh - synthesis on the activity calculation of structures: dimensioning of a structure (comparison RDM -EF in the areas comparable to beams, study of influence of the mesh in the zones of stress concentrations, interpretation of the results, elastoplastic analysis . 	<p>Lectures : 20h00</p> <p>Lab Work : 16h00</p>
		Materials for Engineering Office	<p>Description :</p> <p>The course is based on the analysis of concrete applications to provide the necessary concepts for the understanding, definition and use of technical, functional, economic and / or environmental criteria for the choice of materials and processes</p> <p>Course content :</p> <ul style="list-style-type: none"> - Materials (and processes) choice : main principles and methodology - Metallic materials for highly stressed mechanical parts, adaptation of mechanical properties by heat treatment processes, influence of parts size - Light structural parts: use of low density metallic materials, engineering polymers or composite materials - Materials for very high temperature parts - Durability of materials (corrosion, polymers aging) - Parts end of life (recycling, ...) <p>Practice</p> <p>The practical work will highlight and observe the effects of corrosion and aging on metals and polymers. The choice of materials will be implemented through case studies through the use of a software for materials choice</p>	<p>Lectures : 38h00</p> <p>Lab Work : 12h00</p>

SEMESTER 6 (January - June)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
PROGRAMMING AND DATABASES	2	Software Development	<p>Description :</p> <p>Concepts of software development project management, study of each regular stage in the process: analysis of needs, functional specifications, UML, architecture, modeling, test, acceptance test, operating systems. Study of a few models in development cycles with critical insight (V, W, Spiral, Agile methodology).</p> <p>Project: Development of a Java application in groups of 4 to 5 persons, using a project management methodology, within a timeframe of five 4-hour sessions.</p> <p>The project is divided into stages:</p> <ul style="list-style-type: none"> - Drafting specifications - Modelization, UML class diagram - Development - Use of GIT - Defense 	<p>Lectures : 3h00</p> <p>Lab Work : 20h00</p>
		DataBase	<p>Description :</p> <p>The MCD will be approached using the UML class diagram and the MLD with the relational table model.</p> <p>Using SQL language for databases.</p>	<p>Lectures : 2h00</p> <p>Tutorials : 2h00</p> <p>Lab Work : 4h00</p>
AUTOMATIC SYSTEMS AND DATA PROCESSING	3	Automatics 1	<p>Description :</p> <p>"</p> <p>Boolean Algebra, Combinatorial and Sequential Logic</p> <ul style="list-style-type: none"> - Numeration, and Coding - Digital functions - Le Grafcet - Mobile robots <p>"</p>	<p>Lectures : 10h00</p> <p>Tutorials : 4h00</p> <p>Lab Work : 8h00</p>
		Statistics	<p>Description :</p> <ul style="list-style-type: none"> - The use of statistics and probabilities in the industry. - Different graphic representation modes (Pareto, box plot, histogram, etc) - Concept of population and sampling - Data characterization: average, median, quartiles, standard deviation, variance - Probability calculations (Bayes formula) - Statistical laws: <p>Discrete laws (binomial law, hypergeometric law, Poisson)</p> <p>Continuous laws (Normal law, Student)</p> <ul style="list-style-type: none"> - Confidence intervals - Type 1 risk, type 2 risk - Variance analysis 	<p>Lectures : 16h00</p> <p>Lab Work : 8h00</p>
ENERGY TRANSITION 1	4	Fundamentals of Energy	<p>Description :</p> <p>"Fossil energy / easy energy: Back to Basics, Basics of energy in the 21st century, what is energy? Order of magnitude change in consumption and demography, primary energy or final energy what are we talking about? the question of returns.</p> <p>- Fossil energy / easy energy 2: The French energy mix, the different uses, the issue of travel, housing, consumption, price formation, the message of the Club of Rome, Oil, gas and coal, what is the situation? What climate for tomorrow? the question of stocks.</p> <p>- Some possible solutions: Energy savings and the issue of social acceptability, factor 4, what would sustainable development require? Respect the Kyoto protocol: easy or not easy? Renewables, what are they? exactly? Carbon has its accounting plan: the Bilan Carbone. Carbon offsetting, the Negawatt scenario, from Kyoto to Copenhagen, what's new?, The political toolbox,</p> <p>- Prospective: What challenges for renewable energy in France, what scenarios for the future?</p> <p>- What impacts for the professions of tomorrow? based on Kaya's equation, which profession for sustainable development, analysis by function, analysis by sector, analysis from classified ads from different files."</p>	<p>Lectures : 12h00</p>

SEMESTER 6 (January - June)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		Advanced Thermodynamics	<p>Description :</p> <ol style="list-style-type: none"> Changes and coexistence of phases Steam engine cycles <ol style="list-style-type: none"> Operating principle and energy balances. Use of usual thermodynamic diagrams. Practical case study Refrigerating machines with mechanical vapor compression. <ol style="list-style-type: none"> Refrigeration overview Importance of the nature of the refrigerant. Operation and performance of refrigeration machines. Practical case study Heat pumps. <ol style="list-style-type: none"> The different uses of heat pumps. Operation and performance of heat pumps. Practical case study Humid air and air conditioning <ol style="list-style-type: none"> General information on humid air Importance on the energy consumption of buildings Using the humid air diagram Practical case study 	<p>Lectures : 10h00</p> <p>Tutorials : 10h00</p> <p>Lab Work : 12h00</p>
		Design of Electrical machines	<p>Description :</p> <ul style="list-style-type: none"> Identification games for the different types of machines with a participatory restitution to describe each of the rotating electrical machines. Description of the technical vocabulary of synchronous electric machines with permanent magnets, using real open and dismantled machines as support. Reminders of the physical phenomena in place in electrical machines (Maxwell's laws) and details on the numerical calculation methods that can be envisaged in electromagnetism to solve these complex equations. Comparison of numerical calculation methods and justification of the choice of finite elements. Description of single and double layer winding techniques and their influence on the induction harmonics present in the electrical machine. Apprehension of the techniques for calculating the winding coefficient via the distribution and shortening coefficient. Description of the analytical sizing method with the progress of a complete example Description of the modeling approach: analytical pre-dimensioning with the method seen previously, description of the geometry in MATLAB, piloting of the FEMM4.2 finite element CAD software by MATLAB. Realization of a 12-hour project on the design of a synchronous machine with permanent magnets based on industrial specifications. 	<p>Lectures : 4h00</p> <p>Tutorials : 2h00</p> <p>Lab Work : 12h00</p>
FACTORY 4.0 - 1	4	Methods 3	<p>Description :</p> <p>"</p> <p>Definition and configuration of MOCN resources: tools, chuck, turret, machining assembly, etc.</p> <ul style="list-style-type: none"> Configuration of MOCN workspace: machine origins, machining assembly and part. Simulation of the CNC program from the ISO code. Detection of MOCN collisions, assembly, machining and workpiece. Validation of the CNC program for mass production. <p>"</p>	<p>Tutorials : 12h00</p>

