Cti
Commission
des titres d'ingénieur

ESIROI
ÉCOLE D'INGÉNIEURS
UNIVERSITÉ DE LA RÉUNION

Syllabus

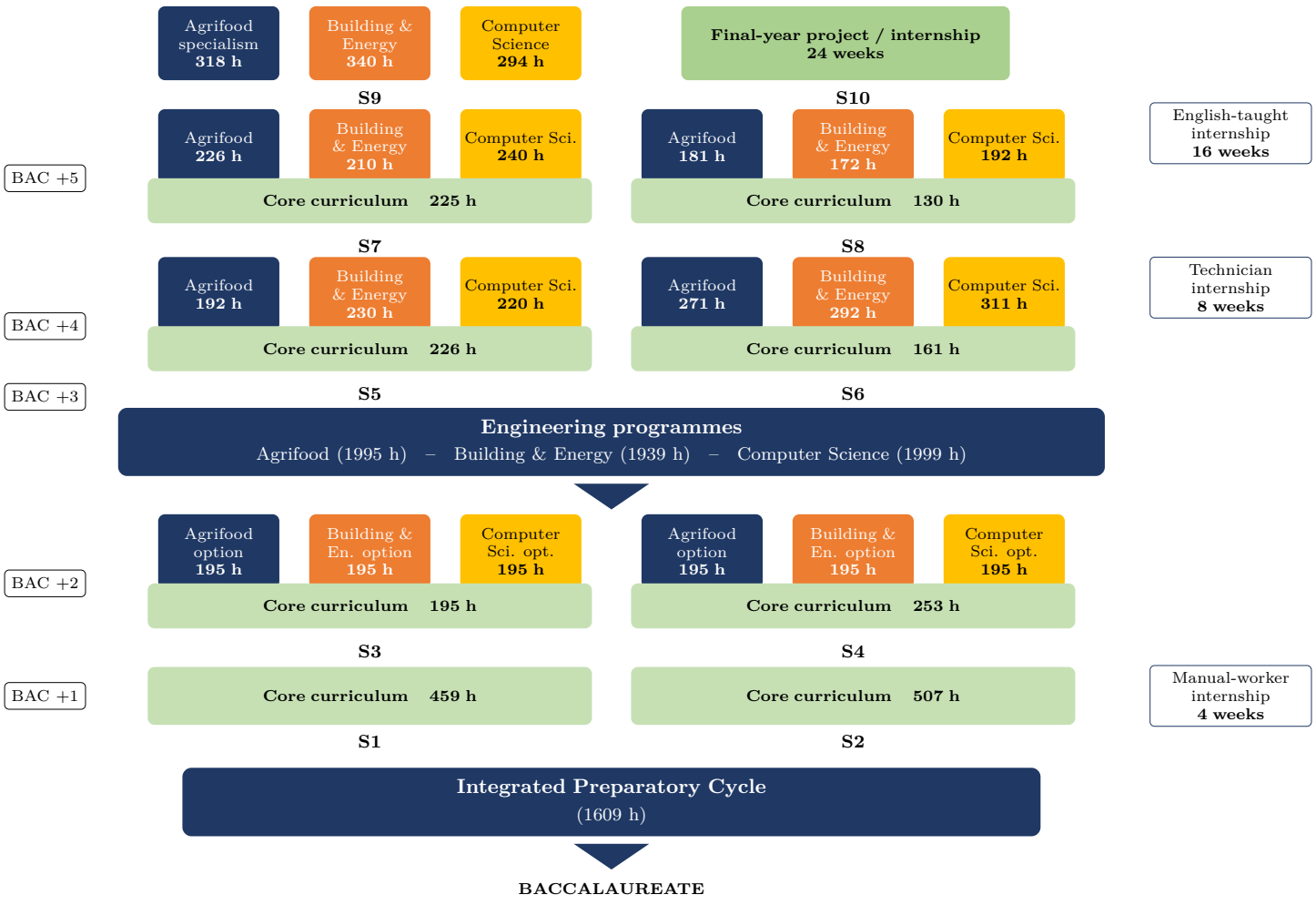
of courses

ESIROI | University of La Réunion

ACADEMIC YEAR 2026 - 2027

CTI accreditation 2025 - 2030

Training programmes



Contents

Curriculum overview

Cycle préparatoire intégré — CPI1					SEMESTER S1
Code	**Title**	**CM**	**TD**	**TP**	**ECTS**
CORE | HUMANITES: HUMANITES					
E1CP1HU1	Life Sciences I	8	10	0	1
E1CP1HU2	Sport I	0	15	0	1
E1CP1HU3	English I	0	30	0	3
E1CP1HU4	DDRS I	12	4	0	1
CORE | MATHEMATIQUES: MATHEMATIQUES					
E1CP1MT1	Mathematics for Engineers I-a	20	28	0	3
E1CP1MT2	Mathematics for Engineering I-b	20	28	0	3
E1CP1MT3	Descriptive Statistics	6	6	8	1
CORE | OUTILS: OUTILS POUR L'INGENIEUR					
E1CP1OI1	Communication Techniques I	0	8	0	0.5
E1CP1OI2	Digital Tools and Modeling I	2	24	8	2
E1CP1OI3	Metrology	4	12	0	1
CORE | PHYSIQUE-CHIMIE: PHYSIQUE-CHIMIE					
E1CP1PC1	Matter Architecture	10	12	0	1
E1CP1PC2	Chemical Equilibria I	18	20	8	3
E1CP1PC3	Electricity I	8	14	8	2
E1CP1PC4	Optics I	6	12	8	1.5
E1CP1PC5	Mechanics of a Point I	14	20	0	2
CORE | PROJET: PROJET PROFESSIONNEL					
E1CP1PP1	Discovering the agri-food specialization	0	4	4	1
E1CP1PP2	Introduction to the Building-Energy Specialization	0	4	4	1
E1CP1PP3	S-I PROJECT	0	0	0	1
E1CP1PP4	Introduction to the computer science specialization	0	4	4	1

Cycle préparatoire intégré — CPI1					SEMESTER S2
Code	**Title**	**CM**	**TD**	**TP**	**ECTS**
CORE | AGROALIMENTAIRE: AGROALIMENTAIRE I					
E1CP2AA1	Basis of Biochemistry	8	6	4	1.5
E1CP2AA2	Organic Chemistry I	8	4	4	1
CORE | BATIMENT: BATIMENT ET ENERGIE I					
E1CP2BE1	Technical Drawing	8	0	8	1.5
E1CP2BE2	Statics of rigid bodies	8	10	0	1
CORE | HUMANITES: HUMANITES					
E1CP2HU1	Sports II	0	15	0	1

Cycle préparatoire intégré — CPI1					SEMESTER S2
Code	**Title**	**CM**	**TD**	**TP**	**ECTS**
E1CP2HU2	English II	0	30	0	3
E1CP2HU3	"'markdown CSR II "'	10	8	0	1.5
E1CP2HU4	Life Sciences II	4	4	0	0.5
CORE | INFORMATIQUE: INFORMATIQUE I					
E1CP2IF1	Algorithmic and Programming	8	10	16	2.5
CORE | MATHEMATIQUES: MATHEMATIQUES					
E1CP2MT1	Mathematics for Engineering II-a	12	20	0	2
E1CP2MT2	Mathematics for Engineering II-b	24	40	0	4
E1CP2MT3	Inferential Statistics I	6	12	8	2
CORE | OUTILS: OUTILS POUR L'INGENIEUR					
E1CP2OI1	Communication Techniques II	0	8	0	0.5
E1CP2OI2	Digital Tools and Modeling II	2	24	8	2.5
E1CP2OI3	PROJECT-SII	0	0	0	1
CORE | PHYSIQUE-CHIMIE: PHYSIQUE-CHIMIE					
E1CP2PC1	Mechanics of Particles II	8	10	8	2
E1CP2PC2	Fluid Mechanics	18	26	8	2
E1CP2PC3	Thermodynamics I	10	14	0	1.5
E1CP2PC4	Chemical Equilibria II	10	12	8	2
E1CP2PC5	Evolution of a chemical system	14	16	8	2

Cycle préparatoire intégré — CPI2					SEMESTER S3
Code	**Title**	**CM**	**TD**	**TP**	**ECTS**
CORE | AGROALIMENTAIRE: AGROALIMENTAIRE III					
E2CP3A1	PROJECT S-III	0	0	0	1
E2CP3A2	Fundamentals of Process Engineering	6	6	0	0.5
E2CP3A3	Molecules of Life	12	10	4	2
E2CP3A4	Molecular Biology	10	10	0	1
E2CP3A5	Cell Biology - Fundamentals of Microbiology	4	4	4	1
E2CP3A6	Organic Chemistry II	10	10	12	2
CORE | BATIMENT-ENERGIE: BATIMENT-ENERGIE III					
E2CP3B1	Buildings and Energy Systems	4	8	8	1
E2CP3B2	Energy Context I	4	2	0	0.5
E2CP3B3	PROJECT S-III	0	0	0	1
E2CP3B4	3D Modeling	4	0	4	1
E2CP3B5	Architecture	8	8	0	1
E2CP3B6	Math for BE	8	12	0	1
E2CP3B7	Signal, Sensors and Metrology	10	6	16	2
CORE | HUMANITES: HUMANITES III					
E2CP3HM1	Life Sciences III	4	4	0	1
E2CP3HM2	Sports III	0	15	0	1
E2CP3HM3	English III	0	30	0	3

Cycle préparatoire intégré — CPI2					SEMESTER S3
Code	**Title**	**CM**	**TD**	**TP**	**ECTS**
E2CP3HM4	DDRS III	8	8	0	1.5
E2CP3HM5	Controversy	0	8	0	1
CORE | INFORMATIQUE: INFORMATIQUE III					
E2CP3I1	PROJECT S-III	0	0	0	1
E2CP3I2	C and C++ Programming	10	8	12	2
E2CP3I3	Web Development	4	6	8	1
E2CP3I4	Operating Systems	6	6	12	1.5
E2CP3I5	Introduction to Networks	8	10	12	2
CORE | MATHEMATIQUES: MATHEMATIQUES III					
E2CP3MT1	Mathematics for Engineering III-a	24	40	0	4.5
E2CP3MT2	Mathematics for Engineers III-b	6	10	0	1.5
E2CP3MT3	Inferential Statistics II	6	12	6	2
CORE | PHYSIQUE-CHIMIE: PHYSIQUE-CHIMIE III					
E2CP3PC1	Electricity II	12	14	8	2.5
E2CP3PC2	Electromagnetism I	10	14	8	2.5
E2CP3PC3	Thermodynamics II	14	16	0	2

Cycle préparatoire intégré — CPI2					SEMESTER S4
Code	**Title**	**CM**	**TD**	**TP**	**ECTS**
CORE | AGROALIMENTAIRE: AGROALIMENTAIRE IV					
E2CP4A1	PROJECT S-IV	0	0	0	1
E2CP4A10	Enzymology	12	8	0	1.5
E2CP4A2	Food Microbiology	10	8	8	2.5
E2CP4A3	Food and Biological Engineering	8	12	16	2.5
E2CP4A4	Food challenges	0	4	4	1
E2CP4A5	Application Project	0	16	28	3.5
E2CP4A6	BPH / PRP	6	0	6	1.5
E2CP4A7	Metabolism and Bioenergetics	10	10	0	2
E2CP4A8	Genetics	8	8	0	1.5
E2CP4A9	Physicochemical Analyses	10	4	16	2
CORE | BATIMENT-ENERGIE: BATIMENT-ENERGIE IV					
E2CP4B1	Bioclimatic Design and Comfort 24	8	12	8	2.5
E2CP4B2	PROJECT S-IV	0	0	0	1
E2CP4B3	Numerical Analysis and Scientific Computing	8	10	12	2.5
E2CP4B4	Control and Command	10	10	12	2.5
E2CP4B5	Electrical Engineering	6	10	12	2.5
E2CP4B6	Introduction to Strength of Materials (RDM)	8	8	8	2.5
E2CP4B7	Advanced Heat Transfer I	10	12	8	2.5
E2CP4B8	Solid Mechanics	16	16	8	3
CORE | HUMANITES: HUMANITES IV					
E2CP4HM1	Sport IV	0	15	0	1.5

Cycle préparatoire intégré — CPI2					SEMESTER S4
Code	**Title**	**CM**	**TD**	**TP**	**ECTS**
E2CP4HM2	English IV	0	30	0	4
CORE | INFORMATIQUE: INFORMATIQUE IV					
E2CP4I1	PROJECT S-IV	0	0	0	1
E2CP4I2	Software Development	10	12	12	2
E2CP4I3	Introduction to Data Analysis	8	8	8	2.5
E2CP4I4	Cryptography and Cybersecurity	8	8	12	2.5
E2CP4I5	Introduction to Embedded Systems	8	8	8	2.5
E2CP4I6	Set Theory and Algebra	20	20	0	3
E2CP4I7	Computer Architecture	10	10	4	2.5
E2CP4I8	Mathematics for Computer Science	14	24	0	3
CORE | PHYSIQUE-CHIMIE: PHYSIQUE-CHIMIE IV					
E2CP4PC1	Bilans and Transfers	12	12	12	4

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UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S1*

IDENTIFICATION

Course code :	E1CP1HU1
ECTS :	1

DURATION

Lectures :	8
Tutorial classes :	10
Labs :	0
Total :	18

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : HUMANITES

COURSE : Life Sciences I

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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IDENTIFICATION

Course code : E1CP1HU2
ECTS : 1

DURATION

Lectures :	0
Tutorial classes :	15
Labs :	0
Total :	15

Project :
Personnal work :

ASSESSMENT

Oral : 1.5h - Coefficient : 1.0

TEACHING MATERIALS

Materials available on the Moodle platform.

