PreRequisite for Graduation

Commitment And Responsibilities

Unité d'Enseignement	ECTS	Unité de Cours	Contenu	Nb d'Heures

DELF

Unité d'Enseignement	ECTS	Unité de Cours	Contenu	Nb d'Heures

IELTS

Unité d'Enseignement	ECTS	Unité de Cours	Contenu	Nb d'Heures

PreRequisite for Graduation

Commitment And Responsibilities

EENG - Year 1

Semester 1

Unité d'Enseignement	ECTS	Unité de Cours	Contenu	Nb d'Heures
Engineering Sciences S1	3	**Mechanical Design 1**	- Technical Drawing: - Theory of projections - Types of drawings - Standards- Drawing Rules - Threads: Assemblies Screwing and Bolting ,drawing Screw Threads and other threaded elements - Creating sheet drawing on paper based on 3D view - Surface-to-surface intersection - Assembly Drawing: - Recognize standard parts and elements - Mechanism understanding - Elementary technological Functions: - Assembly surfaces - Complete joints function - Guiding in translation - Guiding in rotation function - Analysis of Mechanism - External analysis - Internal analysis - Mechanical joints - Technical solutions for joints - Minimum kinematic diagram - Computer Aided Design (CAD): - Presentation of CAD software: PTC CREO - Software environment - 2D sketches principals - 3D constructing base features - Basic 3D functions	TD : 12h00 TP : 12h00 Travail personnel : 24h00 Durée totale: 48h00
		Methodology	1 lecture provides theoretical background: precision & accuracy, systematic & random errors, uncertainty quantification (types A & B) 3 practical works provide applied situations: one in mechanics (period of a pendulum), one in chemistry (volume of gas produced during a reaction) and one in electricity (Ohm's law).	TD : 12h00 Travail personnel : 8h00 Durée totale: 20h00
Fundamental Sciences S1	9	**Chemistry**	Electronic structures & periodic properties (atomic radius, ionization energy, electronegativity…) Types of chemical bonds between atoms (ionic, covalent, metallic) and between molecules (dispersion force, dipole-dipole, hydrogen bond) involving molecule polarity (dipole moment, VESPR model…) States of matter: gaseous state (concept of pressure including partial pressure & vapour pressure, ideal gas law, real gases, density, kinetic theory of gases, diffusion, effusion), condensed matter states (in particular crystallographic structures of solids). Aqueous solutions (solubility, different types of concentrations, colligative properties) Chemical equilibrium (advancement table for reversible reactions, equilibrium constant K & quotient of reaction Q, Le Châtelier's principle, introduction to thermochemistry) Chemical Kinetics (rate of reaction, half-life, orders of reaction & rate laws, Arrhenius equation) Chemical kinetics Chemical equilibrium Application to electrochemistry	TD : 18h00 TP : 6h00 Cours : 18h00 Travail personnel : 36h00 Durée totale: 78h00

Semester 1				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
		Dc Electrical CirculT Theory	1. Circuit terminology (branches, nods, meshes & loops…) 2. Circuit variables (definitions of current & voltage, I & V measurements, characteristics, power, energy) 3. Ideal basic circuit elements: independent voltage and current sources, dependent voltage and current sources, resistors, main properties, sign conventions 4. Ohm's law, Kirchhoff's current and voltage laws 5. Resistive circuits (series and parallel combinations, voltage and current dividers, ?-to-Y transformation) 6. Methods for circuit analysis (node voltage and mesh current methods, number of independent equations) 7. Source transformation 8. Thévenin's and Norton's theorems 9. Superposition theorem 10. Maximum power theorem 11. Inductors and capacitors (description of the components, voltage and current relation, exchanged power formulas, mutual inductance and mesh current equations for circuits containing magnetically coupled coils) 12. 1st Order responses (natural and step functions, RL & RC circuits) and 2nd order responses (RLC circuits) 13. Beyond DC circuits (introduction to AC signals and frequency responses of RLC circuits	TD : 24h00 TP : 6h00 Cours : 18h00 Travail personnel : 42h00 Durée totale: 90h00
		General Mechanics 1	The topics covered in General Mechanics 1 consist of a general introduction of Mechanics and the study of kinematics: 1- Introduction: generalities (particle vs body), vectors, reference systems (Cartesian, cylindrical, spherical) 2- Rectilinear motion of a particle: velocity and acceleration, motion equations, continuous and erratic motion 3- General curvilinear motion of a particle: rectangular components, projectile motion 4- Curvilinear motion of a particle: normal and tangential components, cylindrical components, circular motion 5- Two-particle motion analysis: dependent absolute motion, Relative motion 6- Kinematics of a rigid body: translation, rotation about a fixed axis, absolute and relative motions	TD : 12h00 TP : 4h00 Cours : 12h00 Travail personnel : 24h00 Durée totale: 52h00
Mathematics For Engineering S1	9	**Introduction To Algorithms**	- Algorithmic tools in and Python: variable, types, logic statements, loops - Truth tables, boolean algebra - Lists and functions - Binary numbers	TD : 16h00 Cours : 6h00 Projet : 8h00 Travail personnel : 30h00 Durée totale: 60h00
		Mathematics Part 1	o Basic Mathematics o Trigonometry o Complex Numbers o Vectors	TD : 20h00 Cours : 10h00 Travail personnel : 30h00 Durée totale: 60h00
		Mathematics Part 2	o Functions o Differentiation o Integration	TD : 20h00 Cours : 10h00 Travail personnel : 30h00

Unité d'Enseignement	ECTS	Unité de Cours	Contenu	Nb d'Heures
Semester 1				
				Durée totale: 60h00
		Mathematics Part 3	o Matrices o Linear systems o Vector Geometry	TD : 20h00 Cours : 10h00 Travail personnel : 30h00 Durée totale: 60h00
Projects S1	3	**Engineering Practice 1**	- FabLab Training: Prototyping of a gripper: - Manufacturing of parts with 3D printers - Manufacturing of parts by laser cutting - Manufacturing of a part by manual turning - Manufacturing of a part in wood - Assembling and testing of the gripper - Study and improve of a steering system: - Presntation of the method of work: Analyse, Search, Construct, Test, and Measure - Introduction to AKERMAN angle and history of steering system - Assembling of a LEGO car - Measure steering angle of the car - Calcul of the steering radius - Search a solution to reduce the steering radius - Realise the modification on the car - Test the car on a specific track - Competition beteween the students teams	TD : 12h00 TP : 12h00 Travail personnel : 12h00 Durée totale: 36h00
		Sustainable Development 1	Part 1: Discussion: - About the background of the students - About the role of engineers in the future, in the context of industry evolution. Course 1: Introduction to Sustainable Development: - Historical background - The 12 SD objectives of the United Nations - Main issues raised from technology development and current trends Choice of topics and constitution of pairs.	Cours : 4h00 Projet : 6h00 Travail personnel : 9h00 Durée totale: 19h00
Society, Management And EntrepreneurshIP 1	6	**Advanced English Skills 1**	Learning to learn Phrasal verbs in context Research Company creation project Presentation/ pitch Start Up Fair IELTS listening practice	TD : 14h00 Travail personnel : 14h00 Durée totale: 28h00
		Foreign Language 1	2 hour lessons every week. Expanded vocabulary Revision of grammar points Improvement of phonological control Language skills according to different CEFR level groups: A1 Can establish basic social contact by using the simplest everyday polite forms of: greetings and farewells; introductions; saying please, thank you, sorry etc. A2/B1 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. Can produce brief everyday expressions in order to satisfy simple needs of a concrete type: personal details, daily routines, wants and needs,	TD : 18h00 Travail personnel : 18h00 Durée totale: 36h00

Semester 1				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			requests for information. 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. Has a limited repertoire of short memorised phrases covering predictable survival situations; frequent breakdowns and misunderstandings occur in non-routine situations. 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. B2 Can express him/herself clearly and without much sign of having to restrict what he/she wants to say. 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. 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. C1 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.	
		Conferences On The Social Sciences	Each of these conferences will explore one of the social sciences	Cours : 4h00 Durée totale: 4h00
		Sports Activities 1	The sports course allows students to engage physically and mentally on a regular basis in a fun, supportive environment, fostering self-improvement and self-awareness. The courses are organized into sequences of 4 to 5 sessions of the same sport, depending on the practice location. A schedule of the different sports is given to students at the beginning of the year (appendix "Yearly Programming ...../.....""). It is accompanied by a document indicating the location of the courses according to the trimester (as the facilities are shared with the Lazaristes school), the day of the week, and the time slot (appendix "Sports course locations year ...../......"). The general structure of a sequence: A discovery phase: it gets students "moving," allows them to take bearings, and build meaning through an initial representation of the activity. A learning phase ensuring sufficient training time to achieve objectives and thus acquire skills. An evaluation phase allowing all students, regardless of their level, to demonstrate their ability to act in a situation presenting a certain level of complexity.	TD : 30h00 Durée totale: 30h00
		Written And Oral Communication 1	– Introduction and fundamentals of communication. – Essentials of Technical Writing (project scope report) - Oral Presentation Basics (peer evaluation submission) –Output (graded written report)	Cours : 8h00 Projet : 8h00 Durée totale: 16h00

Semester 2				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
Engineering Sciences S2	5	**Electronic Principles And Technology**	- Diodes : N and P semiconductors, PN junction, analysis of series diode configurations and parallel configurations - Characteristics and biasing of Bipolar Junction Transistors and Field Effect Transistors - Operational amplifiers: structure, the ideal op-amp model, negative feedback, fundamental op-amp configurations	TD : 12h00 TP : 9h00 Cours : 12h00 Travail personnel : 24h00 Durée totale: 57h00
		Mechanical Design 2	- Geometric Dimensioning and Tolerancing (GD&T): - Definition - How to indicate GD&T on a technical drawing - Meaning of standard contraint: - Form: Straightness, Flatness, Circularity and Cylindricity - Profile: of a line or a surface - Orientation: Angularity, Perpendicularity and Parallelism - Location: Position, Concentricity and Symmetry - Runout: Circular and Total Runout - Writing dimension and tolerance - Functional surfaces Operating conditions clearance conditions tightening conditions play conditions - The I.S.O. fit system Recommended fits Writing the fits on a drawing Fundamental deviations of the shafts and bores - Functional conditions, Functional dimensions, Chain of dimensions method - Computer Aided Design (CAD): - Dynamic assembly - Technical Drawing on CREO - improvement of an existing system - Design of a new mechanism according specifications	TD : 10h00 TP : 20h00 Travail personnel : 30h00 Durée totale: 60h00
		Manufacturing Processes	INTRODUCTION TO MANUFACTURING: -Fundamentals Manufacturing processes (turning , milling) -Cutting parameters -Engineering metrology and instrumentation -Numerical control machining -GDT (geometrical dimension and tolerencing) -Machining operations and machine tools : machining and part geometry, turning and related operations, drilling and related operation, milling Cutting-tool technology: tool life, tool materials, tool geometry ? Surface texture: Two dimensional METROLOGY o Geometrical and surface profile Roughness parameters o Measuring length o Filters and cut off o Amplitude parameter o The different types of profiles (ISO3247) o Analyze experimental data of roughness and waviness using the surface state measurement TP: Turning and Related Operations Milling and Related Operations Measurement of Surface state Coordinate measuring machine (CMM) Computer-aided manufacturing control (for milling)	TP : 12h00 Cours : 4h00 Travail personnel : 16h00 Durée totale: 32h00

Semester 2				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
Fundamental Sciences S2	8	**Ac Electrical Circuits Theory**	1- Sinusoidal signal. 2- Phasor and inverse phasor transform 3- Impedance/admittance and relationships for circuit elements in frequency domain. 4- Main steps to analyze AC circuits. 5- Methods for circuit analysis: Kirchhoff's laws, voltage and current division, node-voltage and mesh-current methods, Thevenin and Norton theorems, source transformation, superposition principle. 6- AC power analysis: Instantaneous & average power, reactive power, complex and apparent power, Conservation of AC power, RMS value, Power factor correction, Maximum average power transfer 7- Frequency response, transfert function and Bode plots. 8- RL, RC circuit configurations acting as low-pass filters and high-pass filters 9- Series resonance and Parallel resonance 10- RLC circuit configurations acting as bandpass filters and Bandstop filters 11- A tool for advanced circuit analysis: Laplace transform	TD : 18h00 TP : 4h00 Cours : 14h00 Travail personnel : 32h00 Durée totale: 68h00
		Fundamental Thermodynamics	Introduction to basic concepts of system, state, surroundings, process , and cycle; review the concept of temperature, temperature scales, pressure , various types of pressure and their calculation Definition and different forms of Energy Physical properties and state description, various methods to determine the properties of matter, equations of state for gases, ideal gases vs. real gas. First law of thermodynamics and application to ideal gases for closed and open systems Energy analysis for closed systems Mass and Energy analysis for open systems/control volumes	TD : 10h00 Cours : 10h00 Travail personnel : 20h00 Durée totale: 40h00
		General Mechanics 2	The topics covered in General Mechanics 2 are a continuation of the topics covered in General Mechanics 1 by addressing the topics of Statics and Dynamics: 1- Newton's laws: basic concepts (force, mass), the three laws of motion, common forces 2- System of forces: forces resultant, force-moment equivalent at a point, particle equilibrium and its conditions 3- Non-inertial reference systems: ficitious forces, types of friction (static and dynamic) 4- Oscillations: Free undamped oscillations, simple harmonic motion, spring-mass sytems, simple pendulum, damped oscillations basics 5- Work and Energy: work, energy, power, work of common forces, work-energy theorem 6- Work and Energy: kinetic energy, gravitational potential energy, elastic potential energy, energy conservation.	TD : 12h00 TP : 4h00 Cours : 12h00 Travail personnel : 24h00 Durée totale: 52h00
Mathematics For Engineering S2	9	**Computer Programming**	Basics of data structures : arrays and linked lists Dynamic arrays Queues efficiently. Applications of data structrue	TD : 8h00 Cours : 6h00 Projet : 16h00 Travail personnel : 30h00 Durée totale: 60h00
		Mathematics Part 4	o Differential Equations o Polynomials	TD : 20h00 Cours : 10h00