SEMESTER 6 (January - June)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		CAD 3	<p>Description :</p> <p>This course allows students to improve their use of advanced digital CAD tools. The mechanical designer:</p> <ul style="list-style-type: none"> • Designs mechanical systems, • Projects (draws), • Sizes the mechanical components, • Defines the technological characteristics, • Specifies the technical features, • Guides the production department. <p>Each session includes a theoretical part and a practical part.</p> <p>The theoretical part allows the student to improve his knowledge in the following areas:</p> <ul style="list-style-type: none"> • Advanced use of CAD software: brings together the computer tools that make it possible to carry out a geometric modeling of an object in order to be able to simulate tests with a view to manufacturing, • Advanced use of simulation tools (kinematics, dynamics, digital), • Advanced use of augmented reality tools, • Advanced use of topological optimization tools, • Advanced use of PLM software: corresponds to all the processes, technologies, software and methods put in place to properly manage the lifecycle of a product. <p>The practical part allows the student to apply his knowledge through a team project comprising the following phases:</p> <ul style="list-style-type: none"> • Complete modeling of the project proposed by the teacher, • Complete production of a prototype using the tools available in the FabLab, • Writing of a complete mechanical design report, • Presentation of a communication medium and promotion of the work carried out over the year. 	Lab Work : 28h00
		Statistics and Big Data	<p>Description :</p> <p>"Comparison of several statistical populations</p> <ul style="list-style-type: none"> - Analysis of variance - Modeling of a process (polynomial regression, design of experiments) - Statistical control of the processes (notion of capability, control charts, R and R test) - Definition of Big Data. - The stages of a Big Data project. - The different technologies for processing big data. - The applications of Big Data in the company, the focus being on industrial activities. - Statistics in the age of Big Data. <p>"</p>	<p>Lectures : 8h00</p> <p>Lab Work : 12h00</p>
SEMESTER 6	30			

A&M - YEAR 4 (1 academic semester and 1 semester abroad)

SEMESTER ABROAD				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
APPLIED INTERNSHIPS	3	Applied Engineering Internship	Description : During this applied engineering internship (13 to 16 weeks, starting at the end of year 3), the engineering student joins a company or a university laboratory with the objective of taking on a variety of tasks and assignments that correspond to his/her level of studies.	Traineeship : 455h00
SEMESTER ABROAD	30			
ACADEMIC SEMESTER				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
ADVANCED DIMENSIONING AND OPTIMIZATION	6	Damage and Failure	Description : Failure under static stresses The brittle and ductile fracture mechanisms are studied for the different families of materials as well as the various influencing parameters. The brittle ductile transition, the toughness, as well as the fracture statistics, complete this part to refine the choices of materials and their dimensioning for the strenght to sudden fracture by crack propagation. Failure under dynamic stresses The mechanisms of fatigue failure in materials, and the bases of pre-dimensioning of parts for dynamic stresses are studied. The course is illustrated with numerous examples and exercises from expertises treated in the laboratory. Practical work In the form of mini projects allowing for a global consideration of the design, choice of materials, analytical and numerical calculations and expertise of parts subjected to dynamic or statics constraints.	Lectures : 14h00 Lab Work : 24h00
		Vibratory Expertise	Description : The chapters of the course, grouped according to the general objectives, are as follows: Characterization of the vibrations of a system: - analytical study: sub-structuring of a complex system, - experimental study: means of measurement and software for experimental modal analysis. Vibration reduction methodology: - actions on the source of the vibrations, - actions on the transmission of vibrations, - actions on the system's own response. Conditional and provisional maintenance of rotating machinery: - types of defects in rotating machinery, - choice and limitations of monitoring indicators and diagnostic tools. These chapters are complemented by the presentation of frequency analysis tools: Fourier series and digital Fourier transform, used in the experimental characterization of systems and diagnosis of defects in rotating machines. The theoretical knowledge on the characterization of the vibrations of a system is implemented during three sessions of practical work, relating respectively to the use: - means of measurement, - a modal analysis software, - finite element calculations software. These three sessions make it possible to compare, on the same system, the vibratory characteristics extracted from measurements with those calculated from a modeling of the system.	Lectures : 14h00 Lab Work : 12h00

ACADEMIC SEMESTER				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		Mechanical Topology Optimization	<p>Description :</p> <p>The first session is devoted to the general presentation of the method followed by an example of application on the ANSYS WorkBench software. This example will illustrate the different options and the different stages of a topological optimization.</p> <p>The following 3 sessions will be devoted to carrying out a project in a group and independently. This project will consist of the following stages:</p> <p>Mechanical characterization of the material used: creation and 3D printing of test specimens which will be subjected to a tensile test. The anisotropy of the material can be highlighted and characterized.</p> <p>Topological optimization: search for an optimized solution for a given load case. The influence of parameters such as mesh size, boundary conditions or optimization methods should be evaluated.</p> <p>Numerical validation of the optimized structure (simulation on the optimized structure)</p> <p>3D printing of the optimized structure and mechanical test on this part. The experimental results will be compared with the numerical results; we will then try to explain any differences.</p>	<p>Tutorials : 4h00</p> <p>Project : 12h00</p>
STRUCTURAL DYNAMICS	2	Structural Dynamics	<p>Description :</p> <p>The course resumes the basics of rigid body mechanic before introducing less common notions such as shocks theory and vibration analysis.</p> <p>The movement is studied independently of its causes first. The kinematic and the associated torsor are introduced. The course focus and the point before extrapolating the results to generic solids.</p> <p>Mechanical actions and their modelling is presented in order to apply the dynamic notions.</p> <p>Newton's laws are introduced et allow to link the movement to it cause.</p> <p>Energy is approached as well as the basics of shock theory, which is at the limit of the rigid body hypothesis.</p> <p>Finally, the vibration analysis and it matrix formalism is presented and applied at two degrees of freedom systems.</p> <p>Exercises are done after each notion to put into practice formula and method introduced in the course.</p>	<p>Lectures : 26h00</p> <p>Lab Work : 8h00</p>
INDUSTRY OF THE FUTURE	3	Supply Chain : Fresh connection	<p>Description :</p> <p>The Fresh Connection "is an online simulation exercise game of the management of the supply chain of a company in difficulty. The Fresh Connection is therefore a real simulator in which the Board of a company is faced with a difficult situation and must do so. remedy A real challenge!</p> <p>Organized as a management committee, the team members develop a strategy to maximize the profitability of their business and satisfy their customers.</p> <p>The game is organized in 6 rounds spread over 3 sessions of 4 hours. The difficulty is growing with more and more parameters to integrate and an increasingly constrained environment.</p> <p>Management of supplies and stocks (Safety stocks, batch sizes, ...)</p> <p>Production and operations management (Loads & Capacity, Launch, Scheduling, machine investments, Lean Manufacturing, ...)</p> <p>Customer management (Sales) Service level delivery times, Product quality service level.</p> <p>Supplier management (Purchasing)</p>	<p>Lectures : 4h00</p> <p>Lab Work : 12h00</p>
		Maintenance 1	<p>Description :</p> <ul style="list-style-type: none"> - Introduction & definition of the RMA system: Reliability, Maintainability and Availability of production equipment, - Study of repairable FMD systems: indicators, characterization methods, reliability laws: study of models Exponential & Weibull, - Application to the management of spare parts, - Case study. 	<p>Lectures : 2h00</p> <p>Tutorials : 6h00</p>