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : HUMANITES

COURSE : Sport I

SCOPE OF THE COURSE

OBJECTIVES

— Acquire knowledge related to the practice of physical and sports activities (engineering and culture of APS).
— Develop and refine physical and energy capacities.
— Gain a better self-awareness.
— Commit to a progress-oriented approach.
— Know how to surpass oneself and achieve personal growth.
— Develop a better understanding of others and oneself within a group.

COMPETENCE AND SKILLS

— Engage to gain points by making relevant technical and tactical choices based on the analysis of the power balance.
— Identify and/or create open spaces to produce targeted attacks and generate fast or downward trajectories to accelerate play.
— Defend by seeking to neutralize an unfavorable power balance to regain the upper hand.
— Prepare and train individually to lead and master a confrontation and shift the power balance in one's favor.
— Condition oneself, alone, to engage in a confrontation and recover from it.
— Identify, using indicators, the state of the power balance and one's individual performance level in attack and defense.
— Choose and implement, alone, one or more individual technical-tactical projects to create the conditions for winning the point and ensuring target protection.

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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DEPARTMENT : *CPI*
SEMESTER : *S1*

IDENTIFICATION

Course code : E1CP1HU3
ECTS : 3

DURATION

Lectures :	0
Tutorial classes :	30
Labs :	0
Total :	30

Project :
Personnal work :

ASSESSMENT

Written exam : 2.0h - Coefficient : 0.5
Written exam : 2.0h - Coefficient : 0.5

TEACHING MATERIALS

Materials available on the Moodle platform.

LANGUAGE

English

CONTACT

HUGUES PETIT
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Modifié le : 14 juillet 2026

UE : HUMANITES

COURSE : English I

SCOPE OF THE COURSE

OBJECTIVES

"Learning pragmatic, socio-linguistic, and linguistic skills (vocabulary, syntax, grammar, phonology) necessary for understanding authentic documents and for oral and written interaction in authentic communication situations."

COMPETENCE AND SKILLS

— Completion of tasks involving strategies, sometimes within a project or mission framework (e.g., CLES level) **[Level 1]**.
— B2 level in listening comprehension (LC) and reading comprehension (RC) *(TOEIC)*.
— B2 level in written production (WP) and oral interaction (OI) *(CLES)*.
— English for media and business.

PROGRAM

1. Training in oral and written comprehension using authentic documents (articles, broadcasts, video excerpts, interviews).
2. Guided written production : summaries, reformulations, professional emails, justification notes.
3. Oral interaction : professional role-plays, discussions, short presentations, structured speaking.
4. Completion of a task or mini-project (e.g., CLES-style) : information gathering, analysis, preparation, and presentation.
5. Acquisition of vocabulary and cultural codes related to media and business.

BIBLIOGRAPHY

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UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S1*

IDENTIFICATION

Course code : E1CP1HU4
ECTS : 1

DURATION

Lectures :	12
Tutorial classes :	4
Labs :	0
Total :	16

Project :
Personnal work :

ASSESSMENT

Written exam : 2.0h - Coefficient : 1.0

TEACHING MATERIALS

Materials available on the Moodle platform.

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : HUMANITES

COURSE : DDRS I

SCOPE OF THE COURSE

OBJECTIVES

1. **Historical approach to DDRS and global SDGs (4h)**
   - Understanding the origins and evolution of Sustainable Development and Social Responsibility (DDRS).
   - Comprehending the Sustainable Development Goals (SDGs) as an international reference framework.
   - Identifying and analyzing the progress of the SDGs at different territorial scales (international, national, regional).
   - Identifying DDRS challenges in a territory using the SDGs.
2. **Historical approach to economic models (4h)**
3. **Introduction to stakeholder theory (4h)**
4. **Planetary boundaries (4h)

COMPETENCE AND SKILLS

- Briefly describe the 9 planetary boundaries and identify their interconnections.
- Describe the causes and consequences of global warming based on IPCC (and other institutions such as the HCC) reports. Explain and illustrate the concepts of adaptation and mitigation.
- Describe the causes and consequences of biodiversity loss based on IPBES reports. Cite and illustrate key ecosystem services.
- Identify the impacts of the dominant economic model on global resources (mineral resources, water, biomass, energy).
- Cite the main stages in the emergence of CSR, sustainable development, and the SDGs. Identify social and societal challenges of sustainable development and locate the corresponding SDGs.
- Demonstrate how an organization can act on each SDG.
- Identify types of organizations with positive social, societal, or environmental impact (social and solidarity economy organizations — ESS, solidarity-based utility companies — ESUS, mission-driven companies).
- Analyze key governance models (stakeholders, objectives, decision-making processes) in light of economic, social, societal, and environmental challenges of sustainable development.

PROGRAM

1. Planetary boundaries : presentation of the 9 boundaries, interactions, and global challenges.
2. Climate change : causes, consequences, IPCC and HCC reports, mitigation and adaptation concepts.
3. Biodiversity loss : IPBES reports, ecosystem services, and human dependence on living systems.

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4. Natural resources and the dominant economic model : extraction, pressures on water, biomass, minerals, and energy.
5. History and structuring of sustainable development : CSR, SD, SDGs, and associated social/societal challenges.
6. Organizations' actions on the SDGs : levers, strategic coherence, operational integration.
7. Discovering impact organizations : ESS, ESUS, mission-driven companies, and alternative models.
8. Governance and decision-making : analyzing organizational models in light of economic, social, societal, and environmental challenges.

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UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S1*

IDENTIFICATION

Course code : E1CP1MT1
ECTS : 3

DURATION

Lectures :	20
Tutorial classes :	28
Labs :	0
Total :	48

Project :
Personnal work :

ASSESSMENT

Written exam : 1.0h - Coefficient : 0.5
Written exam : 1.0h - Coefficient : 0.5

TEACHING MATERIALS

Materials available on the Moodle platform.

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : MATHEMATIQUES

COURSE : Mathematics for Engineers I-a

SCOPE OF THE COURSE

OBJECTIVES

This course aims to provide students with the fundamental mathematical tools necessary for modeling and solving problems in engineering sciences. It specifically targets :

— mastering trigonometric concepts for the geometric analysis of phenomena ;
— understanding and using matrices to solve linear systems and manipulate transformations ;
— developing the ability to represent and manipulate vectors in the plane and in space ;
— acquiring the basics of calculations with complex numbers, useful for studying dynamic systems and signals.

This course forms an essential foundation for physics, mechanics, automation, and numerical modeling courses.

COMPETENCE AND SKILLS

— Ability to represent a system of equations in matrix form.
— Ability to define a vector relative to a chosen basis.
— Ability to compute a dot product.
— Ability to compute a cross product.
— Ability to define a complex number.
— Ability to use complex notation to solve a physical problem.
— Ability to calculate the modulus and argument of a complex number.
— Ability to perform operations on complex numbers.
— Ability to derive the formulas : $\sin(a+b)$, $\sin(a-b)$, $\cos(a+b)$, $\cos(a-b)$.

PROGRAM

Trigonometry : review of the trigonometric circle, angles, cosine, sine, tangent, expressions for cosine and sine of associated angles, as well as the main trigonometric formulas.

Matrix Calculus : introduction to matrices (definition, notation, types). Fundamental operations on matrices (transpose, addition, subtraction, scalar multiplication). Matrix multiplication (definition, properties, and applications). Determinant and inverse matrix (existence, calculation). Solving linear systems using matrix formulation and the inverse method. Least squares method for overdetermined systems.

Vector Calculus in the Plane and in Space : definition and representation of a vector. Representation in a direct orthonormal basis. Dot product and orthogonal projection. Cross product (calculation and properties). Basis change and rotation matrices. Vector functions and vector fields. Velocity and acceleration in a moving basis.

Complex Numbers : definition, notation, and properties of complex numbers. Basic operations (addition, subtraction, multiplication, division). Matrices with

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complex coefficients. Functions taking complex values. Trigonometric and exponential forms. Complex exponential and n-th roots. Solving quadratic equations in the set of complex numbers.

BIBLIOGRAPHY

REQUIREMENTS

Prerequisites :

— Basic knowledge of algebra (solving equations, manipulating algebraic expressions).
— Elementary concepts of plane geometry (coordinate systems, vectors).
— Operations on real numbers : basic calculations, powers, roots, fractions.
— Basic knowledge of common functions (linear, affine, simple polynomials, elementary trigonometry).

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IDENTIFICATION

Course code :	E1CP1MT2
ECTS :	3

DURATION

Lectures :	20
Tutorial classes :	28
Labs :	0
Total :	48

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : MATHEMATIQUES

COURSE : Mathematics for Engineering I-b

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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IDENTIFICATION

Course code : E1CP1MT3
ECTS : 1

DURATION

Lectures :	6
Tutorial classes :	6
Labs :	8
Total :	20

Project :
Personnal work :

ASSESSMENT

Lab work : 2.0h - Coefficient : 1.0 Written exam : 2.0h - Coefficient : 1.0 Written exam : 2.0h - Coefficient : 1.0

TEACHING MATERIALS

Materials available on the Moodle platform.

LANGUAGE

English

CONTACT

KAMAL EL OMARI
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Modifié le : 14 juillet 2026

UE : MATHEMATIQUES

COURSE : Descriptive Statistics

SCOPE OF THE COURSE

OBJECTIVES

1. **Descriptive statistics for a single variable**
   - Definitions and vocabulary.
   - Statistical variable and nature of a variable.
   - Frequencies.
   - Graphical representations of a distribution.
   - Measures of central tendency : mean, median.
   - Measures of dispersion : variance, quartiles.
2. **Descriptive statistics for a pair of variables**
   - Two-dimensional statistical series.
   - Correlation : covariance, correlation coefficient, analysis of the relationship between two variables.
   - Linear (affine) fitting :
     - Scatter plot.
     - Mayer's line.
     - Least squares method.
   - Non-linear regressions.
   - Contingency table.

COMPETENCE AND SKILLS

- Understand and define the fundamental concepts of descriptive statistics : population, sample, variable, types of data (quantitative and qualitative).
- Calculate and interpret measures of central tendency and measures of dispersion.
- Describe the shape of a distribution using symmetry, skewness, and kurtosis.
- Know and use different types of graphical representations : histograms, bar charts, box plots, scatter plots, pie charts.
- Organize and present data in the form of frequency tables and cross-tabulations.
- Use statistical software (Python / R) to perform descriptive analyses and generate graphical representations.
- Analyze and interpret results and formulate relevant conclusions based on data analysis.
- Understand the fundamental concepts of linear regression and the relationship between dependent and independent variables.
- Calculate and interpret regression coefficients (slope and intercept) using the least squares method.
- Calculate and interpret the coefficient of determination R^2.
- Use a linear regression model to make predictions.
- Use a numerical tool to perform regression.