Semester 2				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			o Integration 2	Travail personnel : 30h00 Durée totale: 60h00
		Mathematics Part 5	o Limits & Sequences o Limits & Functions o Taylor Series	TD : 20h00 Cours : 10h00 Travail personnel : 30h00 Durée totale: 60h00
		Mathematics Part 6	o Parametric representations o Functions with two variables o Double Integrals	TD : 20h00 Cours : 10h00 Travail personnel : 30h00 Durée totale: 60h00
Projects S2	2	**Engineering Practice 2**	- 2 separat projects of 8 hours each - Students team work - Based on specifications, each team must propose a technical solution to a problem - After validation by the teacher, each team have to manufacture , test and improve their solution	TP : 16h00 Travail personnel : 16h00 Durée totale: 32h00
		Sustainable Development 2	Part 2: Presentation by the students of the topics they have chosen during Part 1. Followed by debates, Q&A. Discussions about: - Individual and collective actions in favour of Sustainable Development. - Expectations from the students regarding their engineering curriculum.	Cours : 2h00 Projet : 6h00 Travail personnel : 9h00 Durée totale: 17h00
Society, Management And EntrepreneurshIP 2	6	**Advanced English Skills 2**	Writing skills: email writing and cover letters Time management and study skills Planning and presenting a weekend integration project	TP : 14h00 Travail personnel : 14h00 Durée totale: 28h00
		Foreign Language 2	2 hour lessons every week. Expanded vocabulary Revision of grammar points Improvement of phonological control Language skills according to different CEFR level groups: A1 Can establish basic social contact by using the simplest everyday polite forms of: greetings and farewells; introductions; saying please, thank you, sorry etc. A2/B1 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. 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. 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. Has a limited repertoire of short memorised phrases covering predictable survival situations; frequent breakdowns and misunderstandings occur in non-routine situations. Has enough language to get by, with sufficient vocabulary to express him/herself with some hesitation and circumlocutions on topics such as	TP : 18h00 Travail personnel : 18h00 Durée totale: 36h00

Semester 2				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			family, hobbies and interests, work, travel, and current events, but lexical limitations cause repetition and even difficulty with formulation at times. B2 Can express him/herself clearly and without much sign of having to restrict what he/she wants to say. 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. 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. C1 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.	
		Professional Project	This module is aimed to help students prepare for their operator internship. Students will be introduced to LinkedIn and other tools to help them find internship opportunities.	TD : 8h00 Travail personnel : 8h00 Durée totale: 16h00
		Professional Project	1- Sinusoidal signal. 2- Phasor and inverse phasor transform 3- Impedance/admittance and relationships for circuit elements in frequency domain. 4- Main steps to analyze AC circuits. 5- Methods for circuit analysis: Kirchhoff's laws, voltage and current division, node-voltage and mesh-current methods, Thevenin and Norton theorems, source transformation, superposition principle. 6- AC power analysis: Instantaneous & average power, reactive power, complex and apparent power, Conservation of AC power, RMS value, Power factor correction, Maximum average power transfer 7- Frequency response, transfert function and Bode plots. 8- RL, RC circuit configurations acting as low-pass filters and high-pass filters 9- Series resonance and Parallel resonance 10- RLC circuit configurations acting as bandpass filters and Bandstop filters 11- A tool for advanced circuit analysis: Laplace transform	TD : 8h00 Travail personnel : 32h00 Durée totale: 40h00
		Conferences On The Social Sciences 2	Each of these conferences will explore one of the social sciences	Cours : 4h00 Durée totale: 44h00
		Sports Activities 2	The sports course allows students to engage physically and mentally on a regular basis in a fun, supportive environment, fostering self-improvement and self-awareness. The courses are organized into sequences of 4 to 5 sessions of the same sport, depending on the practice location. A schedule of the different sports is given to students at the beginning of the year (appendix "Yearly Programming ...../....."). It is accompanied by a document indicating the location of the courses according to the trimester (as the facilities are shared with the Lazaristes school), the day of the week, and the time slot (appendix "Sports course locations year ...../......"). The general structure of a sequence: A discovery phase: it gets students "moving," allows them to take bearings, and build meaning through an initial representation of the activity.	TD : 20h00 Durée totale: 20h00

Semester 2				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			A learning phase ensuring sufficient training time to achieve objectives and thus acquire skills. An evaluation phase allowing all students, regardless of their level, to demonstrate their ability to act in a situation presenting a certain level of complexity.	
		Written And Oral Communication 2	This course aims to make students aware of their learning capacity and to raise their awareness of the learning process. It leads students to reflect on their learning experiences and identify the best practices working for them. It also provides self-management tools to improve their learning abilities. The work axes are learning reflection, organizing information, time management, and group learning.	TD : 8h00 Travail personnel : 12h00 Durée totale: 20h00

EENG - Year 2

Semester 3

Unité d'Enseignement	ECTS	Unité de Cours	Contenu	Nb d'Heures
Electrical Engineering S3	6	Digital Design	Introductory concepts Number systems, operations, and codes Logic gates and circuits Boolean algebra and logic simplification including Karnaugh maps Combinational logic analysis and functions of combinational logic Latches, flip-flops, timers, shift registers and counters Programmable logic Data storage Signal conversion and processing Data transmission, data processing, and control Integrated circuit technologies	TD : 3h00 TP : 9h00 Cours : 14h00 Travail personnel : 17h00 Durée totale: 43h00
		Electronic Circuits And Systems	- Main types of filters and filtering response: low pass filter, high pass filter, band pass filter, band rejection filter - Study of oscillators - Sensors: a short introduction and guide line for basic implementation - Electronic functions and applications - Study of the key functions of the NE555: monostable and astable configuration	TD : 10h00 TP : 9h00 Cours : 8h00 Travail personnel : 16h00 Durée totale: 43h00
		Electrostatics And Magnetostatics	1. Introduction - Elements of vector analysis - Scalar and vector fields - Derivatives and integrals - Cartesien, cylindirical and spherical coordinate systems. 2. Electrostatics - Electrical force (Coulomb's law) - Superposition principle, Curie's theorem - Gauss's law used to express electric field in simple situations) - Electric potential and work, conservative field - Electrostatics in metals (emphasizing the study of capacitors) 3. Magnetostatics - Magnets (historical background) - Magnetic field (Biot-Savart law) due to a line, a loop. - Ampère's circuital law (used to express magnetic field in simple situations) - Magnetic force (Lorentz) - Ampère's force law and magnetic torque. Their application to electrical machines. - Faraday's law and Lenz's law. Their application to alternators. - Introduction to Maxwell's equations	TD : 24h00 Cours : 18h00 Travail personnel : 36h00 Durée totale: 78h00
Mathematics For Engineering S3	6	Databases	Introduction to Relational database Models of database systems Theory of database systems Implementation of database systems Introduction to SQL language • Reminder on the relational model • Characteristics of SQL Query data • Data selection • Restrictions or conditions • Sorts • Joins	TD : 2h00 TP : 4h00 Cours : 2h00 Travail personnel : 4h00 Durée totale: 12h00
		Mathematics For Engineers 7	- Multivariable calculus: ° multivariate calculus (coordinate systems, scalar functions, vector functions, conservative vector fields, differential operators, Taylor expansions for functions from R^n to R^p, Implicit function theorem, simple PDE, Local Inverse Theorem) ° multiple and line integral (substitutions, volume integrals, area	TD : 60h00 Cours : 30h00 Travail personnel : 48h00 Durée totale: 138h00

Semester 3				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			integrals, curvilinear integrals, Green-Riemann Theorem) - Linear algebra ° Introduction to linear spaces/subspaces in R^n, bases. ° Fundamental subspaces of a matrix - Rank Nullity theorem. ° Orthogonality ° Eigenvalues and Eigenvectors	
		Introduction To Numerical Simulations	Introduction to the programming language Matlab for numerical computing. Octave presentation (graphical interface, quick start, documentation, help …). Variables and elementary instructions (elementary instructions and matrices operations). Scripts and structures instructions (creation and execution, loops iterations, logic tests). Functions and graphical illustrations.	TD : 12h00 Cours : 12h00 Travail personnel : 24h00 Durée totale: 48h00
Mechanical Engineering S3	6	**Fluid Mechanics**	This course aims to master the basic laws and principles of fluid mechanics and to be able to solve simplified examples of fluid mechanics due to theoretical and practical work preparing students to apply the acquired knowledge and skills in professional and advanced fluid mechanics courses. 18 hours of lectures, 18 hours of tutorials: • Review of fundamental Concepts and fluid properties • Fluid Statics: Hydrostatics, the branch studying fluids at rest • Fluid Kinematics & fluid motion analysis approaches (focus on Reynolds Transport Theorem) • Conservation laws part I: fundamental to our understanding of the physical and thermos-fluid systems (mass, momentum and energy conservation) • Conservation laws part II: efficiency concept & Bernoulli equation and extended Bernoulli equation as an application • Dimensional analysis: non-dimensional equations, from prototypes to models due to similitude principle and method of the repeating variables • Internal flows: Viscous flows in piping networks and pressure losses, major and minor losses • External flows: Flows over bodies, Drag and Lift forces • Fluid flow governing equations: Navier Stokes equations 8 hours of labs: • Venturi tube study: Bernoulli equation application • Hydraulic jet study: application of Momentum conservation • Flowmeters: flow measurement techniques • Pressure losses in a piping system • Drug force study: Assessment of the drag coefficient of different obstacles • Pump study: operating condition identification	TD : 18h00 TP : 8h00 Cours : 18h00 Travail personnel : 36h00 Durée totale: 80h00
		General Mechanics 3	1. Linear Momentum and Center of Mass • Linear Momentum • Newton's Second Law • System of Particles • Center of Mass 2. Impulse, Reduced Mass, Kinetic Energy of a System • Impulse of a Particle and a System • Impulse due to a Constant Force • Reduced Mass of a System • Kinetic Energy of a System 3. Elastic and Inelastic Collisions • Types of Collision • Coefficient of Restitution 4. Momentum • Linear and Angular Momentum	TD : 12h00 Cours : 12h00 Travail personnel : 24h00 Durée totale: 48h00

Semester 3				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			• Moment due to Resultant Forces • Rigid Body • Linear and Angular Momentum of a Rigid Body 5. Impulse and Variable Mass System • Linear and Angular Impulse • Variable Mass Systems 6. Rolling, Rigid Body, and Pendulum • Rolling Motion • Sliding and Rolling • Kinetic Energy and Work of a Rigid Body • Physical Pendulum	
		Manufacturing Processes Insa		TP : 12h00 Cours : 4h00 Travail personnel : 20h00 Durée totale: 36h00
		Mechanical Design 3	Subject 1 (More advanced theoretical concepts of design) • PRECISION MACHINE DESIGN • Principal criteria for joint functioning (static and dynamic) • Guide Performances (without rolling elements) (shaft/housing) in rotation • Plain Bearings (Bushings) • Ball/roller bearing Design, Bearing Load Ratings and Life Calculations • APTE method (APplication to business TEchniques) • Mechnaism using CREO software + simulation + kinematics+ dynamics + static. They developed their understanding of theoretical design +kinematics+ dynamics using CREO software. • Mechanisms/Linkages: Kinematic Constraints, Degree of Freedom (Mobility) in Planar and Spatial Mechanisms Mechanisms, Gruebler's equation, Types of kinematic chains Subject 2: 2- Assembly Project of wind turbine system : The students apply all the theoretical design aspects and computer aided design on a project developed by the professor. Objectives of the project: -Starting from the old existent design to modify and improve or create a new design using CREO dynamic assembly and dynamic joints. -Find the design solution on the paper • Create the sub-assemblies • Create the assembly of final new design+ mechanism: dynamic joins, simulations, kinematics, • Create the drawing draft for the created and modified designed parts Subject 3- Mechanics calculation (machine cinematic) 1. POSITION ANALYSIS 2. VELOCITY AND ACCELERATION ANALYSIS -velocity/acceleration polygon for mechanisms- analysis (relative velocity method) -position, velocity and acceleration analyses for planar mechanisms using complex number method (analytical method)	TD : 14h00 Projet : 12h00 Travail personnel : 24h00 Durée totale: 50h00
Multidisciplinary Projects S3	5	**Multidisciplinary Project 1**	Project Based Learning: Mechanical Design: - using the CREO CAD software, create the parts starting from the real & sectioned prototype by measuring dimensions using adapted measurement tools (metrology) - Create the subassemblies - Create the final assembly using the necessary dynamic joints. - Create the assembly drawing draft with nomenclature. Represent at	TD : 10h00 Cours : 2h00 Projet : 4h00 Travail personnel : 6h00 Durée totale: 22h00