ACADEMIC SEMESTER				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		robotization methodologies	<p>Description :</p> <p>Realization of a pre-diagnosis containing 5 influencing factors. TP1 carried out on equipment from the Gene Haas Center with the study of 2 types of GHC robots.</p> <p>Economical with ROI calculation</p> <p>Organizational with the impact on flows</p> <p>Human and social with in particular training</p> <p>Maintenance following the integration of new techniques</p> <p>Quality with the goal of zero defects</p> <p>Carrying out of a diagnosis comprising 6 parts. TP2 carried out on equipment from the Gene Haas Center with the study of 2 types of GHC robots.</p> <p>Information gathering</p> <p>Detailed operating mode</p> <p>Cycle time analysis</p> <p>Solution of principle and choice of robotic cell</p> <p>Summary of the welding machine robotization project</p> <p>Balance sheet</p> <p>Drafting of specifications intended for consultation with integrators</p>	Lab Work : 8h00
		Basics of robotization	<p>Description :</p> <ul style="list-style-type: none"> • Kinematics/movement • Learning points on a dedicated software • Handling of ECAM's virtual and physical robots 	<p>Lectures : 2h00</p> <p>Tutorials : 2h00</p> <p>Lab Work : 4h00</p>
ENERGETIC 3	4	control of electrical machine	<p>Description :</p> <p>Presentation of the physical phenomena involved in semiconductors (PN junction and MOS effect). Description of the basic components of power electronics (Diode, Thyristor, MOSFET, IGBT).</p> <p>Study of the basic circuits of power electronics: Choppers (Buck, Boost, Buck-Boost), Single-phase and three-phase rectifiers and inverters.</p> <p>Presentation of the pulse width method via a visual analogy.</p> <p>Reminder of the DC machine models and their characteristics (Torque-current and Speed-voltage). Presentation of power converters according to the type of network (choppers from DC and rectifiers from AC) and the operating quadrant (bidirectional voltage and / or current converter).</p> <p>Reminders on the induction machine. Presentation of the two types of control allowed by a frequency converter (scalar and field oriented). Demonstration of maintaining the performance of the machine at variable speed in both modes with explanations of the limits at high and very low frequencies.</p> <p>Tutorials :</p> <p>Complete study of a synchronous machine autopiloted by a thyristor inverter</p> <p>Complete study of an asynchronous machine controlled by scalar control</p> <p>Sizing of an autonomous electricity installation containing a generator (synchronous generator) and photovoltaic panels.</p>	<p>Lectures : 8h00</p> <p>Tutorials : 4h00</p> <p>Lab Work : 4h00</p>
		Heat Transfer	<p>Description :</p> <p>The approach on theory is made in masterclasses and with class exercises on the following points:</p> <ul style="list-style-type: none"> - Conduction: Fourier law, general three-dimensional heat conduction equation for steady state and unsteady conditions, introduction to the concept of thermal resistance. - Convection: Newton law, dimensionless numbers and used correlations in convective transfer situations. - Radiation: study of black bodies and gray bodies, Stefan-Boltzmann law, equivalent thermal network to treat radiation problems. - Application to insulation problems, study of combined transfers (example with fins). - Heat exchangers: description of the main types, study of associated calculation methods. 	<p>Lectures : 24h00</p> <p>Tutorials : 10h00</p> <p>Lab Work : 8h00</p>
STUDENT LIFE COMMITMENT 3	3	STUDENT LIFE COMMITMENT	Description :	

ACADEMIC SEMESTER				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
COMMITMENT & RESPONSIBILITIES 3	0	COMMITMENT AND RESPONSIBILITIES	Description :	Lectures : 2h00
HUMANITIES, ENTREPRENEURIAL AND LANGUAGE TRAINING	3	English 3	Description : 2 hour lessons every week. Consolidation of grammar and expanded vocabulary. Strategies, techniques and practice papers to prepare for the TOEIC (lower-level groups) Assigned presentations (individual and in groups) on a variety of themes, including international current affairs and cross-cultural elements Students animate masterclasses where interactive elements, debates and active participation are encouraged. Task-based practice of language appropriate for professional and social settings. Assignments will be related to engineering or corporate related themes.	Tutorials : 20h00
		Second Foreign Language 3	Description : 1.5 hour lessons every week. Expanded vocabulary Revision of grammar points Improvement of phonological control	Tutorials : 18h00
		Self Knowledge	Description : "Personal development in professional contexts. Identifying values. The contribution of neurosciences and the individual and relational needs that underpin behavior (neuroscience, emotions, cognitive biases). Human Element Exercises, AT: basic needs in social and professional groups (Inclusion, Control, Openness). The 4 dials: establish a relational roadmap. Identifying springs with Appreciative Inquiry: knowing yourself and talking about yourself."	Tutorials : 8h00
		Interculturality 3	Description :	Tutorials : 6h00
		Entrepreneurship 2	Description : "Introduction to marketing concepts. Marketing a product for prospects, customers, managers, investors. Realization of a marketing study and a marketing CDC. Establishment of a business development plan via the establishment of the Canvas business model and a business plan (establishment of the map of actors / customers / suppliers / distribution channels)."	Tutorials : 12h00
STUDENT LIFE INVOLVEMENT 3	2	STUDENT LIFE INVOLVEMENT	Description :	

ACADEMIC SEMESTER				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
DIGITAL	4	Digital systems	<p>Description :</p> <p>Study of the architecture of a digital system: Development environment, emulator, simulator, software development at an industrial level, structure and bus. Numeration, coding, operations on numbers, multiplexing, 3 states operators, internal architecture of a microprocessor.</p> <p>Numerical memories: General knowledge, Physical support principle of digital information, characteristic quantities, configuration, extensions, memory page concepts, types, beam description, study of schematics.</p> <p>Serial transmission: Objectives and fields of application, structure and parameters, norms, RS232, format and speed, connectivity modes, types of transmission, protocol, modulated transmission.</p> <p>Microcontroller 8051: MCS51 family, physical presentation, program and data memory, addressing modes and instruction sets, assembly programming, stack and stack pointer sub-program, interfaces, interruptions.</p> <p>Microcontroller MBED: Internal structure, physical presentation, SFR block, CAN and MLI interfaces.</p> <p>Application: Temperature control, choice criteria, interface definition, programming languages (C and C++), programming.</p>	<p>Lectures : 16h00</p> <p>Tutorials : 2h00</p> <p>Lab Work : 4h00</p>
		Operational Research	<p>Description :</p> <p>Course outline:</p> <ul style="list-style-type: none"> - Graphs: definitions - Connectivity - Path problem - Hamiltonians paths and heuristic - Minimum spanning tree - Graphs coloration - Maximum flow - Problems raised with large graphs 	<p>Lectures : 12h00</p> <p>Tutorials : 4h00</p>
		Fundamentals of Digital Network and Information Systems	<p>Description :</p> <p>The course consists of a lecture and training sessions to practice the concepts seen during lecture.</p> <ul style="list-style-type: none"> - Introduction (objectives, skills targeted, issues for the engineer) - Vocabulary and History (basic vocabulary, network evolution history, future perspectives) - Models and Protocols (ISO and DoD models, standardization, RFC, TCP / IP stack) - Encapsulation (coding and decoding of a frame, network analysis, examples) - Physical Support (cables, connectors, physical characteristics, topologies, pre-wiring) - Active Components (repeaters, switches, routers, firewall, proxy) - Ethernet frame (Mac addresses, use, link with the physical layer, security) - IP datagram (structure of a datagram, IP address, mask, implementation under windows) - Addressing plan (construction of an address plan, configuration of IP addresses, gateways, DHCP / BootP) - Management of the shortage of IPV4 Addresses (NAT, IPv6) - DNS system (general operation, architecture, TLD, diagnostics, vulnerabilities) - ARP (principle, structure, ARP table, example of dynamic use, vulnerabilities) - Routing (routing, routing table, general principle of routing algorithms) - Internet structure (internet map, concept of autonomous systems, peering points, technical and geopolitical issues) 	<p>Lectures : 23h00</p> <p>Tutorials : 4h00</p> <p>Lab Work : 8h00</p>