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IDENTIFICATION

Course code : E1CP1OI1
ECTS : 0.5

DURATION

Lectures :	0
Tutorial classes :	8
Labs :	0
Total :	8

Project :
Personnal work :

ASSESSMENT

Written : 2.0h - Coefficient : 1.0

TEACHING MATERIALS

Materials on the Moodle platform.

LANGUAGE

English

CONTACT

DIDIER LUCAS
didier.lucas@univ-reunion.fr

Modifié le : 14 juillet 2026

UE : OUTILS

COURSE : Communication Techniques I

SCOPE OF THE COURSE

OBJECTIVES

— This module aims to contribute to the development of the future engineer's professional project through two complementary axes :

— **Setting up communication tools for internship search** (4h TD) :

— Writing a CV.
— Writing a cover letter.

— **Training in bibliographic research** (4h TD) :

— Methodology for searching scientific information.
— Correctly integrating references into a report.

COMPETENCE AND SKILLS

— Know how to correctly insert a reference in a document.
— Know how to use the ZOTERO tool.
— Know how to integrate ZOTERO with LaTeX.
— Know how to write an effective and professional CV.
— Know how to write a cover letter tailored to the position sought.
— Know how to conduct bibliographic research.

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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DEPARTMENT : *CPI*
SEMESTER : *S1*

IDENTIFICATION

Course code :	E1CP1OI2
ECTS :	2

DURATION

Lectures :	2
Tutorial classes :	24
Labs :	8
Total :	34

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : OUTILS

COURSE : Digital Tools and Modeling I

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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IDENTIFICATION

Course code : E1CP1OI3
ECTS : 1

DURATION

Lectures :	4
Tutorial classes :	12
Labs :	0
Total :	16

Project :
Personnal work :

ASSESSMENT

Written exam : 2.0h - Coefficient : 1.0
Written exam : 2.0h - Coefficient : 1.0

TEACHING MATERIALS

Materials available on the Moodle platform.

LANGUAGE

English

CONTACT

DIDIER LUCAS
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Modifié le : 14 juillet 2026

UE : OUTILS

COURSE : Metrology

SCOPE OF THE COURSE

OBJECTIVES

To be able to present the result of a measurement while indicating the confidence that can be placed in the measurement process

COMPETENCE AND SKILLS

- Know the units of the International System of Units (SI).
- Know the symbols of SI units and dimensions.
- Know the symbols of dimensions.
- Know how to write a dimensional equation.
- Know how to verify the validity of a relationship up to a constant.
- Know the multiples and submultiples of the SI and their symbols.
- Know how to perform conversions between multiples and submultiples.
- Know the definitions of common units.
- Know how to perform unit conversions.
- Know how to interpret a scale indication.
- Know how to choose an appropriate scale for plotting a graph.
- Know how to use scientific notation.
- Know how to identify the number of significant figures.
- Know how to identify the term “reference value.”
- Know how to define accuracy, precision, and trueness.
- Know how to identify random and systematic errors.
- Know how to define uncertainty and confidence level.
- Know how to validate a measurement process by comparison to a standard.
- Know how to discuss a result in comparison to an interval.
- Know how to read values from a `.csv` file.
- Know how to process values from a `.csv` file.
- Know how to plot a graph from `.csv` data.
- Know how to insert a trend line.
- Know how to understand a sorting algorithm.
- Know how to write a sorting algorithm.
- Know how to numerically compute an integral.
- Know how to numerically compute a derivative.
- Know how to solve a differential equation using Python.
- Know how to compare two numerical integration methods.
- Know how to compare two methods for solving differential equations.
- Understand the steps of the Monte-Carlo algorithm.
- Know how to write a Monte-Carlo uncertainty propagation algorithm.
- Know how to compute a mean and standard deviation using Python.

PROGRAM

1. **Units and Dimensions**

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- The International System of Units (SI).
- Dimensional equations.
- Multiples, submultiples, and conversions.
- Common units.

2. **Uncertainties**

- Measurement.
- Measurement errors and uncertainties.
- Method for evaluating the standard uncertainty.
- Expanded uncertainty and confidence interval.
- Presentation of a result.

3. **Numerical Data Handling**

- Using Python and `csv` files for data manipulation.
- Calculating mean and standard deviation.
- Uncertainty propagation using the Monte-Carlo method.

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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IDENTIFICATION

Course code : E1CP1PC1
ECTS : 1

DURATION

Lectures :	10
Tutorial classes :	12
Labs :	0
Total :	22

Project :
Personnal work :

ASSESSMENT

Written exam : 2.0h - Coefficient : 1.0
Written exam : 2.0h - Coefficient : 1.0
Written exam : 2.0h - Coefficient : 1.0

TEACHING MATERIALS

Materials available on the Moodle platform.

LANGUAGE

English

CONTACT

DIDIER LUCAS
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Modifié le : 14 juillet 2026

UE : PHYSIQUE-CHIMIE

COURSE : Matter Architecture

SCOPE OF THE COURSE

OBJECTIVES

Understanding the structure of a chemical building and its interaction with other molecules in a phase.

COMPETENCE AND SKILLS

- Know how to define the terms : element, nuclide, and isotope.
- Know how to define isotopic abundance and use it to calculate an average molar mass.
- Know how to define covalent and ionic radii.
- Know how to define first ionization energy, electron affinity, and electronegativity (know the usual scales).
- Know how to describe the construction of the periodic table and the evolution of periodic properties.
- Know how to identify the families : alkali metals, alkaline earth metals, halogens, noble gases.
- Know how to place the metal/non-metal boundary.
- Know how to locate an element given its atomic number.
- Know how to predict possible oxidation states and count valence electrons.
- Know how to give the Lewis structure of an atom (2nd period) and define valence.
- Know how to define the chemical bond according to Lewis and apply the octet rule.
- Know how to recognize an electron deficiency and place formal charges.
- Know how to construct a Lewis structure and understand hypervalence.
- Know how to write limiting mesomeric forms and the resonance hybrid, relate mesomerism to stability.
- Know how to state and use the VSEPR model ; know the coordination polyhedra.
- Know how to determine the VSEPR type and the geometry around a central atom, justify deviations from ideal geometry.
- Know how to define the dipole moment (and its units) and calculate an ionicity percentage.
- Know how to calculate the dipole moment of a molecule from those of the bonds and the geometry.
- Know how to describe intermolecular interactions : charge/charge, charge/dipole, dipole/dipole, Keesom, Debye, London.
- Know how to define the polarizability of a bond and assess the effect of interactions on state changes.
- Know how to define the hydrogen bond and give orders of magnitude of interaction energies.
- Know how to describe the dissolution of a solute in a solvent.
- Know how to characterize a solvent (polar/apolar, protic/aprotic).
- Know how to choose a solvent adapted to the polarity of a solute.

PROGRAM

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1. **Periodic Classification**
   - Organization of the periodic table and periodic properties.
2. **Covalent Bonding and Molecular Geometry**
   - Lewis structures, VSEPR model, polarity of bonds and molecules.
3. **Intermolecular Interactions**
   - van der Waals forces, hydrogen bonds, relation to macroscopic properties.
4. **Crystal Structure**
   - Types of crystals, main geometries and coordinations.
5. **Practical Work** : dissolution, dilution, titration (methodology).

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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IDENTIFICATION

Course code : E1CP1PC2
ECTS : 3

DURATION

Lectures :	18
Tutorial classes :	20
Labs :	8
Total :	46

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : PHYSIQUE-CHIMIE

COURSE : Chemical Equilibria I

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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IDENTIFICATION

Course code :	E1CP1PC3
ECTS :	2

DURATION

Lectures :	8
Tutorial classes :	14
Labs :	8
Total :	30

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : PHYSIQUE-CHIMIE

COURSE : Electricity I

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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IDENTIFICATION

Course code :	E1CP1PC4
ECTS :	1.5

DURATION

Lectures :	6
Tutorial classes :	12
Labs :	8
Total :	26

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : PHYSIQUE-CHIMIE

COURSE : Optics I

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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IDENTIFICATION

Course code : E1CP1PC5
ECTS : 2

DURATION

Lectures :	14
Tutorial classes :	20
Labs :	0
Total :	34

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : PHYSIQUE-CHIMIE

COURSE : Mechanics of a Point I

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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IDENTIFICATION

Course code : E1CP1PP1
ECTS : 1

DURATION

Lectures :	0
Tutorial classes :	4
Labs :	4
Total :	8

Project :
Personnal work :

ASSESSMENT

Lab work : 2.0h - Coefficient : 1.0

TEACHING MATERIALS

Materials available on the Moodle platform.

LANGUAGE

English

CONTACT

AXELLE MALATERRE
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Modifié le : 14 juillet 2026

UE : PROJET

COURSE : Discovering the agri-food specialization

SCOPE OF THE COURSE

OBJECTIVES

2h tutorial on the company forum to understand the various aspects of the sector. 4h lab work to discover an emblematic lab work of the specialization. 2h tutorial (shared) for designing a micro-enterprise.

COMPETENCE AND SKILLS

Choosing the engineering pathway

PROGRAM

Participation in a research project. Discovery of laboratory techniques.

BIBLIOGRAPHY

REQUIREMENTS

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IDENTIFICATION

Course code : E1CP1PP2
ECTS : 1

DURATION

Lectures :	0
Tutorial classes :	4
Labs :	4
Total :	8

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : PROJET

COURSE : Introduction to the Building-Energy Specialization

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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IDENTIFICATION

Course code : E1CP1PP3
ECTS : 1

DURATION

Lectures :	0
Tutorial classes :	0
Labs :	0
Total :	0

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

Materials available on the Moodle platform.

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : PROJET

COURSE : S-I PROJECT

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

— Be able to interact with the various stakeholders in a project.

PROGRAM

Training in project management tools

BIBLIOGRAPHY

REQUIREMENTS

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Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E1CP1PP4
ECTS : 1

DURATION

Lectures :	0
Tutorial classes :	4
Labs :	4
Total :	8

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : PROJET

COURSE : Introduction to the computer science specialization

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E1CP2AA1
ECTS : 1.5

DURATION

Lectures :	8
Tutorial classes :	6
Labs :	4
Total :	18

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

Supports on the Moodle platform.

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : AGROALIMENTAIRE

COURSE : Basis of Biochemistry

SCOPE OF THE COURSE

OBJECTIVES

Know the main constituent molecules of living organisms and their principal biological functions

COMPETENCE AND SKILLS

-To know the structure and main biological functions of nucleic acids

-To know the structure and main biological functions of carbohydrates

-To know the structure and main biological functions of lipids

-To know the structure and main biological functions of amino acids, peptides, and proteins

PROGRAM

— General introduction
— Amino acids, peptides, proteins
— Lipids
— Carbohydrates
— Nucleic acids

BIBLIOGRAPHY

1 *Lehninger Principles of Biochemistry* by Flammarion 2 *Stryer Biochemistry* by Flammarion 3 *Harper's Illustrated Biochemistry* by de Boeck Université 4 *Biochemistry and Molecular Biology* by P. Kamoun, A. Lavoinne and H. de Verneuil, published by Flammarion

REQUIREMENTS

Bases of Biology

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UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S2*

IDENTIFICATION

Course code :	E1CP2AA2
ECTS :	1

DURATION

Lectures :	8
Tutorial classes :	4
Labs :	4
Total :	16

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : AGROALIMENTAIRE

COURSE : Organic Chemistry I

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E1CP2BE1
ECTS : 1.5

DURATION

Lectures :	8
Tutorial classes :	0
Labs :	8
Total :	16

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : BATIMENT

COURSE : Technical Drawing

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E1CP2BE2
ECTS : 1

DURATION

Lectures :	8
Tutorial classes :	10
Labs :	0
Total :	18

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

Materials available on the Moodle platform.