Semester 3				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			least one section to allow the visualization of the mechanism. - Represent in the assembly drawing two main necessary fittings and the functional conditions required in the mechanism. - Using CREO mechanism: run the simulation using the calculated data Electronics: - Realization of the electronic circuit (practically+ using tinkercad) that will be used in order to realize some measurment regarding three aspects (The direction of the wind, the speed of the wind and the strength of the wind - Development of arduino scripts in order to respond to the electronic specifications of the project	
		Sustainable Comsumption And Production 1	This course reinforces the general knowledge on Sustainable Development (SD) acquired in the 1st year and proposes the students to develop some concrete actions towards Sustainable Development in their projects. During S5, students identify a concrete issue in their surrounding environment, and provide a diagnosis of the situation. They also develop an action plan to implement some concrete actions that could improve the problem situation. During S6, students must implement their solution : implementation can take different forms, and results must be ideally measured. Students must adopt a critical viewpoint on their results and present / demonstrate them during the European Sustainable Development week (May).	Cours : 2h00 Projet : 6h00 Travail personnel : 8h00 Durée totale: 16h00
		Pathway Discovery Workshops / Winter Schools	Workshops are mixing three types of activities: - A practical work or experiment related to the pathway - Series of conferences or round tables with professionals - Visits of industrial companies' sites "Robotics & automation" workshop The goal of the workshop is to build a robotic system called Polargraph: the system receives an image as input and draws its contour on a whiteboard as output. First, the students study the mechanical structure of the system to define its specifications. Second, they learn the basics of computer vision during a 4-hours session lab. Third, they setup the system (electronic and mechanic) components, program the contour detection algorithm in Python, and the control algorithm on the Arduino board. Finally, they test the limits of the system by manipulating several parameters (e.g. frame rate). "Energy" workshop i. Students will design the blades, and plan the performance: power vs. wind speed velocity. At this step, aerodynamics and optimization of the design are the two main bricks to focus on. ii. then they will build the electric circuit, connect it to the DC generator and the Boost converter and verify and test the good operation of the circuit iii. Students should finally, assemble all the parts (blades on axis, motor on support/tower) "Mechanical engineering workshop 1- The students will design, using CREO, a mechanical crane that should be able tohold and transport an object in space. The model is sized based on the mechanical components given to the students at the beginning of the workshop (bearings, gears). The total weight of the crane and its volume should be minimized.	TP : 40h00 Travail personnel : 28h00 Durée totale: 68h00

Semester 3				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			2- The CAD design of the crane arm will be then imported to the numerical simulation Ansys software where a FEM (Finite Element) analysis is performed to check the ability of the arm to withstand the maximum force acting upon it. A topology optimization is also performed and the design can be then improved accordingly (A tutorial video about this simulation: https://www.youtube.com/watch?v=qLBpQVhfXIc). 3- Finite element programming of the basic equations with the help of MATLAB language should be realized to study the deformation of the crane arm. The FEM results of the arm using Ansys software should be compared with the analytical solution of finite element method. Please refer to annex for details 4- Once the design is finalized, the final CAD model is 3D-printed using PLS or ABS materials. 5- The prototype is run by servo motor controlled by Arduino to control the speed and the direction of the arm. 6- A test is performed to assess the ability of the prototype to carry the weight.	
Operator Internship	1	**Operator Internship**		Stage : 140h00 Travail personnel : 140h00 Durée totale: 280h00
Professional And Personal Development S3	6	**Advanced English Skills 3**	The Advanced English Skills modules aim to have students develop their language skills across a wide range of topics, often consolidating material from other modules. Describing processes Presentations Reading comprehension (IELTS Academic) Formal academic/professional English (spoken context) Expressing opinions Written expression -tenses, essay structure, C1+ level of vocabulary Spoken expression at C1 level (intonation and sentence stress)	TP : 14h00 Travail personnel : 14h00 Durée totale: 28h00
		Economics And Financial Systems	This course introduces students to the fundamentals of economic analysis and reasoning, and also examines financial systems from the perspective of both financial and economic stability. It will focus on the role of central banks and monetary policy, both in normal times and in financial crises, in order to help students understand the impact of the global and national economies on companies, organizations, and individuals.	TD : 18h00 Travail personnel : 18h00 Durée totale: 36h00
		Foreign Language 3		TD : 18h00 Durée totale: 18h00
		Sports Activities 3	The sports course allows students to engage physically and mentally on a regular basis in a fun, supportive environment, fostering self-improvement and self-awareness. The courses are organized into sequences of 4 to 5 sessions of the same sport, depending on the practice location. A schedule of the different sports is given to students at the beginning of the year (appendix "Yearly Programming ...../.....")... It is accompanied by a document indicating the location of the courses according to the trimester (as the facilities are shared with the Lazaristes school), the day of the week, and the time slot (appendix "Sports course locations year ...../......").	TD : 20h00 Durée totale: 20h00

Semester 3				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			The general structure of a sequence: A discovery phase: it gets students "moving," allows them to take bearings, and build meaning through an initial representation of the activity. A learning phase ensuring sufficient training time to achieve objectives and thus acquire skills. An evaluation phase allowing all students, regardless of their level, to demonstrate their ability to act in a situation presenting a certain level of complexity.	

Semester 4				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
Electrical Engineering S4	5	**Applied Thermodynamics**	In this course we will apply the fundamentals of thermodynamics learned in the previous course of thermodynamics. Understanding 2nd law of thermodynamics, how to apply 2nd law on closed and open systems. Gas power cycles ; Compressions and expansions of gases Thermal machines including internal combustion engines, refrigeration cycles, and gas turbine	TD : 8h00 Cours : 8h00 Travail personnel : 16h00 Durée totale: 32h00
		Electrical Networks	1. Review of DC and AC circuit analysis methods - The Ohms's, Kirchhoff's laws - Node-voltages and mesh-currents methods - Thévenin-Norton and Maximum power theorems 2. Introduction to the three-phase systems - Presentation of three-phase electrical systems: definition, properties, configurations and common representations. - Presentation of balanced three-phase loads, relationships between load voltages and currents. 3. Power-calculations in the three-phase systems - Calculation of active and reactive powers in the three-phase sources and loads - Presentation of reactive power compensation in three phase electrical installations - Presentation of unbalanced three-phase loads, phase to neutral and phase to phase voltages and neutral line current calculation 4. Transformers - Presentation of the single-phase electrical transformers - Modelization of the single-phase transformers - Autotransformers - Power calculations of the transformers - Voltage regulation and efficiency calculations	TD : 14h00 TP : 12h00 Cours : 14h00 Travail personnel : 36h00 Durée totale: 76h00
		Embedded Software	1. Introduction to embedded systems and C programming using Arduino Microcontroller 2. Introduction to Arduino programming : Basic sketches, digital hardware consideration, arrays, functions and pointers 3. Sensors and actuators (analogue and digital inputs and outputs) 4. Port Manipulation : Serial communication (simplex and duplex) 5. Timers, counters and interrupts	TP : 12h00 Cours : 12h00 Travail personnel : 12h00 Durée totale: 36h00
Mathematics For Engineering S4	7	**Mathematics For Engineers 8**	1 - Improper integrals 2 - Power series 3 - Vector space and linear map 4 - Pre-Hilbert space 5 - Systems of differential equations 6 - Orthogonal transformation - Linear isometry 7 - Spectral theorem and SVD	TD : 60h00 Cours : 30h00 Travail personnel : 72h00 Durée totale: 162h00

Semester 4				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
		Simulations And Numerical Methods	Introduction to numerical simulations, mathematical formulations and computer programming. Description of classical numerical methods (discretization, Bisection method, Newton's method, Euler's method, Gaussian elimination, curve fitting, numerical integration, numerical differentiation, finite elements) Implementing appropriate numerical algorithm using Octave. Numerical approximation and error estimation. Graphical representation.	TD : 12h00 Cours : 12h00 Travail personnel : 24h00 Durée totale: 48h00
Mechanical Engineering S4	6	**Materials 1**	1. Introduction to Material Science and Engineering • Classes of Materials • Manufacturing Processes 2. Materials in Atomic Scale • Atomic Structure and Bonding • Different Crystalline Structures • Atomic Arrangement • Crystallographic Directions and Planes 3. Material Properties • Elastic Moduli • Bond Force 4. Failure • Mechanisms of Failure: Fracture, Fatigue, Creep • Ductile and Brittle Materials 5. Dislocations and Strengthening • Dislocations and Plastic Deformation • Mechanisms of Strengthening 6. Introduction to Phase Diagram • Unary and Binary Phase Diagrams • Phase Composition	TD : 12h00 Cours : 12h00 Travail personnel : 24h00 Durée totale: 48h00
		Mechanical Design 4	Subject 1-study the translation and rotation. We also introduce the notion of Homogeneous transformations which combines the operations of rotation and translation into a single matrix multiplication. Subject 2-Mathematical modeling of the aerodynamic equations and programming using Matlab is performed to calculate all the required forces and parameters. Wind turbines are designed to generate the maximum power from the wind with keeping the cost of construction reasonable. In this work, we have developed a mathematical modeling and numerical simulation using Finite volume method to optimize the geometry of the blades and thereby extract the maximum power. Modeling was performed using the Blade Element Momentum Theory, numerical values and Aerodynamic equations were developed for geometry optimization Applying conservation of angular momentum equations and using the blade element theory we derive the differential forces, torque, power, angles and the power coefficient. Then, we calculated the total thrust T, torque, Q, and power, P as the sum of the differential power from each of the spanwise segments. All the geometrical blade parameters that maximize the power extracted from the wind was chosen for geometrical modeling and CFD simulations. These results were obtained as functions of different inputs like the speed ratio and the number of blades and many other geometrical parameters. The obtained values that maximize the maximum power were used to design the geometry of the blade using CREO software. The simulation results show the importance of numerical simulation to optimize the blades geometry and improve wind turbine performance Subject 3 gears 3-• Principal of gearing • (forces analysis)	TD : 8h00 TP : 16h00 Travail personnel : 20h00 Durée totale: 44h00

Semester 4				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			• CREO modeling, assembly and simulation of different type of gears (Advanced level); spur gear, helical gear, bevel gear)	
		Solid Mechanics	- Introductory concepts: Normal and shear stress, strain and deformation - Stress state: stress tensor, stress transformation, Mohr's circle - Strain state: strain tensor, relation between strain component and deformation, Mohr's cirlce - Behavior of materials: constitutive equations, tensile test, linear elastic material properties: Young's modulus, shear modulus, Poisson's ratio - Application: analysis of stresses in thin-walled pressure vessels - Plane elasticity: plane stress and plane strain configurations, 3D Mohr's circle - Yield criteria: yielding and plastic deformation in general configurations, Tresca and Von Mises criteria	TD : 12h00 TP : 8h00 Cours : 12h00 Travail personnel : 24h00 Durée totale: 56h00
Multidisciplinary Projects S4	5	**Multidisciplinary Project 2**	Mechanical Design: - using the CREO CAD software, create the parts starting from the real & sectioned prototype by measuring dimensions using adapted measurement tools (metrology) - Create the subassemblies - Create the final assembly using the necessary dynamic joints. - Create the assembly drawing draft with nomenclature. Represent at least one section to allow the visualization of the mechanism. - Represent in the assembly drawing two main necessary fittings and the functional conditions required in the mechanism. - Using CREO mechanism: run the simulation using the calculated data Electronics: - Sensors characterization (reading and interpreting the mode of operation). - Arduino Code development - Create an electrical circuit on a breadboard	TD : 10h00 Cours : 2h00 Projet : 12h00 Travail personnel : 12h00 Durée totale: 36h00
		Sustainable Comsumption And Production 2	A format based on conferences given by non-profit organizations speakers and visits is planned.	Cours : 2h00 Projet : 6h00 Travail personnel : 8h00 Durée totale: 16h00
		Pathway Discovery Workshops / Summer Schools	Workshops are mixing three types of activities: - A practical work or experiment related to the pathway - Series of conferences or round tables with professionals - Visits of industrial companies' sites "Robotics & automation" workshop The goal of the workshop is to build a robotic system called Polargraph: the system receives an image as input and draws its contour on a whiteboard as output. First, the students study the mechanical structure of the system to define its specifications. Second, they learn the basics of computer vision during a 4-hours session lab. Third, they setup the system (electronic and mechanic) components, program the contour detection algorithm in Python, and the control	TP : 40h00 Travail personnel : 28h00 Durée totale: 68h00