ACADEMIC SEMESTER				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		Information Systems	<p>Description :</p> <ul style="list-style-type: none"> - Introduction (objectives, stakes for the engineer) - History of information systems (IS) - The information system: <ul style="list-style-type: none"> - Urbanization and interoperability (principles of urbanization, criteria of interoperability) - Governance (different organizations, strategic issues, maturity of the IS) - IS modeling (cartography, BPMN) - Technological components - application components (HTTP, XML, HTML, LDAP / Directories, Databases) - Hardware Architecture (processors, storage, system rooms) - Software Architecture (operating system, process management, memory management) - Backup and Archiving (issues, current technologies) - Virtualization and cloud computing (general principle) - Standard software offer (software families, selection criteria, publishers' economic models) - Information system security - Security Policy (document, methods, WSIS) - Actors of the IS and the ISP (CIO, ISSO, DPO, professions, external organizations, geopolitics) - Risk Management (general principle, identification, risk management methods, countermeasures) 	<p>Lectures : 15h00</p> <p>Tutorials : 2h00</p> <p>Lab Work : 4h00</p>
		Introduction to Data Science	<p>Description :</p> <p>The course plan is as follows:</p> <ul style="list-style-type: none"> - Linear regression and Gradient Descent - Logistic regression - Data: learning base vs test base - Over and under learning - Meta parameters - Perceptron - Neural networks <p>The course will be enhanced with many exercises.</p> <p>The second part of the course is carried out in the form of a project whose objective is to implement the concepts seen in the first part. It is about carrying out a machine learning process on a real basis and studying the avenues for improvement.</p>	<p>Lectures : 8h00</p> <p>Project : 8h00</p>
INNOVATION PROJECT	5	Innovation Engineering Project	<p>Description :</p> <ul style="list-style-type: none"> - Each team will independently organize their work corresponding to an overall schedule. They are expected to develop their project over different rush periods/ - Mission statement: Clearly present the conditions and requirements for the mission. Beforehand, they must isolate project features (mission objectives, scope, timeframe, requirements, confirmation, etc.) - Marketing Specifications: Identify future client needs, main elements for market positioning. Information related to project timeframe from the demand until market launch. Analysis of competition. - Creativity: Allowing for innovative solutions and response to current problems. Technical Product Architecture makes up the transition between the creativity phase and the planning phase to go from ideas to solution principals. - Technical Development: Application of technical knowledge acquired during the program. - Defense: Oral defense of the project and the applied methodology. Requirement and functional analyses are offered as well as analyzing the team dynamic over the semester. - Pitch: Pitching to potential investors (played by fellow ECAM Students) to support their engineering project. Maximum length of 2 minutes. - Communication: Apply a communication strategy (posters, videos, articles, etc.) to convince potential investors (played by fellow ECAM students) to support their engineering project. Communication may be displayed at the institution. 	<p>Lectures : 8h00</p> <p>Tutorials : 6h00</p> <p>Lab Work : 4h00</p> <p>Project : 84h00</p>
APPLIED INTERNSHIPS	3	Applied Engineering Internship	<p>Description :</p> <p>During this applied engineering internship (13 to 16 weeks, starting at the end of year 3), the engineering student joins a company or a university laboratory with the objective of taking on a variety of tasks and assignments that correspond to his/her level of studies.</p>	<p>Traineeship : 455h00</p>

ACADEMIC SEMESTER				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
ENERGY TRANSITION 2	6	Industrial Hydraulics	Description : Hydraulic networks (friction and minor losses, altitude rise, pipes in parallel and / or in series), operating principle of rotodynamic pumps (generality, constitution, pump curves, pump coupling, operating point, specific speed, similarity, cavitation, adaptation of the operating point), control valve (types of valves, valve coefficients), transient phenomena in pipes (generalized equations of transient flows, waterhammers, means of protection).	Lectures : 24h00 Tutorials : 6h00
		Acoustics	Description : Acoustic waves (linear acoustic equations, propagation equations, acoustic intensity and power, plane and spherical waves), acoustic levels, elementary acoustic sources (monopole and dipole) and extended acoustic sources, cavities and waveguides, tubes, resonators and filters, acoustic metrology (sound levels, acoustic spectra, microphones, laboratory and in-situ measurements, measurements of intensity and acoustic power).	Lectures : 16h00 Tutorials : 4h00
		Electricity production and network	Description : The electrical network: - From the production of electricity to its distribution - The substation HV/LV - The design of a substation HV/LV - The reactive power compensation The low voltage installation: - LV connections - The protection against electrical shocks - The establishment of grounding systems - The protection of circuits - The electrical equipment - The design of an electrical installation Power system perturbations - Identify the failures in a network	Lectures : 6h00 Lab Work : 8h00
		Energetic issues	Description : " History of major innovations in the energy field. - Influence of regulatory contexts on the development of innovations. - Prospective on future changes in energy consumption. - Influence of the constraints posed by global warming."	Lectures : 16h00
ADVANCED SOFTWARE & HARDWARE 2	6	API Language and Robotic Systems	Description : "Graphic languages (Ladder, FBD) - Structured language - Industrial communications, main protocols - Robotic arms"	Lectures : 6h00 Lab Work : 16h00
		Digital Servo	Description : "Modeling of the sampled signals, the Z transform, recurrence equation - Servo-controls of the sampled linear systems. - The digital equivalent of an analog PID corrector - RST correctors - Control with internal model (predictive control) - Analysis of robustness and performance - Temperature regulation of a unit heater "	Lectures : 12h00 Tutorials : 6h00 Lab Work : 4h00
		Embedded Software	Description : " • Structure and programming of an IoT in the MBED environment with ARM LPC176 microcontroller • Example of applications A student must be able to test and finalize two subjects from the following list: - Receiver of GPS signals - Using a Nintendo Nunchuck grip - ERDF remote information and energy metering - Reading RFID tags - Scan of a CAN network and site manipulators - Processing of an RC5 infrared remote control frame "	Lectures : 4h00 Lab Work : 16h00

ACADEMIC SEMESTER				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		Introduction to Data Science	<p>Description :</p> <p>The course plan is as follows:</p> <ul style="list-style-type: none"> - Linear regression and Gradient Descent - Logistic regression - Data: learning base vs test base - Over and under learning - Meta parameters - Perceptron - Neural networks <p>The course will be enhanced with many exercises.</p> <p>The second part of the course is carried out in the form of a project whose objective is to implement the concepts seen in the first part. It is about carrying out a machine learning process on a real basis and studying the avenues for improvement.</p>	<p>Lectures : 8h00</p> <p>Project : 10h00</p>
INDUSTRY OF THE FUTURE 2 (FACTORY 4.0)	6	Industrial Organization 3	<p>Description :</p> <ul style="list-style-type: none"> • Application of an ECAM workstation analysis methodology & workstation robotization elements. • Failure Modes and Criticality Analysis (FMECA) method applied to design & maintenance • Total Productive Maintenance (TPM) method • 7 principles of Quality Management. The ISO9001 standard and the "8DO" and QRQC (Quick Respond Quality Control) methods applied to a concrete case. • Global vision of the industrial company in order to implement and monitor overall performance in teams via Key Indicators (KPI). 	<p>Lectures : 10h00</p> <p>Tutorials : 10h00</p>
		Maintenance 2	<p>Description :</p> <p>"Introduction & definition of the FMD system: Reliability, Maintainability and Availability of production equipment,</p> <ul style="list-style-type: none"> - Study of repairable FMD systems: indicators, characterization methods, reliability laws: study of Exponential & Weibull models, - Application to the management of spare parts, - Case study. 	<p>Tutorials : 8h00</p>
		Serious Game 4.0	<p>Description :</p> <p>5 "project teams" each composed of 8 to 10 students, are in competition to design and implement the most efficient production organization for a new product within a PMI of 60 people which designs, manufactures and markets products. High-end smart speakers.</p>	<p>Lectures : 12h00</p> <p>Project : 38h00</p>
ACADEMIC SEMESTER	30			
Extra Semester				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
	3	English 4 - Extra Semester	<p>Description :</p> <p>2 hour lessons every week.</p> <p>Consolidation of grammar and expanded vocabulary.</p> <p>Strategies, techniques and practice papers to prepare for the TOEIC (lower-level groups)</p> <p>Assigned presentations (individual and in groups) on a variety of themes, including international current affairs and cross-cultural elements</p> <p>Students animate masterclasses where interactive elements, debates and active participation are encouraged.</p> <p>Task-based practice of language appropriate for professional and social settings.</p> <p>Assignments will be related to engineering or corporate related themes.</p>	<p>Tutorials : 26h00</p>