LANGUAGE

English

CONTACT

Kamal EL OMARI
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Modifié le : 14 juillet 2026

UE : BATIMENT

COURSE : Statics of rigid bodies

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

- Understand the concepts of force, moment of force, and torque.
- Analyze force systems in two and three dimensions.
- Solve static equilibrium problems for rigid bodies.
- Use a vector approach and the formalism of torsors.
- Construct free-body diagrams to isolate and analyze forces acting on a rigid body.
- Identify and correctly represent reaction forces at contact points (supports, connections).
- Isolate the appropriate material system and determine external mechanical actions.
- Identify different types of connections and supports (hinges, sliders, fixed supports, etc.).
- Analyze the effect of connections and supports on the equilibrium and stability of structures.
- Solve practical statics problems in engineering and physics contexts.
- Use software and modeling tools to simulate and analyze statics problems.

PROGRAM

Moment of a force and the concept of torque

Resultant of a force and point of application of the resultant

2D and 3D mechanical connections

Fundamental Principle of Statics (PFS)

Isostaticity

Solving a 3D statics problem

Statics of trusses

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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IDENTIFICATION

Course code : E1CP2HU1
ECTS : 1

DURATION

Lectures :	0
Tutorial classes :	15
Labs :	0
Total :	15

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

Materials available on the Moodle platform.

LANGUAGE

English

CONTACT

Thomas Barbereau
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Modifié le : 14 juillet 2026

UE : HUMANITES

COURSE : Sports II

SCOPE OF THE COURSE

OBJECTIVES

"BEACH VOLLEY

Acquire knowledge related to the practice of physical and sports activities (engineering and culture of physical and sports activities)

Develop and refine physical and energetic abilities

Better self-awareness

Engage in a process of progress

Know how to surpass oneself and achieve fulfillment

Better understanding of others and oneself within a group "

COMPETENCE AND SKILLS

- Engage to win the point by making relevant technical and tactical choices based on the analysis of the balance of power
- Identify and/or create open spaces to produce a targeted attack, and generate tight and/or downward trajectories to speed up the game
- Defend by seeking to neutralize an unfavorable balance of power to regain the upper hand
- Know how to prepare and train individually to conduct and master an individual confrontation to tip the balance of power in one's favor
- Get into condition, alone, to engage in a confrontation and recover from it
- Identify, using indicators, alone, the state of the balance of power and one's individual level of practice in attack and defense
- Choose and implement, alone, one or more individual technical-tactical projects to create the conditions for winning the point and protecting the target

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E1CP2HU2
ECTS : 3

DURATION

Lectures :	0
Tutorial classes :	30
Labs :	0
Total :	30

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

Materials on the Moodle platform.

LANGUAGE

English

CONTACT

Hugues PETIT
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Modifié le : 14 juillet 2026

UE : HUMANITES

COURSE : English II

SCOPE OF THE COURSE

OBJECTIVES

"Learning pragmatic, socio-linguistic, and linguistic skills (vocabulary, syntax, grammar, phonology) necessary for understanding authentic documents and for oral and written interaction in authentic communication situations, particularly professional ones. General English (press and media) + business English (TOEIC)"

COMPETENCE AND SKILLS

— completion of tasks involving strategies, sometimes within a project/mission approach (CLES type) [Level 2]
— B2 level in listening comprehension and reading comprehension (TOEIC)
— B2 level in speaking and writing (CLES)
— English for media and business

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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ESIROI
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UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S2*

IDENTIFICATION

Course code : E1CP2HU3
ECTS : 1.5

DURATION

Lectures :	10
Tutorial classes :	8
Labs :	0
Total :	18

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

Learning resources available on the Moodle platform.

LANGUAGE

English

CONTACT

Joël GRILLASCA
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Modifié le : 14 juillet 2026

UE : HUMANITES

COURSE : "'markdown CSR II "'

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

- List the main greenhouse gases (GHGs) and the causes of their emissions
- Define the concept of carbon footprint at different levels (individuals, organizations, States, humanity) and identify the generating factors
- Examine the main sources responsible for an individual's carbon footprint and the efforts required to achieve the 2050 target of 2 tonnes per person
- Identify key biodiversity state indicators (abundance index, extinction rate, Red List, etc.). Understand the logic of the Pressure-State-Response (PSR) model. Research biodiversity indicators (UN, GRI, IUCN, EU, OECD, etc.)
- Explain and illustrate an organization's dependence on and impacts on ecosystem services
- Demonstrate how an organization can contribute to each SDG
- Identify types of organizations with positive social, societal, or environmental impact (social and solidarity economy (SSE) organizations, solidarity-based enterprises of social utility (ESUS), mission-driven companies)
- Analyze key governance models (stakeholders considered, objectives pursued, decision-making processes, etc.) in light of the economic, social, societal, and environmental challenges of sustainable development

PROGRAM

1. Concepts of biogeochemical cycles

- Water (2h)
- Nitrogen (2h)
- Carbon (2h)

2. Circular economy
3. Ecosystem services

BIBLIOGRAPHY

REQUIREMENTS

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IDENTIFICATION

Course code : E1CP2HU4
ECTS : 0.5

DURATION

Lectures :	4
Tutorial classes :	4
Labs :	0
Total :	8

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

Materials available on the Moodle platform.

LANGUAGE

English

CONTACT

Joël GRILLASCA
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Modifié le : 14 juillet 2026

UE : HUMANITES

COURSE : Life Sciences II

SCOPE OF THE COURSE

OBJECTIVES

Objective 1. To gain basic knowledge of the organization of life in order to understand the impacts on living organisms caused by the Anthropocene and the methods used to measure them (including LCA).

Objective 2. To understand the One Health/Global Health concept (a case study on glyphosate).

COMPETENCE AND SKILLS

— Identify the main impacts on living organisms linked to the Anthropocene
— Understand the measurements that can be used to assess the impact of these impacts and those that can or cannot be included in an LCA
— Understand the concept of global health and be able to relate it to the development of human activities
— Be able to break down living systems at different scales (principle of abstraction)
— Understand the current issue of glyphosate : from its mechanism of action as a herbicide to its human toxicity and environmental impact.

PROGRAM

Links between human health (diseases of society) and the 4 axes of the global health tree : 1. food and water security 2. climate change and air and water quality 3. biodiversity of ecosystems (direct resources, pandemics, pharmaceutical resources…) 4. non-quantifiable aspects (cultural, religious, ethical)

BIBLIOGRAPHY

REQUIREMENTS

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UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S2*

IDENTIFICATION

Course code :	E1CP2IF1
ECTS :	2.5

DURATION

Lectures :	8
Tutorial classes :	10
Labs :	16
Total :	34

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : INFORMATIQUE

COURSE : Algorithmic and Programming

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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IDENTIFICATION

Course code : E1CP2MT1
ECTS : 2

DURATION

Lectures :	12
Tutorial classes :	20
Labs :	0
Total :	32

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

Resources available on the Moodle platform.

LANGUAGE

English

CONTACT

Maxence MULDER
maxence.mulder@univ-reunion.fr

Modifié le : 14 juillet 2026

UE : MATHEMATIQUES

COURSE : Mathematics for Engineering II-a

SCOPE OF THE COURSE

OBJECTIVES

"1. Elements of Linear Algebra The vector space model : definition and examples. The concept of a vector subspace : characterization and properties. Linear combinations of vectors : concepts and applications. Vector subspace spanned by a family of vectors. Linearly independent vectors : definition and criteria. Basis and dimension of a vector subspace. Kernel and image of a matrix : definition and properties. Rank and nullity of a matrix : rank theorem and applications.

2. Systems of m Linear Equations with n Unknowns Structure of the solution set of a linear system. Gaussian elimination method : principle and implementation. Elementary matrices : definition, properties, and applications.
3. Polynomials Euclidean division Roots of a polynomial. Multiplicity of a root. d'Alembert's theorem Factorization of a polynomial in the set of complex numbers"

COMPETENCE AND SKILLS

— Ability to solve systems of n equations with n unknowns

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code :	E1CP2MT2
ECTS :	4

DURATION

Lectures :	24
Tutorial classes :	40
Labs :	0
Total :	64

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : MATHEMATIQUES

COURSE : Mathematics for Engineering II-b

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

ESIROI
ÉCOLE D'INGÉNIEURS
UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S2*

IDENTIFICATION

Course code :	E1CP2MT3
ECTS :	2

DURATION

Lectures :	6
Tutorial classes :	12
Labs :	8
Total :	26

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : MATHEMATIQUES

COURSE : Inferential Statistics I

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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ESIROI
ÉCOLE D'INGÉNIEURS
UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S2*

IDENTIFICATION

Course code : E1CP2OI1
ECTS : 0.5

DURATION

Lectures :	0
Tutorial classes :	8
Labs :	0
Total :	8

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

Materials available on the Moodle platform.

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : OUTILS

COURSE : Communication Techniques II

SCOPE OF THE COURSE

OBJECTIVES

The module aims to establish the foundations of interpersonal communication in project management :

— public speaking
— adopting the right posture in the right situation
— scientific dissemination

COMPETENCE AND SKILLS

— Ability to speak in public
— Ability to listen to collaborators

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E1CP2OI2
ECTS : 2.5

DURATION

Lectures :	2
Tutorial classes :	24
Labs :	8
Total :	34

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : OUTILS

COURSE : Digital Tools and Modeling II

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E1CP2OI3
ECTS : 1

DURATION

Lectures :	0
Tutorial classes :	0
Labs :	0
Total :	0

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

Materials available on the Moodle platform.

LANGUAGE

English

CONTACT

Philippe LAURET
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Modifié le : 14 juillet 2026

UE : OUTILS

COURSE : PROJECT-SII

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E1CP2PC1
ECTS : 2

DURATION

Lectures :	8
Tutorial classes :	10
Labs :	8
Total :	26

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : PHYSIQUE-CHIMIE

COURSE : Mechanics of Particles II

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
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ESIROI
ÉCOLE D'INGÉNIEURS
UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S2*

IDENTIFICATION

Course code :	E1CP2PC2
ECTS :	2

DURATION

Lectures :	18
Tutorial classes :	26
Labs :	8
Total :	52

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : PHYSIQUE-CHIMIE

COURSE : Fluid Mechanics

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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ESIROI
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UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S2*

IDENTIFICATION

Course code :	E1CP2PC3
ECTS :	1.5

DURATION

Lectures :	10
Tutorial classes :	14
Labs :	0
Total :	24

Project :
Personnal work :

ASSESSMENT

Continuous assessment : 1 surprise test (≥ 20 min, 20 %), CA1 (≤ 2 h, 40 %, parts 1–2), CA2 (≤ 2 h, 40 %, full syllabus); final grade = 0.20 (surprise test) + 0.40 (CA1) + 0.40 (CA2).

TEACHING MATERIALS

Learning materials available on the Moodle platform.

LANGUAGE

English

CONTACT

Didier LUCA Sean-Jacques KADJO
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Modifié le : 14 juillet 2026

UE : PHYSIQUE-CHIMIE

COURSE : Thermodynamics I

SCOPE OF THE COURSE

OBJECTIVES

Establish the fundamentals of thermodynamics and the simple and conceptual application of the first law.

COMPETENCE AND SKILLS

- To know how to define the states of matter : fluid, solid, and mesomorphic.
- To know the characteristics of the fluid state. To know the concept of phase and the nomenclature of phase changes.
- To know the concept of thermodynamic system and to know the definitions of closed, open, and isolated systems.
- To be able to define the concept of state parameter.
- To know the zeroth law of thermodynamics and the first definition of temperature.
- To know the principle of a temperature scale and to know the Celsius and Kelvin scales.
- To be able to define the concepts of thermostat, thermodynamic equilibrium, state function (and its properties).
- Transformations and evolutions : isochoric, monothermal, isothermal, monobaric, isobaric, reversible, quasi-static, elementary, and adiabatic ; conservative and non-conservative quantities.
- To understand the inadequacy of mechanics and the necessity of the concept of total energy, kinetic temperature from microscopic kinetic energy.
- To be able to define the concept of molecular chaos and to justify the statistical approach.
- To be able to define the homogeneity of the velocity distribution and isotropy of velocities, and the concept of root-mean-square velocity.
- To know the three hypotheses of the ideal gas.
- To know the expression for kinetic pressure.
- To be able to define kinetic temperature and to know the equipartition theorem.
- To be able to derive the ideal gas equation of state.
- To know the extrapolation to polyatomic ideal gases : concept of rotational and vibrational degrees of freedom, consequences on internal energy and heat capacities at constant volume (CV).
- To be able to determine the expression for internal energy for a monatomic ideal gas and to define the heat capacity at constant volume (CV).
- To know some limitations of the ideal gas model : e.g., the Amagat diagram.
- To know the hypotheses of the Van der Waals gas model and its equation.
- To know the concept of ideal mixture (Dalton's Law).