Semester 4				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			algorithm on the Arduino board. Finally, they test the limits of the system by manipulating several parameters (e.g. frame rate). "Energy" workshop i. Students will design the blades, and plan the performance: power vs. wind speed velocity. At this step, aerodynamics and optimization of the design are the two main bricks to focus on. ii. then they will build the electric circuit, connect it to the DC generator and the Boost converter and verify and test the good operation of the circuit iii. Students should finally, assemble all the parts (blades on axis, motor on support/tower) "Mechanical engineering workshop 1- The students will design, using CREO, a mechanical crane that should be able to hold and transport an object in space. The model is sized based on the mechanical components given to the students at the beginning of the workshop (bearings, gears). The total weight of the crane and its volume should be minimized. 2- The CAD design of the crane arm will be then imported to the numerical simulation Ansys software where a FEM (Finite Element) analysis is performed to check the ability of the arm to withstand the maximum force acting upon it. A topology optimization is also performed and the design can be then improved accordingly 3- Finite element programming of the basic equations with the help of MATLAB language should be realized to study the deformation of the crane arm. The FEM results of the arm using Ansys software should be compared with the analytical solution of finite element method. Please refer to annex for details 4- Once the design is finalized, the final CAD model is 3D-printed using PLS or ABS materials. 5- The prototype is run by servo motor controlled by Arduino to control the speed and the direction of the arm. 6- A test is performed to assess the ability of the prototype to carry the weight.	
Society, Management And EntrepreneurshIP 4	7	**Advanced English Skills 4**	Language classes aim to: - Strengthen vocabulary - Acquire grammatical accuracy - Improve reading comprehension skills - Improve oral expression and listening skills through active discussions and debates - Develop students' written language sklls - Develop students' ability to analyse opposing view points and present a balanced argument	TP : 14h00 Travail personnel : 10h00 Durée totale: 24h00
		Foreign Language 4	2 hour lessons every week. Expanded vocabulary Revision of grammar points Improvement of phonological control Language skills according to different CEFR level groups: A1 Can establish basic social contact by using the simplest everyday polite forms of: greetings and farewells; introductions; saying please, thank you, sorry etc. A2/B1 Has a repertoire of basic language, which enables him/her to deal with	TD : 18h00 Durée totale: 18h00

Semester 4				
Unité d'Enseignement	ECTS	Unité de Cours	Contenu	Nb d'Heures
			everyday situations with predictable content, though he/she will generally have to compromise the message and search for words. 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. 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. Has a limited repertoire of short memorised phrases covering predictable survival situations; frequent breakdowns and misunderstandings occur in non-routine situations. 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. B2 Can express him/herself clearly and without much sign of having to restrict what he/she wants to say. 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. 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. C1 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.	
		Markets And Organisation	This Class is aiming at providing EENG 2 students a first introduction to the Business World More precisely, they will discover how Organizations interact with their Environment. They will start discovering some definitions around Management, Organizations, Markets. Then they will be able to understand what a business is, how it functions and how it interacts with its environment. This class will be taught thanks to lectures, articles comments and practical exercises. They will also be able to test and validate their understanding thanks to a GroupWork consisting of analyzing and presenting a current business. Eventually, they will also be able to meet with a person working in the analyzed company.	TD : 8h00 Cours : 6h00 Durée totale: 14h00
		Sports Activities 4	The sports course allows students to engage physically and mentally on a regular basis in a fun, supportive environment, fostering self-improvement and self-awareness. The courses are organized into sequences of 4 to 5 sessions of the same sport, depending on the practice location. A schedule of the different sports is given to students at the beginning of the year (appendix "Yearly Programming ...../....."). It is accompanied by a document indicating the location of the courses according to the trimester (as the facilities are shared with the Lazaristes school), the day of the week, and the time slot (appendix "Sports course locations year ...../......"). The general structure of a sequence:	TD : 20h00 Durée totale: 20h00

Semester 4				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			A discovery phase: it gets students "moving," allows them to take bearings, and build meaning through an initial representation of the activity. A learning phase ensuring sufficient training time to achieve objectives and thus acquire skills. An evaluation phase allowing all students, regardless of their level, to demonstrate their ability to act in a situation presenting a certain level of complexity.	
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**

EENG - Year 3

Semester 5

Unité d'Enseignement	ECTS	Unité de Cours	Contenu	Nb d'Heures
Electrical Engineering S5	3	**Electrical Machines**	This course provides engineering students with in-depth knowledge of electrical machines theories. It teaches the students the necessary techniques of solving problems. The concept of magnetic field and the principle of operation of machines are covered. DC machines, their construction, their operation and their equivalent model are studied in depth. The principle of rotating magnetic field and AC machinery are underlined. AC machines including three-phase Synchronous machines and three-phase induction machines are explained. Analysis and calculations to find the voltage regulation and efficiency of a machine at a certain load are included. The different applications of each machine are studied as well. o Introduction to Machinery Principles: Rotational Notions, The Magnetic Field, Magnetic Circuit, Voltage & Torque Equations, Magnetic Losses o DC Machines Construction : Simplest DC Machine (1 loop), Armature Construction, Commutation in a 4 Loop DC Machine, Lap & Wave Windings, Problems & Solutions in Real DC Machines, Voltage & Torque Equations, Losses in DC Machines o DC Motors: Separately Excited & Shunt (Parallel) DC Motor, Series DC Motor & Compounded DC Motor, DC Motors Starting, DC Motors Applications & Test Procedures, DC Generators o Principle of Rotating Magnetic Field: Rotating Magnetic Field, Electrical & Mechanical Quantities, Magnetomotive Force and Flux Distribution, Induced Voltage & Torque in AC Machines, Winding Insulation & AC Machine Losses, Voltage Regulation & Speed Regulation o Synchronous Machines: Synchronous Generator Model, Synchronous Generator Operating Alone, Parallel Operation of Synchronous Generators, Control of Parallel Generators, Synchronous Motor Model, Synchronous Motor: Load and Field Effects, Starting Synchronous Motors o Induction Machines: Induction Motor Construction, Induction Motor Concepts & Model, IM Torque Speed Characteristic, IM Rotor Design, IM Starting, Induction Generator	TD : 14h00 TP : 8h00 Cours : 14h00 Travail personnel : 28h00 Durée totale: 64h00
Industrial Organisation S5	6	**Industrial Methods**	• Processes for the transformation and processing of metallic and plastics materials. • Introduction to unconventional and CNC (Computer Numerical Control) Manufacturing processes. • Study of workpiece fixturing and development of machining process planning for mechanical parts.	TD : 10h00 Cours : 8h00 Travail personnel : 18h00 Durée totale: 38h00
		Industrial Organisation	• Problem solving methology and related tools (PDCA, 5W2H, Pareto, Ishikawa, risks analysis, 5 Whys & Action Plan) • Industrial Planning management • Manufacturing flows and technical data (Bill of Materials, routing sheet) • Plant implementation and workstation study • Calculation of direct product costs • The MRP2 system with its 3 levels: S&OP (Sales & Operations Planning), determination of the MPS (Master Production Schedule), load calculations and introduction to MRP (Materials Requirements Planning). Link with capacity planning. • Lean Management • TPM: OEE, OOE, 6 major losses • Basics of inventory management • VSM • FMECA	TD : 16h00 Cours : 16h00 Travail personnel : 44h00 Durée totale: 78h00
Mathematics For Engineering S5	8	**Mathematics For Engineers 5**	* Lebesgue integration and Hilbert Spaces - Parameter dependant integrals. * Fourier Series * Fourier Transform * Laplace Transform * Some Classical examples in Partial Differential Equations	TD : 30h00 Cours : 30h00 Travail personnel : 60h00 Durée totale: 120h00

Semester 5				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			* optimization: non linear optimization (unconstrained and constrained optimisation for functions of several variables) linear optimisation (simplex method)	
		Network And Security	1 - Understand the fundamentals of computer networks, including their historical context and various use cases. 2 - Learn about the client/server model of communication, network components, and infrastructure. 3 - Gain knowledge of communication protocols and their specifications, as well as TCP/IP and OSI models for communication. 4 - Understand addressing schemes at layer 2 (MAC Address) and layer 3 (IP Address), frames and packet processing, and the role of end devices and intermediary devices in network communication. 5 - Gain an in-depth understanding of communication on local and remote networks, including the Address Resolution Protocol (ARP). 6 - Understand the critical aspect of information system security and learn about internal and external threats to information systems. 7 - Learn about cryptographic schemes to encrypt and decrypt data, as well as the Information Systems Security Policy (ISSP). 8 - Gain knowledge of the General Data Protection Regulation (GDPR) and its impact on data protection and privacy for individuals in the EU and EEA.	TD : 6h00 TP : 8h00 Cours : 20h00 Travail personnel : 34h00 Durée totale: 68h00
Mechanical Engineering S5	7	**Introduction To Heat Transfer**	• General introduction : fundamentals of heat transfer, heat transfer mechanisms, relationship to thermodynamics. • Fundamentals of conduction : Heat conduction equation, Fourier's law, one-dimensional heat conduction equation solutions with/without heat generation, variable thermal conductivity, boundary and initial conditions. • Steady heat conduction : heat conduction in plane walls, cylinder wall and spherical shell, thermal resistance concept, generalized thermal resistance network, thermal contact, critical radius of insulation, heat transfer from finned surfaces. • Fundamentals of convection : physical mechanisms, hydrodynamic/thermal boundary layer equations, Nusselt and Prandtl numbers, boundary layer similarity, Reynolds analogy. • External forced convection : laminar and turbulent flow, heat transfer correlations for the parallel flow over flat plates and the flow over cylinders and spheres, flow across tube banks. • Internal forced convection : laminar and turbulent flow in tube, thermal entry length, general thermal analysis, log mean temperature difference, heat transfer correlations for circular/non-circular tubes. • Introduction to radiation: spectral and directional distribution, solid angle, blackbody radiation, Stefan-Boltzmann law, emission from real surfaces, radiative properties (emissivity, absorptivity, transmittivity, reflectivity), Kirchoff's laws.	TD : 12h00 TP : 8h00 Cours : 12h00 Travail personnel : 24h00 Durée totale: 56h00
		Materials 2	1. Diffusion • Mechanisms of Diffusion • Diffusion Flux • Factors of Diffusion 2. Phase Diagrams I • Microstructure • Equilibrium and Non-Equilibrium Cooling 3. Phase Diagrams II • Binary Eutectic Systems	TD : 6h00 TP : 12h00 Cours : 6h00 Travail personnel : 20h00 Durée totale: 44h00