Extra Semester				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
Advanced structural design - extra semester	9	Vibratory Expertise - Extra Semester	<p>Description :</p> <p>The chapters of the course, grouped according to the general objectives, are as follows:</p> <p>Characterization of the vibrations of a system:</p> <ul style="list-style-type: none"> - analytical study: finite element calculation. - experimental study: means of measurement and software for experimental modal analysis. <p>Vibration reduction methodology:</p> <ul style="list-style-type: none"> - actions on the source of the vibrations, - actions on the transmission of vibrations, - actions on the system's own response. <p>Conditional and provisional maintenance of rotating machinery:</p> <ul style="list-style-type: none"> - types of defects in rotating machinery, - choice and limitations of monitoring indicators and diagnostic tools. <p>These chapters are complemented by the presentation of frequency analysis tools: Fourier series and digital Fourier transform, used in the experimental characterization of systems and diagnosis of defects in rotating machines.</p> <p>The theoretical knowledge on the characterization of the vibrations of a system is implemented during three sessions of practical work, relating respectively to the use:</p> <ul style="list-style-type: none"> - means of measurement, - a modal analysis software, - finite element calculations software. 	<p>Lectures : 14h00</p> <p>Lab Work : 12h00</p>
		MASA Project - Extra Semester	<p>Description :</p>	<p>Lab Work : 16h00</p>
		Damage and Failure - Extra Semester	<p>Description :</p> <p>Failure under static stresses</p> <p>The brittle and ductile fracture mechanisms are studied for the different families of materials as well as the various influencing parameters. The brittle ductile transition, the toughness, as well as the fracture statistics, complete this part to refine the choices of materials and their dimensioning for the strenght to sudden fracture by crack propagation.</p> <p>Failure under dynamic stresses</p> <p>The mechanisms of fatigue failure in materials, and the bases of pre-dimensioning of parts for dynamic stresses are studied.</p> <p>The course is illustrated with numerous examples and exercises from expertises treated in the laboratory.</p> <p>Practical work</p> <p>In the form of mini projects allowing for a global consideration of the design, choice of materials, analytical and numerical calculations and expertise of parts subjected to dynamic or static constraints.</p>	<p>Lectures : 14h00</p> <p>Lab Work : 24h00</p>
Energy Transition 2 - Extra semester	9	Acoustics - Extra Semester	<p>Description :</p> <p>"Acoustic waves: linear acoustic equations, propagation equations, acoustic intensity and power, plane and spherical waves.</p> <ul style="list-style-type: none"> - Acoustic levels. - Acoustic sources: elementary (monopole and dipole) and extended acoustic sources. - Cavities and waveguides. - Tubes, resonators and filters. - Acoustic metrology: sound levels, acoustic spectra, microphones, laboratory and in-situ measurements, measurements of intensity and acoustic power." 	<p>Lectures : 16h00</p> <p>Tutorials : 4h00</p>
		Energetic issues	<p>Description :</p> <p>" History of major innovations in the energy field.</p> <ul style="list-style-type: none"> - Influence of regulatory contexts on the development of innovations. - Prospective on future changes in energy consumption. - Influence of the constraints posed by global warming." 	<p>Lectures : 16h00</p>

Extra Semester				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		Industrial Hydraulics - Extra Semester	Description : "Hydraulic networks (regular and singular pressure drops, elevation rise, pipes in parallel and / or in series). - Operating principle of rotodynamic pumps: generality, constitution, manometric load curves, pump coupling, operating point, specific speed, similarity, cavitation, adaptation of the operating point; - Transient phenomena in pipes: Generalized equations of transient flows; mass hammers and waves, means of protection. "	Lectures : 24h00 Tutorials : 6h00
		Electricity production and network - Extra Semester	Description : The electrical network: - From the production of electricity to its distribution - The substation HV/LV - The design of a substation HV/LV - The reactive power compensation The low voltage installation: - LV connections - The protection against electrical shocks - The establishment of grounding systems - The protection of circuits - The electrical equipment - The design of an electrical installation Power system perturbations - Identify the failures in a network	Lectures : 6h00 Lab Work : 8h00
Factory 4.0 - extra semester	9	maintenance 2 - Extra semester	Description : "Introduction & definition of the FMD system: Reliability, Maintainability and Availability of production equipment, - Study of repairable FMD systems: indicators, characterization methods, reliability laws: study of Exponential & Weibull models, - Application to the management of spare parts, - Case study. "	Tutorials : 8h00
		Industrial Organization 3 - extra semester	Description : "• Application of an ECAM workstation analysis methodology & workstation robotization elements. • Failure Modes and Criticality Analysis (FMECA) method applied to design & maintenance • Total Productive Maintenance (TPM) method • 7 principles of Quality Management. The ISO9001 standard and the "8DO" and QRQC (Quick Respond Quality Control) methods applied to a concrete case. • Global vision of the industrial company in order to implement and monitor overall performance in teams via Key Indicators (KPI). "	Tutorials : 20h00
		serious game 4.0 - Extra Semester	Description : 5 "project teams" each composed of 8 to 10 students, are in competition to design and implement the most efficient production organization for a new product within a PMI of 60 people which designs, manufactures and markets products. High-end smart speakers.	Lectures : 12h00 Project : 40h00
Innovation strategy and management - Extra semester	18	Industrial Excellence Systems - Extra Semester	Description : Conception and implementation of industrial excellence Learning organizations for industrial excellence Industrial excellence sustainability Conferences and professional feedback from industry managers	Project : 250h00

Extra Semester				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
Mechanical Design	18	Mechanical Design	Description : Methodology Conduct of several multidisciplinary projects alone and/or in a team highlighting the skills developed during the ecam training Educational content Students must know how to solve problems such as: - technical project: Creation of a vegetable garden with intelligent programming of watering with recovered water and electricity generated by solar panels + big data (digitalization of the vegetable garden) - Moodle project: integration of an existing project at ECAM into an educational platform: integration of grade management, groups, multiple choice questions, communications, announcements, scheduling, ... take advantage of the educational advantages of the platform on an already existing project	Project : 250h00
Research & Development Track	18	Research and Development Project - Extra Semester	Description : Conception and implementation of industrial excellence Learning organizations for industrial excellence Industrial excellence sustainability Conferences and professional feedback from industry managers	Project : 250h00
Innovation strategy and management	18	Management of Innovation - Extra Semester	Description :	Project : 250h00
ADVANCED SOFTWARE & HARDWARE 2- Extra Semester	9	Robotic Systems - Extra Semester	Description : "Graphic languages (Ladder, FBD) - Structured language - Industrial communications, main protocols - Robotic arms"	Lectures : 6h00 Tutorials : 2h00 Lab Work : 12h00
		Numerical servo - Extra Semester	Description : "Modeling of the sampled signals, the Z transform, recurrence equation - Servo-controls of the sampled linear systems. - The digital equivalent of an analog PID corrector - RST correctors - Control with internal model (predictive control) - Analysis of robustness and performance - Temperature regulation of a unit heater "	Lectures : 10h00 Tutorials : 4h00 Lab Work : 4h00
		Data - Extra Semester	Description : The course plan is as follows: - Linear regression and Gradient Descent - Logistic regression - Data: learning base vs test base - Over and under learning - Meta parameters - Perceptron - Neural networks The course will be enhanced with many exercises. The second part of the course is carried out in the form of a project whose objective is to implement the concepts seen in the first part. It is about carrying out a machine learning process on a real basis and studying the avenues for improvement.	Lectures : 16h00
		Embedded Softwares - Extra Semester	Description : " • Structure and programming of an IoT in the MBED environment • Example of applications A student must be able to test and finalize two subjects from the following list: - Receiver of GPS signals - Using a Nintendo Nunchuck grip - ERDF remote information and energy metering - Reading RFID tags - Scan of a CAN network and site manipulators - Processing of an RC5 infrared remote control frame "	Lectures : 2h00 Lab Work : 16h00