PROGRAM

1. Thermodynamics language
2. The ideal gas
3. First Law applied to simple ideal-gas transformations

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Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

BIBLIOGRAPHY

Reference works (lectures and applications)

— J.-P. Pérez, *Thermodynamique. Fondements et applications*, Dunod. Reference for conceptual structure (language, principles, perfect gas).

— B. Diu, C. Guthmann, D. Lederer, B. Roulet, *Thermodynamique*, Hermann. Rigorous treatment of kinetic theory, kinetic pressure and temperature, and equipartition.

— C. Lhuillier, J. Rous, *Introduction à la thermodynamique*, Dunod. Progressive introduction adapted to the module level.

— M.-N. Sanz, A.-E. Badel, F. Clausset, *Physique tout-en-un*, collection « Tout-en-un », Dunod. For the first law and simple transformations of the perfect gas, numerous corrected exercises.

Further reading and physico-chemical aspects

— P. W. Atkins, J. de Paula, *Chimie physique*, De Boeck. Real gases (Van der Waals, Amagat diagrams), ideal mixtures, Dalton's law.

— O. Bonnefoy, *Thermodynamique*, course handout, École des Mines de Saint-Étienne (available online). Clear synthesis with statistical perspective.

Exercise collections

— H. Lumbroso, *Thermodynamique — Problèmes résolus*, Dunod.

REQUIREMENTS

Entry-level expectations for the module :

Mathematics
Differential and integral calculus in one variable ; partial derivatives and total differential of a function of several variables ; notion of differential form, distinction between exact differential (state function) and non-exact form (transfer quantity) ; integration along a path.

Point Mechanics
Work of a force, kinetic energy and the kinetic energy theorem, potential energy and mechanical energy ; momentum and momentum balance (useful for kinetic pressure and wall impacts).

General Physics
Concepts of force, pressure and units of the International System ; order of magnitude and dimensional homogeneity.

General Chemistry
States of matter, notion of mole, Avogadro's number, molar mass.

Elementary Statistical Tools
Concept of mean value and distribution of a quantity (foundation of the statistical approach to molecular chaos and root-mean-square speed).

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IDENTIFICATION

Course code : E1CP2PC4
ECTS : 2

DURATION

Lectures :	10
Tutorial classes :	12
Labs :	8
Total :	30

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

Materials available on the Moodle platform.

LANGUAGE

English

CONTACT

Didier LUCAS
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Modifié le : 14 juillet 2026

UE : PHYSIQUE-CHIMIE

COURSE : Chemical Equilibria II

SCOPE OF THE COURSE

OBJECTIVES

Redox reactions involving metals : under what conditions can a metal oxidize ? How to protect it from corrosion ? How to detect the presence of metals in solution ?

COMPETENCE AND SKILLS

- Know how to write the formation reaction of a metal oxide with a coefficient of -1 for dioxygen
- Know how to state Ellingham's hypothesis
- Know how to express the standard Gibbs free energy of reaction under Ellingham's hypothesis
- Know how to plot an Ellingham diagram
- Know how to interpret a change in slope in the Ellingham diagram
- Know how to derive the equation of the Ellingham line after a phase change
- Know how to identify the stability domains of the metal and the oxide
- Know how to relate the rate of a redox reaction to electric current
- Know how to justify the need for a three-electrode setup
- Know how to define the term overpotential
- Know how to use a current-potential curve to predict a reaction
- Know how to use a current-potential curve to propose a metal protection solution
- Know how to use a current-potential curve in the context of a titration at imposed current
- Know how to define the corrosion pressure
- Know how to calculate the corrosion pressure
- Know how to graphically determine the corrosion pressure
- Know how to define the corrosion temperature
- Know how to calculate the corrosion temperature
- Know how to graphically determine the corrosion temperature
- Know how to superimpose two Ellingham diagrams to predict the reaction between an oxide and a metal

PROGRAM

1. Oxidation in contact with air
2. Oxidation in aqueous medium
3. Selective precipitation and complexation of metal cations

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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ESIROI
ÉCOLE D'INGÉNIEURS
UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S2*

IDENTIFICATION

Course code : E1CP2PC5
ECTS : 2

DURATION

Lectures :	14
Tutorial classes :	16
Labs :	8
Total :	38

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

Materials available on the Moodle platform.

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : PHYSIQUE-CHIMIE

COURSE : Evolution of a chemical system

SCOPE OF THE COURSE

OBJECTIVES

Predict the evolution of a chemical system : Is the system at equilibrium ? How fast will the system evolve ?

COMPETENCE AND SKILLS

- Know how to define state functions H, S, and G
- Know how to define a reaction quantity
- Know how to calculate a reaction enthalpy from standard enthalpies of formation
- Know how to calculate a reaction entropy from standard entropies of pure substances
- Know how to relate the sign of the reaction enthalpy to the exothermic/endothermic nature
- Know how to relate the sign of the reaction entropy to the variation in the number of moles of gas
- Know how to predict the evolution of a system based on the reaction Gibbs free energy
- Know how to define the terms homogeneous and isothermal
- Know how to define the rate of appearance of a product/rate of disappearance of a reactant
- Know how to define the (intensive) reaction rate
- Know how to present kinetic factors
- Know how to define a catalyst
- Know the different types of catalysis
- Know how to describe the mode of action of a catalyst
- Know how to describe the selectivity of a catalyst
- Know that the rate of certain reactions can take a particular form
- Know how to define the terms partial order and overall order
- Know how to differentiate overall order and current order
- Know how to define simple and complex reactions
- Know that a kinetic study aims to determine the rate constant and the orders
- Know how to describe the differential method
- Know how to describe the integral method
- Know how to apply the integral method to reactions of order 0, 1, and 2
- Know how to use the half-life to determine a partial order
- Know how to state Arrhenius' law
- Know how to use experimental results to determine the activation energy
- Know how to define the terms endothermic and exothermic

PROGRAM

1. Elements of thermochemistry
2. Chemical kinetics (formal kinetics without MR)

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP3A1
ECTS : 1

DURATION

Lectures :	0
Tutorial classes :	0
Labs :	0
Total :	0

Project :
Personnal work :

ASSESSMENT

Report + Oral presentation

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Alexandre DOUYERE
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Modifié le : 14 juillet 2026

UE : AGROALIMENTAIRE

COURSE : PROJECT S-III

SCOPE OF THE COURSE

OBJECTIVES

Engineer's life simulator. Students must demonstrate that they can not only solve a technical problem but also manage its resolution within constrained conditions (time, resources, team).

COMPETENCE AND SKILLS

- **Project Management Mastery** : Ability to plan, lead, and monitor a project (defining specifications, managing a Gantt chart, identifying risks, and meeting deadlines)
- **Technical Application** : Applying scientific and technical knowledge acquired in courses to design, model, or implement a concrete solution (prototype, software, technical study)
- **Teamwork and Collaboration** : Demonstrating the ability to organize collectively, delegate tasks, manage group interactions, and work effectively in a team
- **Autonomy and Initiative** : Ability to research information, learn new tools, and make decisions to overcome obstacles without passively waiting for solutions
- **Professional Communication** : Ability to document the project (reports) and present the work (oral presentations), justifying technical choices and the approach clearly and convincingly

PROGRAM

1. Introduction to project management : writing specifications, planning, work organization, and risk management.
2. Design and development : applying scientific and technical knowledge to model or implement a solution (prototype, software, study).
3. Collaborative work : task delegation, coordination, progress tracking, and use of shared management tools.
4. Developing autonomy : resource research, mastering new tools, problem-solving, and decision-making.
5. Documentation and valorization : writing a structured report and preparing an oral presentation with justification of technical choices and the approach.

BIBLIOGRAPHY

REQUIREMENTS

Entire CPI Training

ESIROI - Campus de Terre Sainte
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Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP3A2
ECTS : 0.5

DURATION

Lectures :	6
Tutorial classes :	6
Labs :	0
Total :	12

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : AGROALIMENTAIRE

COURSE : Fundamentals of Process Engineering

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code :	E2CP3A3
ECTS :	2

DURATION

Lectures :	12
Tutorial classes :	10
Labs :	4
Total :	26

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : AGROALIMENTAIRE

COURSE : Molecules of Life

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP3A4
ECTS : 1

DURATION

Lectures :	10
Tutorial classes :	10
Labs :	0
Total :	20

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h)

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : AGROALIMENTAIRE

COURSE : Molecular Biology

SCOPE OF THE COURSE

OBJECTIVES

Understand the molecular mechanisms of expression, transmission, and regulation of genetic information.

COMPETENCE AND SKILLS

Interpret classical experiments (Meselson-Stahl, Griffith, Watson & Crick). Manipulate molecular biology diagrams/methods (PCR, electrophoresis, restriction enzymes).

PROGRAM

Techniques : PCR, cloning, electrophoresis, sequencing.

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP3A5
ECTS : 1

DURATION

Lectures :	4
Tutorial classes :	4
Labs :	4
Total :	12

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h) + 1 Lab report

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : AGROALIMENTAIRE

COURSE : Cell Biology - Fundamentals of Microbiology

SCOPE OF THE COURSE

OBJECTIVES

To provide the foundations of cell structure and function, and introduce the main microorganisms (bacteria, viruses, fungi).

COMPETENCE AND SKILLS

Identify the components of eukaryotic/prokaryotic cells. Understand essential mechanisms : cell division, membrane transport, communication. Recognize microorganisms and their roles (health, industry, environment). Follow microbiological safety rules in the laboratory.

PROGRAM

Eukaryotic vs prokaryotic cell : nucleus, organelles, plasma membrane.

Cell cycle, mitosis and meiosis.

Membrane transport : diffusion, osmosis, ATP-dependent pumps.

Introduction to microorganisms : bacteria, viruses, yeasts.

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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IDENTIFICATION

Course code : E2CP3A6
ECTS : 2

DURATION

Lectures :	10
Tutorial classes :	10
Labs :	12
Total :	32

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h) + 1 Lab report

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : AGROALIMENTAIRE

COURSE : Organic Chemistry II

SCOPE OF THE COURSE

OBJECTIVES

The course aims to enable students to understand the mechanisms involved in the transformation of organic molecules. Which reactions can occur, under what conditions, and with what outcomes.