Semester 5				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			• Hypoeutectic and Hypereutectic • Relative Amounts in the Micro-constituents • Equilibrium and Non-Equilibrium Cooling of Binary Systems	
		Strength Of Materials	- Introduction: review of Statics and Solid Mechanics (stress and strain) - Axial loads: stress concentrations, stresses due to temperature change, solutions of hyperstatic systems - Torsional loads: torsion of shafts due to applied torques, design of transmission shafts, stress concentrations - Analysis of beams under later loads: shear and moment diagrams - Pure bending of beams: normal stresses, properties of cross-sections - Deflection of beams: elastic curve equation, resolution of hyperstatic systems	TD : 12h00 TP : 8h00 Cours : 12h00 Travail personnel : 24h00 Durée totale: 56h00
Multidisciplinary Projects S5	3	**Ecodesign Project Part 1 - Environment**	The project contains 3 expected content types: courses & tutorials, project sessions (labs), and personal work. Content of Semester 5: 1. Courses & tutorials: basics of environmental evaluation & LCA. - Courses topics: global environmental issues, impacts and indicators, life cycle thinking, environmental evaluation using LCA - Tutorials on Simapro 2. Project sessions (labs) supervised by the teacher. - Energy measurements: data acquisition using a data logger - Dismantling (tools available) and BoM definition - Life cycle modelling on Simapro 3. Personal work: information search, interpretation of LCA results.	TD : 10h00 Cours : 5h00 Projet : 4h00 Travail personnel : 13h00 Durée totale: 32h00
		Ecodesign Project Part 1 - Technical	The project contains 3 expected content types: courses & tutorials, project sessions (labs), and personal work. For each semester, this projects represents ~40h of work on-site + 20h-30h of personal work. The total workload for each semester is estimated to 60- 70h/student. Content of Semester 5: 1. Courses & tutorials: basics of environmental evaluation & LCA. - Courses topics: global environmental issues, impacts and indicators, life cycle thinking, environmental evaluation using LCA - Tutorials on Simapro 2. Project sessions (labs) supervised by the teacher. - Energy measurements: data acquisition using a data logger - Dismantling (tools available) and BoM definition - Life cycle modelling on Simapro 3. Personal work: information search, interpretation of LCA results.	TP : 8h00 Cours : 3h00 Projet : 2h00 Travail personnel : 11h00 Durée totale: 24h00
Society, Management And EntrepreneurshIP 5	3	**Lv2 Mutualisée 1Er Semestre**		Durée totale: 0h00
		Advanced English Skills 5: (Ielts Preparation)	Introduction to test. Mock Listening paper and feedback. Mock Reading paper and feedback. Introduction to Writing Tasks 1 and 2. Sample papers Full mock IELTS paper Individual mock speaking tests (by student request).	TP : 14h00 Travail personnel : 14h00 Durée totale: 28h00
		Engineering Ethics	The course will examine the development of Ethics as a social science and prepare students to approach decision making using coherent ethical frameworks. It helps students understand various moral principles and theories that guide human behavior. By encouraging critical thinking	Cours : 4h00 Projet : 8h00 Travail personnel : 4h00

Semester 5				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			about complex moral issues and dilemmas, it provides tools for making ethical decisions in both personal and professional contexts. Additionally, it fosters awareness of different cultural perspectives on ethics, promoting personal growth by encouraging students to reflect on their own values and beliefs. Overall, the aim is to equip students with the knowledge and skills to navigate ethical challenges thoughtfully and responsibly.	Durée totale: 16h00
		French As à Foreign Language	6 hour lessons every week : 4h face-to-face +2h guided autonomy Expanded vocabulary Introduction of grammar points Improvement of phonological control A1 Can establish basic social contact by using the simplest everyday polite forms of: greetings and farewells; introductions; saying please, thank you, sorry etc.	TP : 21h00 Travail personnel : 18h00 Durée totale: 39h00
		Optional Foreign Language	1.5 hour lessons every week. Expanded vocabulary Revision of grammar points Improvement of phonological control	TP : 21h00 Travail personnel : 18h00 Durée totale: 39h00
		Professional Engineering Project	After a general presentation of the functioning of a company and the different professions that make it up, a presentation of the sectors of activity open to engineers will be discussed. The internship search techniques will then be presented (from the definition of your project to preparation for the interview). Students will thus be encouraged to develop their employability and understand the challenges of recruitment, and be able, as future managers, to recruit new employees.	Projet : 5h00 Durée totale: 5h00
Semester 6				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
Control Engineering S6	6	**Introduction To Control Theory**	1. Introduction to continuous Linear Time-Invariant (LTI) systems 2. Mathematical models of LTI systems 3. Block diagram and the reduction rules 4. Time-domain analysis of a first order system 5. Time domain analysis of a second order system 6. PID controllers for TLI systems	TD : 10h00 TP : 8h00 Cours : 14h00 Travail personnel : 24h00 Durée totale: 56h00
		Power Electronics	This course introduces a comprehensive overview of different power electronics components and applications. It presents the basics of devices, their characteristics, their principle of operation, and their range of applications as well. The course also underlines the principle of operation of converters used in DC drives (diodes rectifiers, controlled rectifiers and choppers). It discusses the principle of harmonics, performance parameters and filtering techniques. Furthermore, upon completion of this course, the student will be able to outline the characteristics and operation principle of power AC drives (inverters and AC-AC controllers). Mainly full bridge and three phase circuits are highlighted. The effect of inductive loads and protection schemes are discussed as well. The student will understand and be able to describe switching techniques and conduct both performance and harmonical studies. The student will be able to demonstrate a certain familiarity with the various configurations and applications and to develop models and simulations. o Introduction & Basics in Power Electronics: Purpose, History &Application, Devices & Circuits Characteristics, Ideal and Practical	TD : 6h00 TP : 8h00 Cours : 10h00 Travail personnel : 24h00 Durée totale: 48h00

Semester 6				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			device, Semi-conductors basics o Conversion Basics & Diodes Rectifiers : Conversion Circuits Types, Switching Sequence & Methodology, Protection, Performance Parameters, FW SP Diode Rectifier, FW 3P Diode Rectifier o Controlled Rectifiers & DC/DC converters: FW SP Controlled Rectifier, FW 3P Controlled Rectifier, o Introduction to DC-DC drives: Buck Converter, Boost Converter, Buck Regulator, Other topologies o DC/AC Conversion: Introduction to AC Drives, SP Full Bridge Inverter, 3P Full Bridge Inverter o AC-AC Conversion: R Load	
Sustainable Energy And Environmental Engineering S6	8	**Advanced Heat Transfer**	-Steady Heat conduction : heat transfer in common configuration, conduction shape factors. - Transient conduction : lumped system analysis, Biot number, transient heat conduction in large plane walls, long cylinders, and spheres with spatial effects, transient heat conduction in semi-infinite solids. - Numerical methods in heat conduction : finite difference formulation of differential equations, two-dimensional steady heat conduction. - Natural convection : physical mechanisms, equation of motion and the grashof number, natural convection over surfaces, natural convection inside enclosures, combined natural and forced convection. - Boiling and condensation : boiling heat transfer, pool Boiling, flow boiling, condensation heat transfer, film condensation, dropwise condensation - Heat exchangers : heat exchanger types, overall heat transfer coefficient, the log mean temperature difference, the effectiveness-NTU method, heat exchanger design and performance calculations. - Radiation heat transfer : the view factor, view factor relations, black surfaces, diffuse and gray surfaces, radiation shields and the radiation effect.	TD : 12h00 TP : 12h00 Cours : 12h00 Travail personnel : 24h00 Durée totale: 60h00
		Heating Ventilation And Air Conditioning Hvac	The purpose of this course is to deeply understand Heat, Ventilation and Air Conditioning technologies and their importance in the building and industry sectors (buildings energy consumption, thermal comfort, ...) and to manage to size and optimize and HVAC system. The course addresses also the future of the HVAC&R industry (EU F-Gas regulation, use of new refrigerant fluids, improvement of energy efficiencies, etc.). course content (10h of lectures + 10h of tutorials) • Introduction to HVAC (Importance of HVAC processes in our current society, cold production, cold chain management, energy consumption, environmental consequences) and classic mechanical refrigeration • Different Refrigeration technologies, and their performance (specificities and comparison) • Heat pumps specificities and performance (different heating technologies) • Humid air: Psychrometrics and thermodynamics of moist air. • Air Handling Units for air conditioning (components and technology evolution) Labs: (12h) Study of a volumetric compressor of a refrigerating machine Study of a refrigeration machine with a water secondary circuit Study of an Air Handling Unit with a recycling option	TD : 10h00 TP : 12h00 Cours : 10h00 Travail personnel : 20h00 Durée totale: 73h00
		Hydraulics	- Hydraulic networks: fundamentals of fluid flow in pipes, major and minor and head loss, system head, branches in parallel and series. - Pumping systems: classification of pumps, operation of dynamic pumps, pump main parameters, pump performance curves, pumps combined in series and parallel, matching a pump to a piping system, cavitation and net positive-suction head, dimensionless pump performance, similarity rules, specific speed, adaptation of operating conditions.	TD : 10h00 Cours : 10h00 Travail personnel : 20h00 Durée totale: 70h00

Semester 6				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			- Hydraulic power systems: Fundamentals of Hydraulic Power Transmission, hydraulic power generation, positive displacement pumps (design and performance), hydraulic power distribution (hydraulic valves: types, design and function), hydraulic power deployment (hydraulic cylinders, hydraulic motors, hydrostatic transmission), hydraulic circuits.	
System Engineering S6	3	**Quality**	Introduction to Quality, its history and evolution. Learn about quality management with the main tools related to it. Analysis and understanding of the ISO 9001 standard, its purpose, context and stakes. Audit: Preparing and conducting an Audit. QRQC : Operational method of quality management and problem solving. Discovery and appropriation of A3 and Kanban communication tools. Experience plan: Initiation to the PEX tool, mathematical approach and method.	TD : 10h00 Cours : 8h00 Travail personnel : 18h00 Durée totale: 51h00
		Vibrations	The course resumes the basics of vibration analysis. At first the vibration analysis and its matrix formalism is presented and applied at two degrees of freedom systems. Then, damping and vibration isolation is presented. Exercises are done after each notion to put into practice formula and method introduced in the course.	TD : 4h00 TP : 4h00 Cours : 12h00 Travail personnel : 16h00 Durée totale: 51h00
Industrial Engineering And Supply Chain Management S6	8	**Industrial Engineering And Project Management**	• To study process flows before implementation of a manufacturing plant • Workstation analysis, determination and optimization of times • Design, methods and tools for industrialization • Exploring the challenges facing Total Productive Maintenance • Total Productive Maintenance - TPM : Reliability functions, probability density functions. Serie and Parallele systems Failure rate, MTTF (Mean Time To Failure), MTBF (Mean Time Between Failure), MTTR (Mean Time To Repair) • Analysis & specifications of product • (Re)Designing a product with Creo Parametric • Being able to define standard documents • To understand the types and levels of maintenance • Establish a simple version of the maintenance plan • Flow simulation with FLEXSIM	TD : 22h00 Cours : 8h00 Travail personnel : 12h00 Durée totale: 42h00
		Introduction To Supply Chain Management	- Ergonomy, Health and Security at work - Inventory Management: Define and manage the economic quantity, the safety stock and the stock classification - Approach of Inventory Management - Knowledge in Financial Management in industries	TD : 12h00 Cours : 12h00 Travail personnel : 12h00 Durée totale: 36h00
		The Fresh Connection	- The Fresh Connection: serious game in a web-based simulation	TD : 12h00 Cours : 4h00 Travail personnel : 16h00 Durée totale: 32h00
Mathematics For Engineering S6	6	**Mathematics For Engineers 6**	Introduction to statistics and probability - Graphical Tools to represent data Meaningful Values Probability Theory Common Discrete and Continuous Probability Distributions Convergence Theorems Sampling Estimations and Confidence intervals Statistical Tests Comparison of Normal Distributions	TD : 16h00 Cours : 16h00 Travail personnel : 32h00 Durée totale: 64h00

Semester 6				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			Normality Assumption checking Homogeneity of a population: ANOVA Chi-Square test Correlation and linear regression	
		Object-Oriented Programming	Basics of Java Introduction to Object Oriented Programming Classes and Methods Inheritance Standard Library of Java	TD : 4h00 TP : 12h00 Cours : 6h00 Projet : 8h00 Travail personnel : 18h00 Durée totale: 48h00
Mechanical Engineering S6	8	**Advanced Heat Transfer**	12 hours (lecture), 12 hours (tutorial) - Steady Heat conduction : heat transfer in common configuration, conduction shape factors. - Transient conduction : lumped system analysis, Biot number, transient heat conduction in large plane walls, long cylinders, and spheres with spatial effects, transient heat conduction in semi-infinite solids. - Numerical methods in heat conduction : finite difference formulation of differential equations, two-dimensional steady heat conduction. - Natural convection : physical mechanisms, equation of motion and the grashof number, natural convection over surfaces, natural convection inside enclosures, combined natural and forced convection. - Boiling and condensation : boiling heat transfer, pool Boiling, flow boiling, condensation heat transfer, film condensation, dropwise condensation - Heat exchangers : heat exchanger types, overall heat transfer coefficient, the log mean temperature difference, the effectiveness-NTU method, heat exchanger design and performance calculations. - Radiation heat transfer : the view factor, view factor relations, black surfaces, diffuse and gray surfaces, radiation shields and the radiation effect.	TD : 12h00 Cours : 12h00 Travail personnel : 24h00 Durée totale: 48h00
		Hydraulics	- Hydraulic networks: fundamentals of fluid flow in pipes, major and minor and head loss, system head, branches in parallel and series. - Pumping systems: classification of pumps, operation of dynamic pumps, pump main parameters, pump performance curves, pumps combined in series and parallel, matching a pump to a piping system, cavitation and net positive-suction head, dimensionless pump performance, similarity rules, specific speed, adaptation of operating conditions. - Hydraulic power systems: Fundamentals of Hydraulic Power Transmission, hydraulic power generation, positive displacement pumps (design and performance), hydraulic power distribution (hydraulic valves: types, design and function), hydraulic power deployment (hydraulic cylinders, hydraulic motors, hydrostatic transmission), hydraulic circuits.	TD : 10h00 Cours : 10h00 Travail personnel : 20h00 Durée totale: 70h00
		Materials 3	1. Introduction to Phase Transformation • Processes and Types of Phase Transformation • Types of Nucleation • Phase Transformation Rate 2. Part 1: Heat Treatment • Equilibrium and Non-equilibrium States • Eutectoid, Hypereutectoid and Hypoeutectoid Points • Martensite Transformation 3. Part 2: Heat Treatment • Mechanical Properties of Martensite • Tempering of Steel Alloys • Continuous Cooling Transformation Diagrams 4. Structural Hardening of Aluminum • Equilibrium Diagram of Aluminum Alloys • Heat Treatments of Aluminum Alloys	TD : 10h00 TP : 12h00 Cours : 10h00 Travail personnel : 40h00 Durée totale: 72h00