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Extra Semester				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
Extra Semester				

A&M - YEAR 5

SEMESTER 9/10 - DOUBLE DEGREE				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
SEMESTER 9/10 - DOUBLE DEGREE	60			
SEMESTER 9 (September - January)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
SCIENTIFIC AND TECHNICAL SPECIALIZATION	6	ENERGY	<p>Description :</p> <ol style="list-style-type: none"> This course comprises a number of lecture classes and lab work which cover the following points: <ul style="list-style-type: none"> - Why should we be concerned with energy efficiency? - What is energy efficiency? - Measuring energy efficiency - Global and local methods This project is structured around various sessions of group work with access to the necessary computer resources. Students have the possibility to meet with a professor at different steps of the project in order to verify that their project is on the right tracks. 	<p>Lectures : 16h00</p> <p>Tutorials : 8h00</p> <p>Lab Work : 8h00</p> <p>Project : 32h00</p>
		MATERIALS & STRUCTURES	<p>Description :</p> <p>Course : The course comprises several independent parts:</p> <ul style="list-style-type: none"> - Car-suspensions & axles - Suspensions: <p>Roles - Calculation of the vehicle's Eigen frequencies using plane models - Balance between the front and back suspensions - Choice of stiffness.</p> <ul style="list-style-type: none"> - Review of static load strength calculations: <p>Isostatic and hyperstatic systems - Choice of types of connectors – Consideration of clearances and connectors stiffness.</p> <ul style="list-style-type: none"> - Materials Strength concepts reviewed: <p>Stress calculations – Concept of yield strength - Optimal sizing corresponding to the choice of material - Mass reduction.</p> <ul style="list-style-type: none"> - Finite Element Method reviewed - Screw-assemblies: <p>Quality class of bolts - Fatigue resistance - Rigidity of on assembly - Minimum starting load coefficient - Best practices</p> <ul style="list-style-type: none"> - Failure analysis: Case study - Analysis of failures of suspension components. <p>Project : Students are divided into four groups and are responsible for the sizing and design of a vehicle axle in accordance with the established specifications (external dimensions, kinematics, loads applied, maximum weight, etc.).</p>	<p>Lectures : 8h00</p> <p>Tutorials : 16h00</p> <p>Lab Work : 8h00</p> <p>Project : 32h00</p>
		FACTORY 4.0	<p>Description :</p> <ol style="list-style-type: none"> LD: <ul style="list-style-type: none"> - challenges of new products + dynamics of development - different management methods - fundamental principles of Lean Product Development Discover production management tools Improvement with the SCRUM method Project <p>Simulation and operation of a small business (students are assigned operational and functional roles). Various projects are conducted with the original organization, which is also inefficient. Implementation of Lean processes in development phase.</p>	<p>Lectures : 20h00</p> <p>Tutorials : 24h00</p> <p>Project : 20h00</p>
		AUTOMATION & IT	<p>Description :</p> <ol style="list-style-type: none"> During teaching modules lasting 2 to 8 hours each, the new material will cover: <ul style="list-style-type: none"> - Data bases - Measurement chains, sample and signal treatment - Business Intelligence reporting tools - Regulation using predictive Controller - Network Security The design and application of an M2M control and monitoring tool of a fleet of machines/systems located worldwide: from local monitoring of a machine to reporting its operational parameters. The fleet of machines consists of a CTA air treatment and heat exchanger connected to the school's intranet. The tools used to monitor, sensor, record data, and report are programmed using industrial software and are implemented in realistic conditions. 	<p>Lectures : 10h00</p> <p>Tutorials : 10h00</p> <p>Lab Work : 10h00</p> <p>Project : 30h00</p>

SEMESTER 9 (September - January)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
STUDENT LIFE COMMITMENT 4	3	STUDENT LIFE COMMITMENT 4	Description :	
SOFT SKILLS	7	Professional and Personal skills	<p>Description :</p> <p>detailed content (course module):</p> <ul style="list-style-type: none"> • MBTI questionnaire: understand and develop one's personality • Identification exercise over personal values with Vincent Cespedes • Different forms of intelligence (IQ, EI, CI, MI) <ul style="list-style-type: none"> o Multiple intelligence: where am I since 2015? o The cultural intelligence • My line of Professional Life (Human Element) • My drivers: levers and brakes • Self-esteem - self confidence: how to consolidate? • Motivation and Change • Choices and power (Milgram, current economic system) • Detect and manage stress and discomfort • Project priorities by using NLP • My career plan and life: identify wellsprings with the Appreciative Inquiry. Know oneself and talk about oneself • Use complementary projection tools: anchors • How to formalize Professional Project and life • 4 relational dials for my project • My sociogram to support my project • A network serving one's life & Professional Project 	Tutorials : 8h00
		Finance	Description :	Tutorials : 12h00
		Human Resources	<p>Description :</p> <p>The role of Human Resources within the company:</p> <ol style="list-style-type: none"> 1 - The role of Human Resources today: maintain the "human" corporate value, a main value for the company 2 - The evolution of the human resource function: From personnel management to career management 3 - The human resource function prerogatives 4 - The human resource partner roles and functions 5 - Social law and human resource management <p>5 - 1 - Social law</p> <p>A complex "ever changing" law: evolving with society</p> <ul style="list-style-type: none"> * Various relevant business related texts: the law, the collective agreement, trade agreements, the contract, its usage, jurisprudence... * A detailed review of the French legal chain and regulations * Labor tribunal, reconciliations, appeal, cassation...who does what? * Make the difference between Social law and Criminal law <p>5 - 2 - The main texts and practices relating to the particular case of:</p> <ul style="list-style-type: none"> * Hiring * Employment contract: scope and content * Employee's life within the company <p>5 - 3 - Contract termination</p> <ul style="list-style-type: none"> * How to prepare for letting an employee go? * Layoffs for economic reasons: a special case <p>5 - 4 - Relations with social partners</p> <ul style="list-style-type: none"> * Various social partners, their staff, their role and their operation * How to manage employees who are members of IRPs (staff representative organizations)? 	Tutorials : 16h00