COMPETENCE AND SKILLS

- Know how to define a nucleophilic center and provide examples
- Know how to rank the strength of nucleophiles
- Know how to define an electrophilic center and provide examples
- Know how to define a nucleofuge (leaving group) and provide examples
- Know how to compare two nucleofuges
- Know how to define the term substrate
- Know how to correctly use curved-arrow formalism
- Know how to define nucleophilic substitution
- Know the characteristics of SN2
- Know the reaction mechanism of SN2
- Know the reaction profile of SN2
- Know how to explain the stereospecificity of SN2
- Know how to define the terms stereoselective, stereospecific, regioselective, regiospecific
- Know the characteristics of SN1
- Know the reaction mechanism of SN1
- Know the reaction profile of SN1
- Know how to explain the non-stereospecificity of SN1
- Know how to present the Wagner–Meerwein rearrangement
- Know that both mechanisms (SN1 and SN2) are in competition
- Know how to discuss the influence of substrate class
- Know how to discuss the influence of steric hindrance
- Know how to discuss the influence of nucleophile strength
- Know how to discuss the influence of solvent polarity
- Know how to discuss the influence of solvent proticity
- Know how to define the β-elimination reaction
- Know how to present the E1 mechanism
- Know how to present the E2 mechanism
- Know how to explain the regioselectivity of elimination
- Know how to state Zaitsev's rule
- Know how to state Hoffmann's rule and the cases in which it applies
- Know how to explain the stereospecificity of the E2 mechanism
- Know that elimination and substitution mechanisms are in competition
- Know how to discuss the influence of substrate class
- Know how to discuss the influence of nucleophile strength
- Know how to discuss the influence of solvent polarity
- Know how to discuss the influence of solvent proticity

— For each functional group, know how to identify the reactivity of the functional group
— For each functional group, know how to predict possible reactions based on operating conditions
— For each functional group, know how to write the reaction mechanism associated with the envisaged reactions

PROGRAM

1. Nucleophilic/electrophilic centers, leaving groups, and writing mechanisms (curved arrows).
2. Nucleophilic substitutions SN1 and SN2 : mechanisms, energy profiles, influencing factors (substrate, nucleophile, solvent).
3. Eliminations E1 and E2 : mechanisms, regioselectivity (Zaitsev / Hoffmann), stereospecificity.
4. Substitution vs. Elimination competition : prediction criteria.
5. Application by functional groups : identifying reactivity and writing associated mechanisms.

BIBLIOGRAPHY

PAUL ARNAUD

REQUIREMENTS

Organic Chemistry I

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IDENTIFICATION

Course code : E2CP3B1
ECTS : 1

DURATION

Lectures :	4
Tutorial classes :	8
Labs :	8
Total :	20

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : BATIMENT-ENERGIE

COURSE : Buildings and Energy Systems

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP3B2
ECTS : 0.5

DURATION

Lectures :	4
Tutorial classes :	2
Labs :	0
Total :	6

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : BATIMENT-ENERGIE

COURSE : Energy Context I

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S3*

IDENTIFICATION

Course code : E2CP3B3
ECTS : 1

DURATION

Lectures :	0
Tutorial classes :	0
Labs :	0
Total :	0

Project :
Personnal work :

ASSESSMENT

Report + Oral presentation

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : BATIMENT-ENERGIE

COURSE : PROJECT S-III

SCOPE OF THE COURSE

OBJECTIVES

Engineer's life simulator. Students must demonstrate not only their ability to solve a technical problem but also to manage this resolution within constrained conditions (time, resources, team).

COMPETENCE AND SKILLS

- **Project Management Mastery** : knowing how to plan, steer, and monitor a project (defining a specifications document, managing a Gantt chart, identifying risks, and meeting deadlines)
- **Technical Application** : applying the scientific and technical knowledge acquired in courses to design, model, or implement a concrete solution (prototype, software, technical study)
- **Teamwork and Collaboration** : demonstrating the ability to organize collectively, assign tasks, manage group interactions, and work effectively in a team
- **Autonomy and Initiative** : being able to research information, learn new tools, and make decisions to overcome obstacles without passively waiting for solutions
- **Professional Communication** : knowing how to document the project (reports) and present the work (oral defenses), justifying technical choices and the approach clearly and convincingly

PROGRAM

1. Introduction to project management : drafting the specifications document, task breakdown, scheduling (Gantt chart), risk identification.
2. Technical implementation : designing, modeling, or implementing a solution (prototype, software, or study) by leveraging scientific knowledge.
3. Collaborative organization : role assignment, coordinating contributions, using shared work tools, and progress meetings.
4. Developing autonomy : researching information, mastering new tools, overcoming technical obstacles, and making reasoned decisions.
5. Professional communication : structured report writing and preparing an oral defense presenting the approach and technical choices.

BIBLIOGRAPHY

REQUIREMENTS

Entire CPI Training Program

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP3B4
ECTS : 1

DURATION

Lectures :	4
Tutorial classes :	0
Labs :	4
Total :	8

Project :
Personnal work :

ASSESSMENT

1 Written exam (2h) + 1 Lab report

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Jean CASTAING LASVIGNOTTES
jean.castaing.lasvignottes@univ-reunion.fr

Modifié le : 14 juillet 2026

UE : BATIMENT-ENERGIE

COURSE : 3D Modeling

SCOPE OF THE COURSE

OBJECTIVES

Become familiar with a 3D modeling tool (e.g., SketchUp) to prepare for Dynamic Thermal Simulation

COMPETENCE AND SKILLS

Be able to model all or part of a building in 3D for subsequent thermal simulation

PROGRAM

1. Familiarization with a 3D modeling software dedicated to buildings (interface, basic tools, project organization).
2. Importing or creating the floor plan : defining layout, levels, and main volumes.
3. Modeling walls : walls, floors, roofs, openings; assigning materials and thermal properties.
4. Defining thermal zones : segmenting spaces based on usage and thermal exchanges.
5. Preparing the model for simulation : checking geometric consistency, closing volumes, exporting to a compatible format.

BIBLIOGRAPHY

REQUIREMENTS

Technical drawing

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP3B5
ECTS : 1

DURATION

Lectures :	8
Tutorial classes :	8
Labs :	0
Total :	16

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h)

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Candice BERENGUER
candice.berenguer@univ-reunion.fr

Modifié le : 14 juillet 2026

UE : BATIMENT-ENERGIE

COURSE : Architecture

SCOPE OF THE COURSE

OBJECTIVES

— Awareness of the architectural design and construction process through an iterative approach
— Understanding the act of building, from needs expression to building obsolescence
— Identifying the role of each stakeholder in the construction process, particularly the relationship between the engineer and the architect

COMPETENCE AND SKILLS

Being able to grasp the complexity of the questioning involved in the design process in which they will participate

PROGRAM

1. Introduction to design challenges : objectives, constraints, stakeholders, and contexts.
2. Needs analysis : problem formulation, identification of uses and priorities.
3. Solution exploration : possible scenarios, technical, economic, and environmental trade-offs.
4. Argumentation and decision-making : justification of choices made and evaluation of alternatives.
5. Reflective feedback : critical analysis of the design process and one's own involvement.

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

ESIROI
ÉCOLE D'INGÉNIEURS
UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S3*

IDENTIFICATION

Course code : E2CP3B6
ECTS : 1

DURATION

Lectures :	8
Tutorial classes :	12
Labs :	0
Total :	20

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h)

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : BATIMENT-ENERGIE

COURSE : Math for BE

SCOPE OF THE COURSE

OBJECTIVES

— **Double integrals** : definition, Fubini's theorem, change of variables, Jacobian, polar coordinates; applications : center of mass, moment of inertia, area calculation, volume under a surface
— **Triple integrals** : definition and applications, cylindrical and spherical coordinates, change of variables with the Jacobian, practical applications
— **Curves and line integrals** : curves and parametric equations, polar coordinates, definition and calculation of line integrals, applications to vector fields and curve length calculations
— **Fundamental theorems** : Green–Riemann theorem, Ostrogradski's and Stokes' theorems, gradient and curl theorems, calculation of the flux of a vector field

COMPETENCE AND SKILLS

— Formulate and evaluate double and triple integrals in Cartesian coordinates
— Formulate and evaluate line integrals in various geometric configurations
— Perform change of variables in multiple integrals (polar, cylindrical, and spherical coordinates)
— Apply multiple integrals to physics and engineering problems (volume, center of mass, moment of inertia calculations, etc.)
— Apply line integrals to physics problems (curve length, work done by a force, flux of vector fields, etc.)
— Use the Green–Riemann theorem and other fundamental theorems to solve physical and geometric problems

PROGRAM

1. Double and triple integrals in Cartesian coordinates : definition, geometric interpretation, calculation over simple domains.
2. Change of variables in multiple integrals : introduction to polar, cylindrical, and spherical coordinates, practical applications.
3. Line integrals : definition, orientation, calculation over parameterized curves in various geometric contexts.
4. Applications in physics and engineering : volume, center of mass, moment of inertia, work of a force, flux of fields calculations.
5. Fundamental theorems : Green–Riemann theorem and introduction to Stokes and Gauss for solving concrete problems.

BIBLIOGRAPHY

REQUIREMENTS

— Differentiation and integration of single-variable functions
— Multivariable functions and partial derivatives

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
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— Vector calculus
— Calculation of the determinant of a 3×3 matrix

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP3B7
ECTS : 2

DURATION

Lectures :	10
Tutorial classes :	6
Labs :	16
Total :	32

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h) + 1 Lab report

TEACHING MATERIALS

- Python Notebook course material - On-line lab manual

LANGUAGE

English

CONTACT

Philippe LAURET
philippe.lauret@univ-reunion.fr

Modifié le : 14 juillet 2026

UE : BATIMENT-ENERGIE

COURSE : Signal, Sensors and Metrology

SCOPE OF THE COURSE

OBJECTIVES

— To know how to analyze the static and dynamic characteristics of a sensor
— To know how to calibrate a sensor
— To understand the different types of measurement errors
— To understand the principle of sensor conditioning
— Detailed study of the PT100 probe

COMPETENCE AND SKILLS

— To be able to set up a measurement campaign
— To be able to select equipment and/or communicate with a specialist
— To know and analyze the limits of measurement

PROGRAM

— Static characteristics of a sensor : calibration curve, sensitivity, accuracy, linearity and hysteresis errors
— Influence quantities
— Dynamic characteristics : time constant, cutoff frequency, bandwidth, first-order sensor response

BIBLIOGRAPHY

REQUIREMENTS

— Mathematics and statistics
— General physics and chemistry
— Electricity
— Metrology

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ESIROI
ÉCOLE D'INGÉNIEURS
UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S3*

IDENTIFICATION

Course code :	E2CP3HM1
ECTS :	1

DURATION

Lectures :	4
Tutorial classes :	4
Labs :	0
Total :	8

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : HUMANITES

COURSE : Life Sciences III

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP3HM2
ECTS : 1

DURATION

Lectures :	0
Tutorial classes :	15
Labs :	0
Total :	15

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : HUMANITES

COURSE : Sports III

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP3HM3
ECTS : 3

DURATION

Lectures :	0
Tutorial classes :	30
Labs :	0
Total :	30

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h)

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Hugues PETIT
hugues.petit@univ-reunion.fr

Modifié le : 14 juillet 2026

UE : HUMANITES

COURSE : English III

SCOPE OF THE COURSE

OBJECTIVES

Consolidation of pragmatic, socio-linguistic, and linguistic skills (vocabulary, syntax, grammar, phonology) necessary for understanding authentic documents and for oral and written interaction in authentic communication situations, particularly professional, scientific, and technical ones. General English (press and media) + business English (TOEIC)

COMPETENCE AND SKILLS

- Level B2 in listening comprehension (LC) and reading comprehension (RC) — *TOEIC*
- Level B2 in written production (WP) and oral interaction (OI) — *CLES*
- Media and business English
- Completion of tasks involving strategies, sometimes within a project or mission framework (type *CLES*) — level 4
- Technical and scientific English

PROGRAM

1. Targeted training in listening and reading comprehension using authentic materials (audio sequences, articles, news dispatches) to consolidate level B2.
2. Guided written production : professional emails, summary notes, structured arguments.
3. Oral interaction : meeting simulations, short presentations, speaking in professional contexts.
4. Analysis and processing of media and business documents : identifying issues, biases, registers, and communication objectives.
5. Completion of integrated tasks such as projects (*CLES*) : information gathering, reformulation, synthesis, oral or written presentation.
6. Introduction to technical and scientific English : popularization, reformulation for non-specialists, presentation of results.

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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IDENTIFICATION

Course code : E2CP3HM4
ECTS : 1.5

DURATION

Lectures :	8
Tutorial classes :	8
Labs :	0
Total :	16

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h)

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Fabrice DOUBLET
fabrice.doublet@univ-reunion.fr

Modifié le : 14 juillet 2026

UE : HUMANITES

COURSE : DDRS III

SCOPE OF THE COURSE

OBJECTIVES

Application of the SDGs at the scale of a territory : La Réunion.