Semester 6				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			5. Corrosion • Redox Reactions • Types of Corrosion • Methods for Corrosion Prevention	
Multidisciplinary Project S6	3	**Ecodesign Project Part 2 - Environment**	The project contains 3 expected content types: courses & tutorials, project sessions (labs), and personal work. For each semester, this projects represents ~40h of work on-site + 20h-30h of personal work. The total workload for each semester is estimated to 60- 70h/student. Content of semester 6: 1. Courses & tutorials: Ecodesign approaches and strategies. - Courses topics: Ecodesign regulations & strategies, Materials & environment, Design for Sustainable behaviour, Thermal insulation & downsizing, Ecodesign of packaging, design for End-of-life, Innovation for ecodesign. - Tutorials: CES EduPack (choice of materials), Simapro, CREO (CAD modelling) 2. Project sessions (labs) supervised by the teacher: Developing 3 levels of ecodesigned solutions - Solutions developments: calculations, CAD modelling, LCA modelling of the 3 levels 3. Personal work: information search, interpretation of LCA results.	TD : 4h00 Cours : 3h00 Projet : 8h00 Travail personnel : 8h00 Durée totale: 31h00
		Ecodesign Project Part 2 - Technical	The project contains 3 expected content types: courses & tutorials, project sessions (labs), and personal work. For each semester, this projects represents ~40h of work on-site + 20h-30h of personal work. The total workload for each semester is estimated to 60- 70h/student. Content of semester 6: 1. Courses & tutorials: Ecodesign approaches and strategies. - Courses topics: Ecodesign regulations & strategies, Materials & environment, Design for Sustainable behaviour, Thermal insulation & downsizing, Ecodesign of packaging, design for End-of-life, Innovation for ecodesign. - Tutorials: CES EduPack (choice of materials), Simapro, CREO (CAD modelling) 2. Project sessions (labs) supervised by the teacher: Developing 3 levels of ecodesigned solutions - Solutions developments: calculations, CAD modelling, LCA modelling of the 3 levels 3. Personal work: information search, interpretation of LCA results.	TD : 2h00 Cours : 3h00 Projet : 8h00 Travail personnel : 4h00 Durée totale: 25h00
Robotics And Automation Engineering S6	8	**Introduction To Robotics**	-Introduction to robotic systems and controllers -Robots in their contexts -Mechanical structures: serial and parallel robots, mobile robots -Forward, Inverse and Differential Kinematics for Robot Arm -Differential Drive robots -Motion planning for mobile robot (Dijkstra, A*) -Practical introduction to robot programming (mBot, poppy)	TD : 12h00 TP : 8h00 Cours : 10h00 Travail personnel : 22h00 Durée totale: 52h00
		Sensing And Perception	-Inertial sensors, GPS and odometry / sonar sensing / vision, bio-inspired sensors, force sensors -Transformation of information into electric properties and its implication -Signal conditioning -ADC: sampling, quantization, windowing -MCU: Application of data acquisition, data analysis, data processing -Introduction to image processing	TD : 4h00 TP : 12h00 Cours : 8h00 Travail personnel : 12h00 Durée totale: 36h00

Unité d'Enseignement	ECTS	Unité de Cours	Contenu	Nb d'Heures
		Signal Processing + Wireless Communications	-Signals: general properties and transformations (convolution…) -Spectral analysis (DFT, FFT…) -Sampling -Signals and systems (stability, causality…) -Filters (FIR, IIR) -Random signals (autocorrelation, intercorrelation…) -Time-frequency analysis -Image processing	TD : 12h00 TP : 8h00 Cours : 12h00 Travail personnel : 24h00 Durée totale: 56h00
Society, Management And EntrepreneurshIP S6	4	**Advanced English Skills 6**	The Advanced English Skills modules aim to have students develop their language skills across a wide range of topics. Organisation and management of workshops on a pedagogical subject of their choice. Research on specific topics and participation in debates.	TP : 14h00 Travail personnel : 14h00 Durée totale: 28h00
		French As à Foreign Language	6 hour lessons every week : 4h face-to-face +2h guided autonomy Expanded vocabulary Introduction of grammar points Improvement of phonological control A1 Can establish basic social contact by using the simplest everyday polite forms of: greetings and farewells; introductions; saying please, thank you, sorry etc.	TP : 21h00 Travail personnel : 18h00 Durée totale: 39h00
		Global Affairs	The academic discipline of International Relations (also called Global Affairs) traditionally focuses on political relationships between sovereign nation-states and non-state actors. This module aims to understand our contemporary international system using three frameworks: realism, liberalism and identity theory. The module begins with a historical analysis, because we cannot understand our contemporary system, without understanding the events that have shaped it. We then will begin to analyze modern history beginning at the end of the Cold War. The module culminates in a project that will require you to analyze the most recent international affairs.	Cours : 4h00 Projet : 10h00 Durée totale: 14h00
		Optional Foreign Language	1.5 hour lessons every week. Expanded vocabulary Revision of grammar points Improvement of phonological control	TP : 21h00 Travail personnel : 18h00 Durée totale: 39h00
		Principles Of Marketing	As future engineers, Students need to understand the way a company works and how they shall collaborate with different functions. Marketing is a key department in a company, interacting with almost all departments, especially with the R&D and Manufacturing functions. This course is aiming at providing students with a global overview of what Marketing is and how Marketing function is interacting with other departments inside a company. Students will discover the major definitions and tools taught in Marketing. The course will be composed of Lectures and Tutorials. Students will have the opportunity to review and check their understanding of the content as well as their level of knowledge Students will have the opportunity to test and learn how to use Marketing tools during the Tutorials thanks to Group Work activities Eventually they willbe able to implement these learning during the Innovation program that they will go throught during their 4th year	Cours : 6h00 Projet : 8h00 Travail personnel : 14h00 Durée totale: 28h00

Semester 6				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
		Professional Project	The objective of the teaching is multifaceted: from the search for a professional project to obtaining their degree, the student is led to understand the challenges of recruitment, to define the favorable conditions for its achievement, and to open up to the external professional world.	Projet : 5h00 Durée totale: 5h00
Students Life Commitment	3	**Students Life Commitment Sem 6**		Durée totale: 0h00
Students Life Involvement	2	**Students Life Involvement Sem 6**		Durée totale: 0h00

Semester 6				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**

EENG - Year 4

Semester 7

Unité d'Enseignement	ECTS	Unité de Cours	Contenu	Nb d'Heures
Sustainable Energy And Environmental Engineering S7	12	**Advanced Electrical Machines And Applications**	This course covers the basics needed for the design of an electrical machine. It introduces the different electrical machines, their components, and the main definitions / technical vocabulary needed for the design. It also sheds the light on the different methods of numerical modelling of magneto static systems as well as the finite element approach for the synchronous machine modelling. This course presents the basic analytical method for designing the various parts of a machine while relying on the client requirements (operating voltage, needed speed, geometrical sizing…). It also provides the student with the in depth knowledge needed to simulate the machine's construction using CAD and Matlab software. o Electrical Machines Design – Basics & Background: Overview on the different electrical machines, Machines Specifications, Analytical sizing of an electrical machine, CAD Design of an electrical machine o Electrical Machines Design – Analytical Method for Design: Overview of the winding and the rotating field, Winding layers & Coefficients, Electric machines: materials & components, Design methodology for a PM Synchronous Machine o Project: Design of an electric machine for a given predefined application using Matlab & FEMM 4.2 software	TD : 2h00 TP : 12h00 Cours : 4h00 Travail personnel : 6h00 Durée totale: 34h00
		Compressible Flows And Propulsion Systems	This course aims to understand • Jet propulsion systems and their performance criteria applied to Air-Breathing and Rocket engines: Thrust; Specific Impulse; Propulsion efficiency; Tsiolkovsky rocket equation; Breguet aircraft equation. • Fundamental of Compressible flows: Mach number and thermodynamics of compressible flows; Shockwaves; Conservation laws; application to Isentropic flows. • Rocket engine design: Stagnation and critical states; operating mode of nozzles in rocket engines; influence of combustion pressure and temperature and of nozzle geometry on the thrust finally produced. Calculation of the resulting specific impulse. • Propulsion systems combustion processes: influence of fuel composition and of Air-Fuel Ratio on the performance of air-breathing combustion processes; use of liquid and solid propellants in rocket engine combustion processes. • Air-breathing propulsion turbomachines: Thermodynamic cycles used in turbojet or turbofans engines; influence of pressure ratios, air and fuel mass flow rates, blades geometries on the engine performances (specific impulse, propulsion efficiency and specific fuel consumption).	TD : 12h00 Cours : 12h00 Travail personnel : 36h00 Durée totale: 70h00
		Computational Fluid Dynamics	This course introduces the student to the subject of Computational Fluid Dynamics, as well as numerical methods for predicting fluid flows and heat transfer in flows. This course aims to help students get a good level of expertise in flow modeling for engineering applications by conducting practical work on a well-known commercial tool. Lectures content (6h) • Introduction to CFD: CFD fundamentals, principles, and steps • Turbulence modeling for CFD part I: Turbulence characteristics and properties, Mean-flow equations • Turbulence modeling for CFD part II: Turbulent-viscosity models (RANS models), Near-wall treatments Practical work: (16h) • Introduction to Ansys Fluent CFD tool: Fluid Flow and Heat Transfer in a Mixing Elbow • Practice on Ansys Fluent CFD tool: Modeling external Compressible Flow • Practice on Ansys Fluent CFD tool: Modeling Transient Compressible Flow • Practice on Ansys Fluent CFD tool: Assessment project	TP : 20h00 Cours : 6h00 Travail personnel : 10h00 Durée totale: 41h00

Semester 7				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
		Gas Turbines	• Gas turbine technologies (heavy duty, aeroderivatives, etc.), improvements (cogeneration, combined cycles) and uses. • Gas turbines specific combustion processes: operating modes, thermodynamics models, practical fuels and pollutants management. • Theory of turbomachines applied to compressible flows and gas turbines. • Gas turbine thermodynamic cycles. • Main components and technological aspects of gas turbine technologies. Steam cycle ; Theoretical cycle; actual cycle coupling of gas turbine cycle with steam cycle HRSG	Cours : 10h00 Travail personnel : 10h00 Durée totale: 30h00
		Hydrogen Technologies	1. Introduction to Hydrogen Technologies: Production, Storage, and Transport of Hydrogen (2H) a. Physico-chemical properties of hydrogen. b. Green, grey, yellow, and blue hydrogen. c. Hydrogen production through natural gas reforming. d. Hydrogen production through water electrolysis. e. High-pressure gaseous hydrogen storage. f. Low-temperature liquid hydrogen storage. g. Metal hydride-based solid hydrogen storage. h. Hydrogen transport: Compressed gas cylinders/cryogenic liquid tanks, pipelines (gas pipelines, hydrogen pipelines, etc.). 2. Fuel Cells: Introduction to Different Technologies (2H) (2H) a. History of the fuel cell. b. Operating principle of a fuel cell. c. Different types of fuel cell. 3. Proton Exchange Membrane Fuel Cell (PEMFC) (2H) a. History. b. Chemical reaction. c. Fuel cell stack. d. Operation. e. Degradation mechanisms. f. Design of the Membrane Electrode Assembly (MEA). g. PEMFC system: Fluidic architecture, thermal management, and power interface. 4. Tutorials (4H) a. Sizing a PEMFC stack with hydrogen storage 5. Lab : Characterization of a PEMFC (4H) a. Establish the characteristic curve of a PEMFC.	TD : 4h00 TP : 4h00 Cours : 6h00 Durée totale: 14h00
		Renewable Energy Systems	• The role of energy in society; Forms of energy; Primary energy; Thermodynamics fundamentals and Energy conversion technologies. • Electricity generation, transmission, and distribution; Renewable technologies; Smart grids; Energy storage; and Nuclear power. • Economic payback modelling and quantitative analysis; Environmental impacts of energy use; and Energy efficiency of renewable energy systems. • Legislation; Markets; Financial support schemes; and Regulations	Cours : 16h00 Travail personnel : 10h00 Durée totale: 26h00
Industrial Engineering And Supply Chain Management S7	12	**Global Supply Chain And Information System**	• Information Systems in Supply Chain • Focus on ERP • Project Management in Supply Chain • Demand Management • Forecasting Management • Warehouse and Distribution Management • Procurement strategies and Suppliers Management	TD : 6h00 TP : 10h00 Cours : 14h00 Projet : 18h00
		Manufacturing Digital Transformation	• XR: - Discover SimLab software solutions for developing VR/AR applications - Developing the first VR experience - Understanding how SimLab software works with VR/AR equipment • Product Lifecycle Management - PLM :	TD : 24h00 Cours : 6h00 Projet : 8h00 Travail personnel : 22h00