SEMESTER 9 (September - January)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		Sales & Marketing	<p>Description :</p> <p>1 - Marketing</p> <ul style="list-style-type: none"> * Marketing challenges * Responding to challenges * The different types of marketing * Marketing studies * Segmentation * The 4 Ps * Building an image * Case studies: Apple, Nespresso and Easyjet data management <p>2 - Sales</p> <ul style="list-style-type: none"> * The importance of sales * The different types of sales * A salesperson's qualities * The sales cycle * Benefits, advantages, functionalities * Case study: Dyson * Objection management * Negotiation * Role playing: practical exercises 	Tutorials : 12h00
		Job-hunting techniques	<p>Description :</p> <p>STAGE 1:</p> <p>Make a self-assessment and define a career objective</p> <ul style="list-style-type: none"> * Make a self-assessment * Build a professional project * Confirm your professional project <p>STAGE 2:</p> <p>Updating your documents</p> <ul style="list-style-type: none"> * Resume * Cover letter <p>STAGE 3: Prospecting</p> <ul style="list-style-type: none"> * Apply to posted job offers * Unsolicited application * Prospect small to medium sized companies and at trade shows * Telephone prospecting * Network prospecting <p>STAGE 4: Preparing for different recruitment methods</p> <ul style="list-style-type: none"> * The interview * Tests * Other methods 	<p>Lectures : 2h00</p> <p>Tutorials : 4h00</p>
		Ethics	Description :	Lectures : 2h00
		MIME	<p>Description :</p> <p>2 full days</p> <p>This practice is based on the principles of economics and the notion of flows.</p> <p>4 teams represent 4 different companies. They each start their activity on an identical basis, that is to say a market study, the amount of equity and a production capacity.</p> <p>Different decisions lead to different activity developments.</p> <p>Decisions are taken in the field of production, financial, business strategies, purchases or risk management.</p> <p>Members in the team meet with different business partners, such as sub-contractors, banks, insurance, suppliers, etc. These roles are acted by the facilitation team.</p> <p>Teams work around a fictitious time frame of 4 semesters.</p> <p>During the last half-day, each team presents a report on its activities.</p> <p>These reports are analyzed by the group through a comparison between different strategic and operational choices and their consequences over this virtual 2-year venture.</p>	Lab Work : 20h00
STUDENT LIFE INVOLVEMENT 4	2	STUDENT LIFE INVOLVEMENT 4	Description :	

SEMESTER 9 (September - January)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
ENGLISH 5	3	English 5	<p>Description :</p> <p>TOEIC preparation: Lessons every week. Close study of practice papers. Revision of grammar and vocabulary. Strategies and techniques for the TOEIC</p> <p>Advanced English: Lessons every other week / Homework & Workshop preparation the other weeks</p> <p>First part is a student-led discussion based on a variety of sources provided at the beginning of the module. Sources originate from newspapers, podcasts, websites etc. Students are encouraged to choose unfamiliar subjects and themes in order to expand vocabulary and lexical range. Teachers provide feedback and grammar corrections at the end of every session.</p> <p>Second part is a workshop. Groups of 2 or 3 students lead a workshop they have previously prepared on a subject appropriate for final year engineering students. Interactive elements, debates and active participation are encouraged. Teachers and peers provide feedback after each session.</p> <p>Following their workshop, students complete a 750-word report evaluating their performance and reflecting on its success.</p>	<p>Lectures : 4h01</p> <p>Tutorials : 22h00</p>
ELECTIVES COURSES	2	Sustainable Energy	Description :	Tutorials : 20h00
		Civil Engineering Module	<p>Description :</p> <p>Students choose 2 of the following modules:</p> <ol style="list-style-type: none"> 1. Becoming an entrepreneur: from idea to action 2. Micro and Nano Technologies 3. Corporate Social Responsibility 4. Civil Engineering 5. Energy Challenges of the 21st Century 6. Managing Health and Safety in the Workplace 7. Supply Chain Management 8. Supply Chain Management 2 	Tutorials : 20h00
		Micro and Nanotechnology Module	<p>Description :</p> <p>Here we rely on general skills in physics and chemistry as well as on several aspects discussed in the semiconductor technology chapter of the electronics course (semester 5).</p> <ul style="list-style-type: none"> * Introduction to micro and nano technologies * Micro fabrication, toolbox available, engraving techniques * Description of micro mechanical sensors (pressure, micromotor ...) * Analysis of the design of an electrochemical micro-sensor (ISFET structure). * Nano FET, nano mechanism, current design limits, manufacturing tools, test tools ... * Ethical aspects around nanotechnologies 	Tutorials : 20h00
		Corporate Social Responsibility Module	<p>Description :</p> <p>Students choose 2 of the following modules:</p> <ol style="list-style-type: none"> 1. Becoming an entrepreneur: from idea to action 2. Micro and Nano Technologies 3. Corporate Social Responsibility 4. Civil Engineering 5. Energy Challenges of the 21st Century 6. Managing Health and Safety in the Workplace 7. Supply Chain Management 8. Supply Chain Management 2 	Tutorials : 20h00
		Supply Chain Management Module	<p>Description :</p> <ul style="list-style-type: none"> • Understand the impacts of the supply chain management on financial results of the enterprises • Justify the actions taken to manage the physical, financial and information flows • Present the global best international practices on supply chain management, and their benefits in our current environment • Current contact updated with the Demand Driven MRP 	Tutorials : 20h00

SEMESTER 9 (September - January)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		Supply Chain Module : Blue Connection	<p>Description :</p> <p>Business simulation THE BLUE CONNECTION (publisher INCHARGE) which students will play via a web interface (in English). ECAM La Salle is a forerunner in the deployment of this game (we work in parallel with professors from HEC).</p> <p>The game takes place in 6 to 8 rounds, the students work in teams of 3 or 4 and each plays the role of a manager within the fictitious company The Blue Connection:</p> <ul style="list-style-type: none"> - Sales management - Purchasing/design department - Supply chain management - Finance department <p>The company sells bicycles (only one model) to 3 different customers and is in great financial difficulty. The goal of this game is to make the company profitable while developing a circular economy.</p> <p>In each round, the students test and deploy a circularity or life extension strategy (maintenance/warranty, refurbishment, remanufacturing, recycling).</p> <p>In the final rounds, they must choose their own strategy, implement it and explain it in an individual report.</p>	Tutorials : 20h00
		Managing Health and Safety in the Workplace Module	<p>Description :</p> <p>Students choose 2 of the following modules:</p> <ol style="list-style-type: none"> 1. Becoming an entrepreneur: from idea to action 2. Micro and Nano Technologies 3. Corporate Social Responsibility 4. Civil Engineering 5. Energy Challenges of the 21st Century 6. Managing Health and Safety in the Workplace 7. Supply Chain Management 8. Supply Chain Management 2 	Tutorials : 20h00
		Quality Module	<p>Description :</p> <p>"• Quality Management Systems in companies and Company Strategy - The Global Vision of Quality Management</p> <ul style="list-style-type: none"> o The Quality Management System according to ISO9001 - detailed decryption, the heart of the standard o Other examples with aeronautical and automotive sector standards o The linking of Quality Management Systems with other Organizational Management Systems: OHSAS18001 (ISO45001), ISO14001, ISO26000, ISO50001 <p>• Quality Management Systems and Operational Steering</p> <ul style="list-style-type: none"> o Operational Risk Analysis tools o Continuous Improvement tools o Internal audit o Monitoring tools, measuring efficiency o Putting into perspective with the economic approach of Quality, analysis of CNQs, the notion of efficiency o Links with benchmarks of excellence, Good Practices <p>• Continuous Improvement as the common thread of Performance Management Systems</p> <ul style="list-style-type: none"> o Business cases on the production side o Case of non-production companies" 	Tutorials : 20h00
PROFESSIONAL SKILLS	2	Continuous Improvement	<p>Description :</p> <p>Introduction to the Lean and continuous improvement</p> <p>Simulation of an entreprise to be improved by using the tools from the Lean</p> <p>The side effects of the Lean and the management situation</p>	Tutorials : 20h00
		Management	<p>Description :</p> <p>Understand the role of the manager in the enterprises</p> <p>Know how to deal with decision situation referring to management</p> <p>Manage the relationships, simple or complex ones</p> <p>Analyse the dynamics of the motivations of the collaborators</p> <p>Know the fundamentals in job psychodynamics</p> <p>Analyse the situations at risks with psychosocial risks</p>	Tutorials : 20h00