COMPETENCE AND SKILLS

- Define the concept of ethics, distinguish it from related notions such as morality or deontology, and apply it to the business world; identify key sustainability values and demonstrate their potential evolution over time and space
- Critically analyze an ethical code or charter in light of the challenges of ecological transition and sustainable development (ETSD)
- Develop a critical mindset regarding one's own practices and those of various organizations through case studies, projects, and internships; adopt a reflective and ethical approach to guide action
- Develop creativity and experiment to evolve individual and organizational practices in favor of ETSD
- Define strategic objectives that take into account the legitimate expectations of key stakeholders
- Identify the causes of resistance to change to initiate a transformation process conducive to ETSD
- Collaborate within a group to imagine and implement solutions in favor of ETSD

PROGRAM

- **SDGs at the scale of a territory : La Réunion (4h CM)**
  - Identify sustainable development and social responsibility (SD-SR) challenges in La Réunion using the Sustainable Development Goals (SDGs)
  - Research relevant information on SD-SR themes
- **Resilience, adaptation, and mitigation (2h CM / 4h TD)**
- **Controversy : case study applied to La Réunion (linked to communication techniques) (2h CM / 4h TD)**
  - Understand the basics of ethics and professional deontology
  - Know how to adopt a scientific approach when addressing complex problems
  - Know how to build an argument and defend a position from an ethical standpoint

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP3HM5
ECTS : 1

DURATION

Lectures :	0
Tutorial classes :	8
Labs :	0
Total :	8

Project :
Personnal work :

ASSESSMENT

1 Written exam (2h)

TEACHING MATERIALS

Course slides

LANGUAGE

English

CONTACT

Sami OUADRANI
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Modifié le : 14 juillet 2026

UE : HUMANITES

COURSE : Controversy

SCOPE OF THE COURSE

OBJECTIVES

On a theme related to SDG-RS and specializations, students will be confronted with ethical questions and develop their critical thinking.

COMPETENCE AND SKILLS

— Develop critical thinking about individual practices and those of various organizations through case studies, projects, and internships ; adopt a reflective and ethical approach to guide action
— Define the concept of ethics, distinguish it from related notions such as morality or deontology, and apply it to the business world ; identify key sustainability values and show their potential evolution over time and space
— Critically analyze an ethical code or charter in light of TEDS issues

PROGRAM

Workshop led by an external speaker (JCI, associative partners, etc.)

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP3I1
ECTS : 1

DURATION

Lectures :	0
Tutorial classes :	0
Labs :	0
Total :	0

Project :
Personnal work :

ASSESSMENT

Report + Oral presentation

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Alexandre DOUYERE
alexandre.douyere@univ-reunion.fr

Modifié le : 14 juillet 2026

UE : INFORMATIQUE

COURSE : PROJECT S-III

SCOPE OF THE COURSE

OBJECTIVES

Engineer's life simulator. The student must demonstrate that they can not only solve a technical problem but also manage this resolution within constrained conditions (time, resources, team).

COMPETENCE AND SKILLS

- **Project Management Mastery** : knowing how to plan, lead, and monitor a project (defining a specifications document, managing a Gantt chart, identifying risks, and meeting deadlines)
- **Technical Application** : applying scientific and technical knowledge acquired in courses to design, model, or implement a concrete solution (prototype, software, technical study)
- **Teamwork and Collaboration** : demonstrating the ability to organize collectively, assign tasks, manage group interactions, and work effectively in a team
- **Autonomy and Initiative** : being capable of researching information, training on new tools, and making decisions to overcome obstacles without passively waiting for solutions
- **Professional Communication** : knowing how to document the project (reports) and present the work (oral defenses), justifying technical choices and the approach clearly and convincingly

PROGRAM

1. Defining the specifications document and project planning (Gantt chart, risk identification).
2. Designing and implementing a technical solution (prototype, model, or study) leveraging scientific knowledge.
3. Collective organization : role distribution, task coordination, use of collaborative tracking tools.
4. Developing autonomy : information research, tool mastery, problem-solving, and decision-making.
5. Producing the final report and preparing the oral defense with justified arguments for technical and methodological choices.

BIBLIOGRAPHY

REQUIREMENTS

Entire CPI curriculum

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

ESIROI
ÉCOLE D'INGÉNIEURS
UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S3*

IDENTIFICATION

Course code :	E2CP3I2
ECTS :	2

DURATION

Lectures :	10
Tutorial classes :	8
Labs :	12
Total :	30

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : INFORMATIQUE

COURSE : C and C++ Programming

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
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ESIROI
ÉCOLE D'INGÉNIEURS
UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S3*

IDENTIFICATION

Course code :	E2CP3I3
ECTS :	1

DURATION

Lectures :	4
Tutorial classes :	6
Labs :	8
Total :	18

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : INFORMATIQUE

COURSE : Web Development

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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ESIROI
ÉCOLE D'INGÉNIEURS
UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S3*

IDENTIFICATION

Course code :	E2CP3I4
ECTS :	1.5

DURATION

Lectures :	6
Tutorial classes :	6
Labs :	12
Total :	24

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : INFORMATIQUE

COURSE : Operating Systems

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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ESIROI
ÉCOLE D'INGÉNIEURS
UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S3*

IDENTIFICATION

Course code : E2CP3I5
ECTS : 2

DURATION

Lectures :	8
Tutorial classes :	10
Labs :	12
Total :	30

Project :
Personnal work :

ASSESSMENT

2 MCQs (30 minutes each)

TEACHING MATERIALS

Course slides + tutorial booklets + practical work booklets available on Moodle

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : INFORMATIQUE

COURSE : Introduction to Networks

SCOPE OF THE COURSE

OBJECTIVES

At the end of this course, the student will be able to :

— understand the information transmission protocols within a local network and on the Internet ;
— install and configure the equipment required to build a minimal network (LANs interconnected by routers).

COMPETENCE AND SKILLS

— Analyse network traffic and associated protocols.
— Administer a network (switch / router).

PROGRAM

— To know the OSI and IETF models and encapsulation
— To know the Ethernet protocol (VLANs and STP are not part of the syllabus)
— To know IPv4 addresses : addresses, subnet mask, routing table, static routing
— To know the transport-layer protocols (TCP/UDP)
— To analyze network frames (Wireshark)
— To administer an active device (switch, router) and set up an initial network (interconnected LANs)

BIBLIOGRAPHY

Online Course : Cisco CCNA

REQUIREMENTS

Operating Systems

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP3MT1
ECTS : 4.5

DURATION

Lectures :	24
Tutorial classes :	40
Labs :	0
Total :	64

Project :
Personnal work :

ASSESSMENT

Written exam : 1h00 weight : 1/3 Written exam : 1h00 weight : 1/3 Written exam : 1h00 weight : 1/3

TEACHING MATERIALS

Handout

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : MATHEMATIQUES

COURSE : Mathematics for Engineering III-a

SCOPE OF THE COURSE

OBJECTIVES

Study differential equations and systems of differential equations used to model physical phenomena and engineering processes.

COMPETENCE AND SKILLS

Solve differential equations and systems of differential equations corresponding to the most common mathematical models in engineering.

PROGRAM

— First-order differential equations
— Bernoulli differential equations
— Matrix diagonalization
— Matrix exponential
— Systems of differential equations
— Applications

BIBLIOGRAPHY

REQUIREMENTS

— Matrix calculus
— Complex numbers
— Differential calculus
— Integral calculus

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40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
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IDENTIFICATION

Course code : E2CP3MT2
ECTS : 1.5

DURATION

Lectures :	6
Tutorial classes :	10
Labs :	0
Total :	16

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h)

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Vincent FONTAINE
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Modifié le : 14 juillet 2026

UE : MATHEMATIQUES

COURSE : Mathematics for Engineers III-b

SCOPE OF THE COURSE

OBJECTIVES

Master the Laplace transform and its applications in an engineering problem

COMPETENCE AND SKILLS

— Know how to use the Laplace transform to solve a system
— Know how to define the Laplace transform

PROGRAM

— **Laplace Transform**

  — Definition
  — Heaviside function
  — Causal function
  — Fundamental properties : linearity, damping, delay, scaling
  — Laplace transform of the derivative
  — Laplace transform of higher-order derivatives
  — Laplace transform of a primitive
  — Laplace transform of a convolution product
  — Inverse Laplace transform
  — Common Laplace transforms
  — Solving linear differential equations using the Laplace transform

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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DEPARTMENT : *CPI*
SEMESTER : *S3*

IDENTIFICATION

Course code :	E2CP3MT3
ECTS :	2

DURATION

Lectures :	6
Tutorial classes :	12
Labs :	6
Total :	24

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : MATHEMATIQUES

COURSE : Inferential Statistics II

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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ESIROI
ÉCOLE D'INGÉNIEURS
UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S3*

IDENTIFICATION

Course code :	E2CP3PC1
ECTS :	2.5

DURATION

Lectures :	12
Tutorial classes :	14
Labs :	8
Total :	34

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h) + 1 Lab report

TEACHING MATERIALS

Slides + tutorial booklets + lab work booklets available on Moodle

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : PHYSIQUE-CHIMIE

COURSE : Electricity II

SCOPE OF THE COURSE

OBJECTIVES

Study of linear electric circuits in quasi-stationary sinusoidal alternating regime.

COMPETENCE AND SKILLS

- To know the U–i relationship of an ideal inductor
- To know the U–i relationship of a capacitor
- To relate the input and output voltages of an RC circuit
- To relate the input and output voltages of an RL circuit
- To relate the input and output voltages of an RLC circuit
- To define a filter
- To state the assumptions of an ideal operational amplifier (ALI)
- To describe the limitations of an operational amplifier (ALI)
- To relate the input and output voltages of an operational amplifier (ALI) configuration
- To define a Bode diagram
- To plot the Bode diagram for first- and second-order filters
- To interpret a Bode diagram
- To describe the operating principle of a PID controller

PROGRAM

- **Composition of a measurement chain**
- **Study of circuits in free regime** : RC, RL and RLC and their applications
- **Study of the ideal integrated linear amplifier (ALI)** : principles and basic structures (amplifier, summing amplifier, differentiator, comparator, etc.)
- **Study of electrical transducers** : overview of transducers and their main characteristics
- **Study of a measurement chain** : constraints and characteristics of a measurement chain ; study of the consequences of ALI and transducer imperfections ; case studies
- **Additional electrical analysis** : sinusoidal signals, complex impedances, study of electrical circuits, electrical power and transfer function (application to filtering)

BIBLIOGRAPHY

- *Electrokinetics (PCSI, MPSI, PTSI)* — Éditions Nathan
- *Electronics, electrokinetics* — Éditions Hachette
- *General electricity* — Éditions Dunod
- *Analysis of electrical circuits* — Charles K. Alexander, Matthew Sadiku

REQUIREMENTS

- Differential equations
- Knowledge of derivatives and integrals

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- Trigonometric functions
- Exponential function
- Ability to graphically represent sinusoidal and exponential functions
- Ability to deduce the function corresponding to a graph
- Complex numbers (for the alternating current/voltage section)

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IDENTIFICATION

Course code :	E2CP3PC2
ECTS :	2.5

DURATION

Lectures :	10
Tutorial classes :	14
Labs :	8
Total :	32

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : PHYSIQUE-CHIMIE

COURSE : Electromagnetism I

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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DEPARTMENT : *CPI*
SEMESTER : *S3*

IDENTIFICATION

Course code :	E2CP3PC3
ECTS :	2

DURATION

Lectures :	14
Tutorial classes :	16
Labs :	0
Total :	30

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h)

TEACHING MATERIALS

moodle

LANGUAGE

English

CONTACT

Jean Jacques KADJO
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Modifié le : 14 juillet 2026

UE : PHYSIQUE-CHIMIE

COURSE : Thermodynamics II

SCOPE OF THE COURSE

OBJECTIVES

The aim of the course is to provide students with the conceptual and methodological foundations of **classical thermodynamics** necessary for understanding and analyzing energy transformations. The course aims to :

— Understand the fundamental principles of thermodynamics (first and second laws) and their implications.
— Establish **energy and entropy balances** for closed or open systems.
— Describe and quantify **state changes** and **perfect gas transformations**.
— Analyze the operation of **thermal machines** (engines, receivers, reversible and real cycles).
— Develop a rigorous scientific approach to model and optimize energy systems.