Unité d'Enseignement	ECTS	Unité de Cours	Contenu	Nb d'Heures
			- PLM Introduction - Windchill PLM software - Project view • Plant Layout 2 : - Redo the implementation from last year, with the simulation flows of a robotic equipment	Durée totale: 60h00
		The Blue Connection	Business simulation THE BLUE CONNECTION (publisher INCHAINGE) 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). 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: - Sales management - Purchasing/design department - Supply chain management - Finance department 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. In each round, the students test and deploy a circularity or life extension strategy (maintenance/warranty, refurbishment, remanufacturing, recycling). In the final rounds, they must choose their own strategy, implement it and explain it in an individual report.	TD : 18h00 Cours : 4h00 Durée totale: 22h00
Innovation Project S7	5	**IP Ideation**	Application of creative brain theory Use of ideation techniques (e.g., brainstorming, SCAMPER, etc.) Definition and synthesis of potential solutions Clear description of how each solution addresses the issues highlighted in the user research phase	Cours : 4h00 Projet : 2h00 Travail personnel : 8h00 Durée totale: 14h00
		IP Marketing	Segmentation - Definition of target customer segments - Identification of customer needs and profiles Needs Intensity - Evaluation of the problem intensity using a quantitative method - Reframing the problem if necessary - Visual representation of the idea on a Business Model Canvas - Qualitative analysis using key success factors for innovation adoption Value Proposition - Description of the solution and how it addresses the problem - Unique and defensible aspects of the product - Revolutionary character of the solution and supporting evidence - Analysis of customer behavior change and adoption drivers - Evaluation of simplicity, accessibility, integration potential, and perceived value - Estimation of return on investment (ROI) and time to value	TD : 2h00 Cours : 8h00 Projet : 8h00 Travail personnel : 12h00 Durée totale: 30h00
		IP Project Management		TD : 4h00 Cours : 6h00 Projet : 6h00 Travail personnel : 10h00 Durée totale: 26h00
		IP Requirements	Functional Analysis - Clarification of objectives - Definition of product life cycle and key life phases - Environmental diagrams for each key phase - Functional diagnosis - Function table with measurable criteria and performance targets	TD : 2h00 Cours : 4h00 Projet : 12h00 Travail personnel : 15h00 Durée totale: 33h00

Unité d'Enseignement	ECTS	Unité de Cours	Contenu	Nb d'Heures
		Semester 7		
			Interactional Analysis - Detailed use cases and justified hypotheses - Prioritization of non-functional criteria (usability, ergonomics, etc.) - Specification of context of use and constraints	
		IP Users Research	Field observations: assumptions, procedures, and key findings Identification of relevant user, task, and environmental parameters Creation of personas with clear justifications Development of a UX map	TD : 4h00 Cours : 4h00 Projet : 8h00 Travail personnel : 8h00 Durée totale: 24h00
Mechanical Engineering S7	12	**Advanced Vibrations**	The presentation of the relations between the physical properties of a mechanical system and its vibratory behavior is carried out in the form of lectures on the following points: 1 - Vibration of a system with one degree of freedom: Conservative System: Free Movement - Clean Pulsation - Kinetic Energy and Deformation Energy. Non-conservative system: Viscous damping model - Frequency response - Resonance. 2 - Vibrations of discrete systems with n degrees of freedom: Modes of vibration - Calculation of modal characteristics - Decoupling of equations of motion - Proportional damping model - Modal superposition - Frequency response - Experimental modal analysis. 3 - Vibration reduction methodology: Vibration isolation - Modification of a natural frequency - Increase of the damping - Use of a dynamic dampener granted	TP : 8h00 Cours : 18h00 Travail personnel : 21h00 Durée totale: 47h00
		Compressible Flows And Propulsion Systems (Mechanical Pathway)	• Jet propulsion systems and their performance criteria applied to Air-Breathing and Rocket engines: Thrust; Specific Impulse; Propulsion efficiency; Tsiolkovsky rocket equation; Breguet aircraft equation. • Fundamental of Compressible flows: Mach number and thermodynamics of compressible flows; Shockwaves; Conservation laws; application to Isentropic flows. • Rocket engine design: Stagnation and critical states; operating mode of nozzles in rocket engines; influence of combustion pressure and temperature and of nozzle geometry on the thrust finally produced. Calculation of the resulting specific impulse. • Propulsion systems combustion processes: influence of fuel composition and of Air-Fuel Ratio on the performance of air-breathing combustion processes; use of liquid and solid propellants in rocket engine combustion processes. • Air-breathing propulsion turbomachines: Thermodynamic cycles used in turbojet or turbofans engines; influence of pressure ratios, air and fuel mass flow rates, blades geometries on the engine performances (specific impulse, propulsion efficiency and specific fuel consumption).	TD : 12h00 Cours : 12h00 Travail personnel : 36h00 Durée totale: 70h00
		Computational Fluid Dynamics	This course introduces the student to the subject of Computational Fluid Dynamics, as well as numerical methods for predicting fluid flows and heat transfer in flows. This course aims to help students get a good level of expertise in flow modeling for engineering applications by conducting practical work on a well-known commercial tool. Lectures content (6h) • Introduction to CFD: CFD fundamentals, principles, and steps • Turbulence modeling for CFD part I: Turbulence characteristics and properties, Mean-flow equations • Turbulence modeling for CFD part II: Turbulent-viscosity models (RANS models), Near-wall treatments Practical work: (16h) • Introduction to Ansys Fluent CFD tool: Fluid Flow and Heat Transfer in a Mixing Elbow	TP : 20h00 Cours : 6h00 Travail personnel : 10h00 Durée totale: 41h00

Unité d'Enseignement	ECTS	Unité de Cours	Contenu	Nb d'Heures
Semester 7				
			• Practice on Ansys Fluent CFD tool: Modeling external Compressible Flow • Practice on Ansys Fluent CFD tool: Modeling Transient Compressible Flow • Practice on Ansys Fluent CFD tool: Assessment project	
		Materials 4 (Polymers)	Macromolecules: degree of polymerization, tacticity, synthesis. Polymers: structures, thermoplastics, thermosets, state changes, thermal and mechanical properties, additives. Specific applications of polymers. The use of conductive polymers, bio-sourced and biodegradable polymers, polymers for packaging or fuel cells are discussed. The interest of developing copolymers is also treated.	TD : 10h00 TP : 12h00 Cours : 10h00 Travail personnel : 20h00 Durée totale: 52h00
Society, Management And EntrepreneurshIP S7	2	**Sme Final Project 1**	The course Society, Management and Entrepreneurship Project 1 will consolidate the students' knowledge of the social sciences and management theory and apply it to creating a business. The course will use a mixture of lectures and case studies to help students become autonomous in their own learning.	Projet : 24h00 Travail personnel : 12h00 Durée totale: 36h00
Robotics And Automation Engineering S7	12	**Advanced Robotics**	-ROS (Robot Operating System) -Numerical Jacobian, singularity avoidance -Trajectory and path planning for robot arms -Performance evaluation : accuracy, precision, load, repeatability, workspace -Dynamics of a robot arm (inertia, Coriolis) -Visual servoing -Programming a robotic arm and a mobile robot	TD : 12h00 TP : 12h00 Cours : 12h00 Travail personnel : 24h00 Durée totale: 60h00
		Control Theory 2A (Digital Control Systems)	1. Introduction to signals : continuous/ sampled/ discrete 2. Distinction between Difference equation (used to describe Discrete systems) and differential equation (used to describe continuous systems) 3. Signal sampling and quantization *Sampling of continuous signals *Signal reconstruction *Practical considerations for signal sampling : anti-aliasing filter *Practical reconsiderations for signal reconstruction :anti-image filter and equalizer *Analog to digital conversion *digital to analog conversion/quantization 4. Determination of the z-transform *Introduction to the z-transform and its properties *Illustration of how we determine the inverse of z-transform using the partial fraction expansion *The use of the z-transform to solve linear difference equations 5. Digital Proportional, PI and PID controllers *Determination of the equation of the digital controller (case of P , PI and PID) *The implementation of digital P, PI and PID on real systems and the evaluation of the system performances	TD : 6h00 TP : 8h00 Cours : 6h00 Travail personnel : 12h00 Durée totale: 32h00
		Control Theory 2B (Multivariable Control Systems)	1. System representation : the state-space representation SSR of monovariable and multivariable systems 2. Determinantion of the system's Block diagram 3. Determinantion of the State space representations in canonical forms : Controllable,Observable,Diagonal/Jordan 4. Evaluation of the Controllability and the observability of a given LTI system using the Kalman citerion 5. Design of State-feedback controller using the Ackermann's formula 6. Analysis of system performances : precision, rapidity, robustness against the presence of disturbances 7. System linearization using the Tylor expansion	TD : 6h00 TP : 8h00 Cours : 10h00 Travail personnel : 12h00 Durée totale: 36h00

Semester 7				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
		IT And Robotic Labs	The scrum methodology is introduced to the students. Then, they apply this agile framework during the whole duration of the project. Each group of students receives a project of robotic application. They state the problem before designing the robotic system that corresponds to the specifications. Then, they build their system and test it extensively. Finally, each group presents their work and write a report describing the technical and managerial aspects of the project.	TP : 28h00 Travail personnel : 15h00 Durée totale: 43h00
Sustainable Management S7	4	**Carbon Footprint**	This course is an introduction to the carbon footprint calculation method proposed by a French association, "Association Bilan Carbone". It will consist of a : - Reminders about Green House Gases and introduction to global warming potential - Definition of carbon footprint - Definition of the 3 scopes - Presentation of the carbon Footprint computation method - Presentation of th Carbon Footprint approach	TD : 6h00 Cours : 4h00 Projet : 4h00 Travail personnel : 9h00 Durée totale: 23h00
		Operational Quality And Lean Management	Introduction to experience plans : - What is an experience plan and how to implement it ? - Several notions : factors, levels of the factors, mathematical model - Experience plans : 2 factors and 2 levels - Experience plans : 3 factors and 2 levels Product FMECA : One case of study to understand what is the purpose of product FMECA and how to implement it : how to reduce the problem at the conception phase of a product Lean-6 sigma tools : Discovery of the different lean tools in the context of a problem-solving approach : - What is the Lean (context and historical approach) - What is 6 sigma (context and historical approach) - What are the tools related to these topics (DMAIC, 5S, Ishikawa, root causes : 5W…) - Possiblity to implement all of these tools with one tutorial : A3 problem solving method.	TD : 12h00 Cours : 4h00 Durée totale: 16h00
		Research Methods	2*2h Lectures 2*2h Guided tutorial 2*2h Project Follow up 15h autonomous work	TD : 8h00 Cours : 4h00 Durée totale: 12h00
Systems Engineering 7	4	**Electrical Machines And Drives**	This course covers the basic characteristics of DC and AC motors and describe their principle of operation and control within a power electronic environment. Basics in power electronics, electric machines and control circuits are reviewed and the overall systems is studied. Control techniques for DC drives are underlined and the four-quadrant operation is analysed. Control strategies for AC drives are discussed as well, mainly the scalar control, the field oriented control and the direct torque control. Detailed modelling of the control of induction motors using the FOC method is carried out. o Electrical Machines Drives – General Overview: Review on Control Systems, Review on Power Electronics, Review on Electrical Machines o DC Motors Control: Introduction to DC Drives, Four-Quadrant Control, Closed Loop Control, Electronic Control o AC Motors Control: Basic Control of Induction Motors (Vs, Vr, F, V/F), Scalar Control o AC Motors Control: Understanding the Challenges, Park Transformation (dq domain), Dynamic Model of Induction Motors, DC Machine Analogy, Field Oriented Control	TD : 6h00 TP : 4h00 Cours : 8h00 Travail personnel : 14h00 Durée totale: 32h00

Semester 7				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
		Multibody Dynamics Systems	The course resumes the basics of rigid body mechanic. 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. Mechanical actions and their modelling is presented in order to apply the dynamic notions. Newton's laws are introduced et allow to link the movement to it cause. Furthermore, the energy formalisme is introduced. Exercises are done after each notion to put into practice formula and method introduced in the course.	TD : 12h00 TP : 4h00 Cours : 8h00 Durée totale: 102h00