SEMESTER 9 (September - January)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
		Managing Health and Safety in the Workplace Module	Description : Students choose 2 of the following modules: 1. Becoming an entrepreneur: from idea to action 2. Micro and Nano Technologies 3. Corporate Social Responsibility 4. Civil Engineering 5. Energy Challenges of the 21st Century 6. Managing Health and Safety in the Workplace 7. Supply Chain Management 8. Supply Chain Management 2	Tutorials : 20h00
		Debriefing	Description :	Lectures : 3h00 Project : 3h00
PROGRAM MANAGEMENT OF ORGANIZATIONAL EXCELLENCE SYSTEMS	10	Industrial Excellence Systems	Description : Mapping tools to observe the sources of waste in value chains Lead Time measurement in relation to customer satisfaction and time to market The Value Stream Design approach guided by the key principles of Lean Thinking The concept of A3 mother and the variation in A3 daughters according to the strategic transformation objectives The priorities of different projects and planning in time and space (SWOT & Gain / Effort Matrices)	Project : 250h00
R&D PROJECT	10	R&D project	Description : The Research and Development projects are, for the most part, conducted in partnership with companies. At the beginning of the semester, the various project areas (Digital, Industrial Management, Materials & Structures, Energy) are presented as well as the number of students that can be accepted. Each student needs to choose a project area and a corresponding project. The R&D projects are generally completed in groups of two people. The R&D projects include in varying proportions depending upon the subject matter: - Rewriting the specifications, project organization and client relations management - Structuring communication with the head teacher - Literature review - Study of theory - Experimental study - Result formatting and presentation of progression during technical meetings -Compiling final case study (files, computer programs), detailed documentation -Final presentation (defense examination) for validation	Project : 250h00

SEMESTER 9 (September - January)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
PROFESSIONAL COURSE	10	Professionalisation Project	<p>Description :</p> <p>The Research and Development projects are, for the most part, conducted in partnership with companies.</p> <p>At the beginning of the semester, the various project areas (Digital, Industrial Management, Materials & Structures, Energy) are presented as well as the number of students that can be accepted. Each student needs to choose a project area and a corresponding project.</p> <p>The R&D projects are generally completed in groups of two people. The R&D projects include in varying proportions depending upon the subject matter:</p> <ul style="list-style-type: none"> - Rewriting the specifications, project organization and client relations management - Structuring communication with the head teacher - Literature review - Study of theory - Experimental study - Result formatting and presentation of progression during technical meetings -Compiling final case study (files, computer programs), detailed documentation -Final presentation (defense examination) for validation 	Project : 300h00
MECHANICAL DESIGN	10	Mechanical Design	<p>Description :</p> <p>Methodology</p> <p>Conduct of several multidisciplinary projects alone and/or in a team highlighting the skills developed during the ecam training</p> <p>Educational content</p> <p>Students must know how to solve problems such as:</p> <ul style="list-style-type: none"> - technical project: Creation of a vegetable garden with intelligent programming of watering with recovered water and electricity generated by solar panels + big data (digitalization of the vegetable garden) - Moodle project: integration of an existing project at ECAM into an educational platform: integration of grade management, groups, multiple choice questions, communications, announcements, scheduling, ... take advantage of the educational advantages of the platform on an already existing project 	Project : 250h00

SEMESTER 9 (September - January)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
STRATEGY AND MANAGEMENT OF INNOVATION	10	Innovation management and strategy	<p>Description :</p> <p>Innovation defines all the scientific, technological, organizational, financial and commercial approaches that result in the production of technologically new and/or improved products/processes. The spirit of innovation ultimately means telling yourself that there is innovation behind every problem and that this can/must lead to making the world a better place.</p> <p>For students, this course is a means of professionalization towards areas of expertise at the heart of industrial issues of today and tomorrow. In particular, it allows for a deeper understanding of innovation management. There are multiple objectives:</p> <ul style="list-style-type: none"> • Advanced training in creativity and concepts associated with innovation (ideation process, collective intelligence and change, financing and frugal design, design thinking and user experience), • Initiation to innovation strategies, • Sensitization of students to entrepreneurship, • Sensitization to industrial and intellectual property, • Training in written, oral and verbal communication, • Improvement in project management and teamwork. <p>To support the students, multiple conferences are held, each supervised by an expert in his field, around the following themes:</p> <ul style="list-style-type: none"> • The concepts behind innovation (the concept of change, concept of heresy, concept of revolution, concept of combination, etc.), • Innovation strategies (Technology Push, Market Pull, Push – pull, etc.), • Innovation and creativity in businesses today, • Innovation: financing strategy and ROI. <p>Finally, this course is directly linked to manufacturers who encounter real problems related to innovation. Students are encouraged to visit companies directly on site, when possible. Then, the students challenge each other to find ideas for concepts of "innovative" products/services to respond to the issues raised by companies. Most often, the work of creativity and innovation carried out by students allows companies to research and file patents.</p>	Project : 250h00
		Innovation Challenge	<p>Description :</p> <p>After following one of the three proposed industrial projects, students will have to organize a competition to which other ECAM students will be invited. Its objective is to build the strongest possible structure from simple materials. The students of the course will oversee monitoring the smooth running of it.</p> <p>the computer tools that make it possible to carry out a geometric modeling of an object in order to be able to simulate tests with a view to manufacturing, • Use of PLM software: corresponds to all the processes, technologies, software and methods put in place to properly manage the life cycle of a product. The practical part allows the student to apply his knowledge through a team project comprising the following phases: • Discovery of the main functions of the CAD tool and configuration of the 3D model, • Complete modeling of the project proposed by the teacher, • Integration of CAD data into the PLM, • Creation of definition plans for each part, and overall drawings, • Writing of a complete mechanical design report.</p>	Project : 8h00
SEMESTER 9	30			

SEMESTER 10 (January - June)				
TEACHING UNIT	ECTS	TEACHING UNIT COMPONENT	Content	TEACHING HOURS
PROFESSIONAL COURSE	30	Engineer Internship	<p>Description :</p> <p>The final engineering internship will be conducted either:</p> <ul style="list-style-type: none"> - Within a company or laboratory in France - In a company abroad or in a university laboratory working in partnership with companies <p>It will be based on an industrial theme; scientific, technical or organizational.</p> <p>It must take place under the supervision of an engineer. A clearly defined assignment must be proposed by the company. Success or failure will be evaluated according to the student's performance and ability to fulfill the requirements set forth by the company.</p> <p>The assessment of this training session will be performed by the trainee's supervisor and a supervising professor designated by the Director of studies.</p> <p>Assessment charts are used to measure the trainee's quality of work, as well as the quality of the written report and oral defense.</p> <p>The internship must last a minimum of 21 weeks.</p>	Traineeship : 770h00
		Debriefing	<p>Description :</p>	<p>Lectures : 3h00</p> <p>Project : 3h00</p>
ENGINEER INTERNSHIP	30	Engineer Internship	<p>Description :</p> <p>The final engineering internship will be conducted either:</p> <ul style="list-style-type: none"> - Within a company or laboratory in France - In a company abroad or in a university laboratory working in partnership with companies <p>It will be based on an industrial theme; scientific, technical or organizational.</p> <p>It must take place under the supervision of an engineer. A clearly defined assignment must be proposed by the company. Success or failure will be evaluated according to the student's performance and ability to fulfill the requirements set forth by the company.</p> <p>The assessment of this training session will be performed by the trainee's supervisor and a supervising professor designated by the Director of studies.</p> <p>Assessment charts are used to measure the trainee's quality of work, as well as the quality of the written report and oral defense.</p> <p>The internship must last a minimum of 21 weeks.</p>	Traineeship : 770h00
SEMESTER 10	30			