Semester 8				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
Sustainable Energy And Environmental Engineering Courses S8	12	**Energy Project**	Group Project structured around various sessions of group work with access to the necessary computer resources.	Projet : 36h00 Travail personnel : 36h00 Durée totale: 72h00
		Energy Storage	• Presentation of different types of energy storage systems (heat, mechanical and electrochemical); • Definition of energy and power densities; • Description of the operating principle of rechargeable batteries and their fundamental electrochemistry (lithium-ion batteries, lead-acid batteries, etc.); • Definition of the electrical characteristics present in the data sheet of each electrochemical storage system; • Description of the operating principle of conventional supercapacitors using the double layer capacitance theory; • Presentation of the chemical constitution of hybrid supercapacitors such as lithium-ion capacitors; • Description of aging mechanisms that may arise in different types of batteries and supercapacitors; • Comparison of different energy storage systems using the Ragone Diagram; • Presentation of electrical modeling methods of electrochemical energy storage systems; • Presentation of power converters used with energy storage systems; • Description of the tools integrated in management systems that aim to control energy storage systems; • Presentation of an example of a complete system integrating an energy storage system, the corresponding management system and the power converters.	TD : 12h00 Cours : 12h00 Travail personnel : 24h00 Durée totale: 72h00
		Environmental Aspects Of Energy	• Fundamental concepts of energy engineering: primary energy, final energy, embodied energy, lost energy, etc. • Performance criteria used to assess existing systems or processes: efficiency, effectiveness, energy returned on energy invested (EROI), etc. • Definitions and limitations of today's energy resources: peak oil, GHG emissions, etc. • Carbon cycles and balances: why it is important and how to use them. • The energy transition and its numerous challenges.	Cours : 18h00 Travail personnel : 18h00 Durée totale: 46h00
		Exergy Analysis	• The exergy and anergy concepts and their relation with energy. • Applications of exergy and energy balances to closed or open systems, housing or not internal reactive processes : heat engines, refrigeration machines, heat exchangers, internal combustion engines, HVAC systems; • Exergy efficiency and effectiveness of energy systems; Exergy analysis on CSP backed up by TES	TP : 4h00 Cours : 10h00 Travail personnel : 8h00 Durée totale: 32h00

Semester 8				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
		Power Systems	- Electrical AC grids. - Electrical DC grids. - Electrical safety measurements. - Autonomous energy grid (smartgrid) sizing and control.	TD : 8h00 TP : 8h00 Cours : 8h00 Travail personnel : 16h00 Durée totale: 40h00
Industrial Engineering And Supply Chain Management S8	12	**Csca Certification**	* Lectures * Quiz sessions * Final certification exam	Cours : 20h00 Travail personnel : 26h00 Durée totale: 46h00
		Industry Of The Future	• Strategies & Effective Meeting Falication using IoT, DMAIC, 5S, UX, HMI • Analyse the product/process impacts and propose improvements • Organisation and management of a production through a challenge in the "School Factory" platform • Discovery and Robotization Project: - To be able to manipulate robots virtually and physically - Initiation to a method of implementation of robotic equipment - To determine the cost effectiveness of robotization on workstation - Difference robot/cobot (strategic, productivity, safety ...) - Risk analysis - Robotisation criteria	TD : 6h00 TP : 22h00 Cours : 8h00 Travail personnel : 52h00 Durée totale: 88h00
		Robust Supply Chain	* Lectures, tutorials and lab work on the main concepts * Implementation during the red thread team project (Connected Speaker) * Simulation on the Theory of Contraints (TOC) * Serious game DDBrix on DDMRP * CSCA course material	TD : 12h00 TP : 8h00 Cours : 8h00 Projet : 6h00 Travail personnel : 32h00 Durée totale: 66h00
Innovation Project – Engineering Developments S8	7	**IP Project Management And Technical Requirements**		TD : 2h00 Cours : 9h00 Projet : 6h00 Durée totale: 17h00
		IP Technical Deployment		Cours : 2h00 Projet : 32h00 Travail personnel : 50h00 Durée totale: 84h00
Innovation Project – Road To Business	3	**IP Business Plan**		Cours : 14h00 Projet : 12h00 Durée totale: 26h00
		IP Project Closure		Cours : 2h00 Projet : 4h00 Travail personnel : 12h00 Durée totale: 18h00

Semester 8				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
		IP User Test Awareness		Cours : 2h00 Travail personnel : 12h00 Durée totale: 14h00
Mechanical Engineering S8	12	**Advanced Cad**	- Introduction to welding: - Definition - Weldability of materials - Methods of welding: Gaz welding, arc welding, MIG, TIG,... - Indication of welding on technical drawing - Rules in mechanical design - Use of standard profiles: - Cutting - Laser cutting - Roll bending - Sheet metal work: - Cutting: shearing, plasma, laser, water jet, punching - Bending - Roll bending - Stamping - Corrosion prevention - Use of CREO Parametric - CAD project	TP : 20h00 Travail personnel : 20h00 Durée totale: 40h00
		Advanced Manufacturing And Processes	Integration of the digital chain in the preparation work. Cutting conditions for solid materials. Optimization of the machining parameters (cutting conditions, CAM "Spirit", process studies, choice of tools ...).	TP : 28h00 Cours : 2h00 Travail personnel : 12h00 Durée totale: 42h00
		Tribology	1. Introduction • Definition of Tribology and Tribological Systems • Applications and Scales in Tribology • Types of Motion • Tribological Testing and Types of Tribometers • Roughness 2. Lubrication and Lubricant Properties • Classification of Lubrication and Lubricant Properties • The Stribeck Curve and Lubrication Regimes • Types of contacts and film thickness • Hertzian Contact Theory • Solid-Solid Contact-Asperity Deformation 3. Friction • Friction Coefficient • Types of Friction • Laws of Dry Friction • Basic Mechanisms of Sliding Friction • Adhesion and Deformation • Stick-Slip Phenomenon 4. Fluid Film Lubrication • Classification of Fluid Film Lubrication • Newtonian and Non-Newtonian Fluids • 1-D Flow between Parallel Plates • Hydrostatic and Hydrodynamic Thrust Bearings 5. Wear • Parameters and Stages of Wear • Wear Types and Mechanisms • Wear Rate • Causes of Wear and Prevention Methods	TD : 8h00 Cours : 12h00 Durée totale: 20h00
		Structural Analysis	Why do we need Finite Element Analysis (FEA) in engineering analysis ? Various FEA applications Stiffness	TD : 10h00 Cours : 10h00 Travail personnel :

Semester 8				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
			Stiffness of a spring and a bar Basic steps involved in FEA Types of FEA and element types used in FEA Derivation of stiffness matrix Problem solving on spring and bar elements Matlab basics and Problem solving on spring and bar elements Beam elements Isoparametric formulations and shape functions	20h00 Durée totale: 40h00
Society, Management And EntrepreneurshIP S8	7	**Society, Management And Entrepre neurshIP Final Project 2**	The course Society, Management and Entrepreneurship Final Project 2 will consolidate the students' knowledge of the social sciences, entrepreneurship and management theory. It builds on students' learning in SME Final Project 1 by further developing their businesses and outlining strategies for expansion in international markets.	Projet : 24h00 Travail personnel : 12h00 Durée totale: 36h00
Robotics And Automation Engineering S8	12	**Introduction To Controllers**	-Definition of a PLC -Hardware components of a PLC -Connection of I/O modules -Program a filling machine using Ladder, Function block, Structured text, Grafcet -Train on data types, variables	TP : 12h00 Travail personnel : 10h00 Durée totale: 22h00
		IT And Robotic Labs	The scrum methodology is introduced to the students. Then, they apply this agile framework during the whole duration of the project. Each group of students receives a project of robotic application. They state the problem before designing the robotic system that corresponds to the specifications. Then, they build their system and test it extensively. Finally, each group presents their work and write a report describing the technical and managerial aspects of the project.	TP : 28h00 Travail personnel : 10h00 Durée totale: 38h00
		IT Expertise - Machine Learning	* Introduction to IA and Machine Learning ° Model Based Learning - main concepts and definitions ° Exact solution, iterative solutions, Gradient Descent ° First algorithms: Regressions - Linear Regression - Logistic Regression ° Data preprocessing ° Hyperparameter tuning * Towards Deep Learning ° more on preprocessing (categories encoding) and data sets ° From biological neuron to perceptron ° Multilayer Perceptron ° Convolutional Neural Networks ° Transfer Learning * Introduction to Natural Language Processing ° Some important ideas about NLP ° Example of statistical NLP (Multinomial Naive Bayes) ° NLP with Deep Learning (LSTM) * Other algorithms * Group project (text classification, image classification, recommendation, regression...)	Cours : 20h00 Travail personnel : 6h00 Durée totale: 26h00
		IT Expertise - Machine Vision	-Introduction to camera features -Introduction to the importance of lighting in image acquisition -Introduction to various technologies in image acquisition -Practical application on stereovision	TP : 8h00 Cours : 4h00 Travail personnel : 6h00

Unité d'Enseignement	ECTS	Unité de Cours	Contenu	Nb d'Heures
				Durée totale: 18h00
		Robotic Expertise - Motion Planning And Control	-Definition of industrial networks: Ethercat, Profinet, OPC-UA, IO-Link… -Practical on PLC/sensors/actuators communication using several industrial networks. -Definition of safety regulations -Procedure to perform risk analysis -Definition of drive-based and controller-based motion planning followed by practicals	TP : 12h00 Travail personnel : 6h00 Durée totale: 18h00
		Robotic Expertise - Automation And Industrial Robotics	This course divided into four parts. In the first part will give an overview of industrial robots basic components and structures. Part 2 depicts principles and methods of programming robots. Part 3 describes industry robotisation and robots workstations. The final part touches the safety of industrial robots and cobots. In this course, we will explore Arm construction and drives, Coordinates systems (BASE • TOOL • TCP • Part frame/User frame/Working frame), programming methods (Online • Offline), Robotized workstations/cells, risk assessments of robotic cells and standardizations/normalizations. • Introduction to industrial robotics • Basic components of industrial robot systems • Structure of industrial robots • Collaborative, non-collaborative, and mobile industrial robot applications • Industrial robot's motion • Methods of programming robots • Hazards associated with industrial robot applications • Safety considerations for employers and workers • Risk assessments • Risk reduction measures • Applicable industry standards for industrial robot system safety	TD : 2h00 TP : 16h00 Cours : 6h00 Travail personnel : 15h00 Durée totale: 39h00
		Wireless Communications And Networks	-Introduction to IoT devices and their architectures (microcontroller, antenna…) -Introduction to radio waves and principles of modulation (amplitude, frequency and phase) -Definition of the various IoT networks (Short-range, LPWAN, Cellular) -Practical case study to choose the best IoT solution given technical specifications -Practical introduction to IoT programming with Sigfox modules for Arduino board	TP : 8h00 Cours : 4h00 Travail personnel : 6h00 Durée totale: 18h00
Students Life Commitment	3	Students Life Commitment Sem 8		Durée totale: 0h00
Students Life Involvement	2	Students Life Involvement Sem 8		Durée totale: 0h00
Sustainable Management S8	1	Circular Economy	This course is an introduction to the circular economy concept. In this course, student will learn about the 7 pillars of the circular economy with many examples.	Cours : 4h00 Projet : 4h00 Travail personnel : 3h00 Durée totale: 11h00
		Corporate Social	Session 1 – Introduction to Corporate Social Responsibility Foundations and Historical Context	TD : 4h00 Cours : 4h00

Semester 8				
Unité d'Enseignement	**ECTS**	**Unité de Cours**	**Contenu**	**Nb d'Heures**
		Responsability	Fundamental Principles of CSR CSR Frameworks and Reporting Standards CSR Challenges and Opportunities Session 2 – Building a CSR Strategy General Approach for Companies CSR Strategy Development Methodology Case Studies and Practical Examples	Projet : 6h00 Travail personnel : 4h00 Durée totale: 18h00
		Innovation Management And Intellectual Property	- Innovation management for companies (different types) - Intellectual property: patent deposit, management of patents - General management of organizations for keeping the company's strategic advantages.	Cours : 3h00 Travail personnel : 3h00 Durée totale: 6h00

EENG - Year 5

Semester 9

Unité d'Enseignement	ECTS	Unité de Cours	Contenu			Nb d'Heures
Engineering InternshIP S9	30	Engineering InternshIP S9				
Capstone	7					
		Management System For Leading Change	4			
			Operations Transformations Following Kaizen And Learning Organisation Principles	7		
				Technological Envrionment	7	

Semester 9

Contenu

Semester 10				
Unité d'Enseignement	ECTS	Unité de Cours	Contenu	Nb d'Heures
Engineering InternshIP S10	30	Engineering InternshIP S10		