COMPETENCE AND SKILLS

— Identify the modes of energy exchange : **work (W)** and **heat (Q)**.
— Apply the **first law** and calculate **Q**, **W**, ΔU, ΔH.
— Perform energy balances according to transformations (isobaric, isochoric, isothermal, adiabatic).

— Use **heat capacities** and perform a **calorimetric balance**.
— Relate heat, temperature, and internal energy in common cases.

— Interpret transformations on a **Clausius-Clapeyron diagram**.
— Apply **Joule's**, **Laplace's**, and **Dulong-Petit's** laws.

— State the **second law** and define **entropy**.
— Establish **entropy balances** for simple systems.

— Understand the operation of **heat engines** and calculate their **efficiency**.
— Describe **heat pumps** and **refrigerators**.
— Identify **phase changes** and use **Clapeyron relations**.

PROGRAM

1. Second law of thermodynamics

— State the **second law** and define the concept of **entropy**.

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— Apply the principle to **isolated** or **steady-state systems**.
— Distinguish between **reversible and irreversible transformations**.
— Use the **fundamental identities** and derive **Laplace's laws** for isentropic cases.
— Perform simple **entropy balances** (Joule–Gay Lussac expansion, thermal contact).

2. Heat engines (motors)

— Define **heat engine**, **motor**, and **receiver**.
— Establish **energy and entropy balances**.
— Calculate **efficiency** and **effectiveness**.
— Identify **monothermal machines** (Kelvin statement) and **dithermal machines** (Raveau diagram).
— Explain the **Carnot cycle and efficiency** and compare it with real cycles (Beau de Rochas, Watt).
— Describe **heat pumps** and **refrigerators**.

3. Phase changes

— Identify the main **phase changes** (melting, vaporization, etc.).
— Use **phase diagrams** (P–T, P–V).
— Know the **triple point** and **critical point**.
— Apply **Clapeyron** and **Clausius–Clapeyron relations**.
— Relate phase changes to variations in **enthalpy** and **entropy**.

BIBLIOGRAPHY

— P. Perrot, *Thermodynamics for Engineers*, Dunod, 2018.
— M. Borel and J.-L. Battaglia, *Thermodynamics – Course and Corrected Exercises*, Dunod, 2021.
— H.B. Callen, *Thermodynamics and an Introduction to Thermostatistics*, Wiley, 1985.
— Online resources : FUN-MOOC Thermodynamics ; PhET Simulations ; NIST WebBook.

REQUIREMENTS

— **General Physics** : fundamental quantities (mass, volume, pressure, temperature, energy), SI units and reading diagrams (P–V, T–S).
— **Classical Mechanics** : work, mechanical energy and the fundamental principle of dynamics.
— **Applied Mathematics** : differentiation, integration, differential equations, logarithmic and exponential functions.
— **Chemistry and Condensed Matter** : physical states, phase changes and intermolecular bonds.
— **Scientific Culture** : orders of magnitude in energy, simple systems (ideal gas, solid, liquid) and the scientific approach.

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IDENTIFICATION

Course code : E2CP4A1
ECTS : 1

DURATION

Lectures :	0
Tutorial classes :	0
Labs :	0
Total :	0

Project :
Personnal work :

ASSESSMENT

Report + Oral presentation (20 min)

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : AGROALIMENTAIRE

COURSE : PROJECT S-IV

SCOPE OF THE COURSE

OBJECTIVES

Engineer's life simulator. Students must demonstrate that they can not only solve a technical problem but also manage its resolution within constrained conditions (time, resources, team).

COMPETENCE AND SKILLS

- **Project management skills** : planning, steering, and monitoring (specification, Gantt chart, risk management, deadline compliance).
- **Technical application** : mobilizing scientific and technical knowledge to design, model, or implement a solution (prototype, software, study).
- **Teamwork and collaboration** : collective organization, task distribution, interaction management, and group efficiency.
- **Autonomy and initiative** : documentary research, mastering new tools, ability to make decisions and proactively overcome obstacles.
- **Professional communication** : report writing and oral presentations, justification of technical choices and methodology in a structured and reasoned manner.

PROGRAM

1. **Introduction to project management**
   Planning methods, specifications, task breakdown, Gantt chart.
2. **Solution design and development**
   Mobilizing scientific and technical knowledge; modeling, prototyping, or study.
3. **Organization and teamwork**
   Responsibility allocation, coordination, progress reviews, risk management.
4. **Autonomy and self-training**
   Documentary research, mastering new tools or methods, problem-solving.
5. **Communication and project valorization**
   Report writing, logbook maintenance, oral defense, justification of technical choices.

BIBLIOGRAPHY

REQUIREMENTS

- Basic scientific and technical knowledge in the field of specialization.
- Elementary notions of planning (work organization, deadlines).
- Proficiency in office tools (spreadsheet, word processor, presentation software).
- Ability to communicate orally and in writing clearly and in a structured manner.
- Capacity to work in a team and engage in a collaborative approach.

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DEPARTMENT : *CPI*
SEMESTER : *S4*

IDENTIFICATION

Course code : E2CP4A10
ECTS : 1.5

DURATION

Lectures :	12
Tutorial classes :	8
Labs :	0
Total :	20

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h)

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : AGROALIMENTAIRE

COURSE : Enzymology

SCOPE OF THE COURSE

OBJECTIVES

— To understand the mechanisms of enzymatic catalysis and the control of enzymatic kinetics.
— To be able to use enzymatic reactions to interpret cellular observations in relation to biochemical and physical compartmentalization.
— To be able to apply knowledge in enzymology to understand food degradation, certain biotechnology applications, and metabolic assays.

COMPETENCE AND SKILLS

— Master the vocabulary of enzymology (enzyme, substrate, product, enzymatic reaction, cofactor, coenzyme, activator, inhibitor, allostery).
— Know the classification of enzymes.
— Understand the principles of enzymatic catalysis : equilibrium, free energy and activation energy, active site and reaction mechanism, specificity of the enzymatic reaction.
— Be able to monitor an enzymatic reaction.
— Enzyme kinetics : single-substrate reaction, Michaelis–Menten equation, kinetic parameters and linearization methods.
— Influence of enzyme or substrate concentration.
— Enzyme activity, specific activity, purification rate and yield of an enzyme.
— Influence of pH and temperature on enzyme activity.
— Understand the inhibition of enzymatic reactions : competitive, non-competitive, uncompetitive.
— Cooperativity and allostery.

PROGRAM

1. Introduction to general enzymology.
2. Classification of enzymes.
3. Kinetics of single-substrate enzymatic reactions.
4. Influence of environmental conditions.
5. Inhibition.
6. Cooperativity and allostery.

BIBLIOGRAPHY

REQUIREMENTS

Molecules of living organisms and bioenergetics

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IDENTIFICATION

Course code : E2CP4A2
ECTS : 2.5

DURATION

Lectures :	10
Tutorial classes :	8
Labs :	8
Total :	26

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h) + 1 Lab report

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : AGROALIMENTAIRE

COURSE : Food Microbiology

SCOPE OF THE COURSE

OBJECTIVES

Understand pathogenic and spoilage microflora : identify microorganisms, their growth conditions, and associated risks (food spoilage, consumer health effects)

COMPETENCE AND SKILLS

— Know the main infectious and toxin-producing pathogens, lactic and acetic bacteria, spore-forming bacteria, as well as yeasts and molds.
— Understand the main foodborne illnesses.
— Know the food contamination processes, from raw material reception to preservation.
— Know cleaning and disinfection protocols.

PROGRAM

1. **Microorganisms of food interest**
   Classification, characteristics, roles, and risks : pathogens, toxin producers, lactic and acetic bacteria, spore-formers, yeasts, and molds.
2. **Foodborne illnesses**
   Main foodborne illness outbreaks, modes of action, growth conditions, prevention.
3. **Food contamination**
   Sources and routes of contamination during production stages : reception, processing, storage, and preservation.
4. **Cleaning and disinfection**
   Protocols, agent selection, key steps, effectiveness control.

BIBLIOGRAPHY

REQUIREMENTS

General knowledge of microorganism classification

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IDENTIFICATION

Course code :	E2CP4A3
ECTS :	2.5

DURATION

Lectures :	8
Tutorial classes :	12
Labs :	16
Total :	36

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h) + 1 Lab report

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : AGROALIMENTAIRE

COURSE : Food and Biological Engineering

SCOPE OF THE COURSE

OBJECTIVES

— The aim of this course is to introduce students to the fundamental principles of process engineering applied to the transformation of biological resources. It seeks to help students understand how to transform a raw material into a safe and stable finished product, while controlling energy and mass transfers, as well as the impact of these operations on the nutritional and sanitary quality of the food.

COMPETENCE AND SKILLS

— Identify and justify the choice of a unit operation in an agri-food production line.
— Quantify the impact of a heat treatment on the microbial population (calculation of pasteurization or sterilization value) and on nutritional, sensory, etc. characteristics.
— Establish a complete manufacturing diagram including material flows and, if possible, critical control points (CCPs).
— Study size reduction, mixing, and agitation operations.
— Experimentally analyze a growth (fermentation) and mortality (pasteurization) kinetic.

PROGRAM

1. Design of agri-food processes and hygiene : methodology for manufacturing diagrams : steps, flows, critical points, and integration of cleaning/disinfectio protocols.
2. Study of food transformations : evolution of nutritional, sensory, and microbial properties according to processes.
3. Low-temperature and ambient processes (Cold : Refrigeration vs Freezing (crystallization, kinetics). - Mechanical : Grinding, sieving, mixing, and homogenization (energy consumption, efficiency)).
4. Thermal processes and biological impact : - Blanching, pasteurization : heat transfers. - Destruction kinetics : Notions of D, z, and pasteurization/sterilization value (PV, SV). - Consequences on food safety, nutritional properties, enzymes, and shelf life (DLC/DDM).
5. Practical Work : Lab 1 : Batch Fermentation Kinetics : Monitoring microbial growth (biomass, substrate) and calculating the growth rate. - Lab 2 : Pasteurization and Microbial Decay : Heat treatment of an inoculated sample, enumeration, and calculation of decimal reduction.

BIBLIOGRAPHY

— Mafart, P., & Béliard, E. (2011). *Génie industriel alimentaire - Tome 1 : Les bases du génie des procédés*. Lavoisier.
— Jeantet, R., et al. (2021). *Génie des procédés appliqué à l'industrie agroalimentaire*. Lavoisier.

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— Brennan, J. G., & Grandison, A. S. (2012). *Food Processing Handbook*. Wiley-VCH.
— *Collection de Techniques de l'Ingénieur*.

REQUIREMENTS

— Biology/Microbiology : Structure of microorganisms and basics of bacterial growth.
— Physics/Chemistry : Concepts of temperature, heat, pressure, and simple mass balances.
— Mathematics : Use of logarithmic and exponential functions, reading graphs.

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IDENTIFICATION

Course code : E2CP4A4
ECTS : 1

DURATION

Lectures :	0
Tutorial classes :	4
Labs :	4
Total :	8

Project :
Personnal work :

ASSESSMENT

1 report

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : AGROALIMENTAIRE

COURSE : Food challenges

SCOPE OF THE COURSE

OBJECTIVES

— Contextualizing food within a supply chain and food system.
— Defining challenges related to food transition, sustainability, and food insecurity.
— Linking food and health.

COMPETENCE AND SKILLS

— Understanding the goals of sustainable food.

PROGRAM

— Concepts of food safety, changes in consumer behavior, and new food trends.

BIBLIOGRAPHY

REQUIREMENTS

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IDENTIFICATION

Course code : E2CP4A5
ECTS : 3.5

DURATION

Lectures :	0
Tutorial classes :	16
Labs :	28
Total :	44

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h) + 2 oral presentations

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : AGROALIMENTAIRE

COURSE : Application Project

SCOPE OF THE COURSE

OBJECTIVES

— Preparation of the project integrating microbiology, molecular biology, biochemistry and enzymology.
— Experimental implementation and data collection.
— Interpretation of results and formulation of perspectives.

COMPETENCE AND SKILLS

— Conduct a situation analysis : gather, exploit, analyze and process information, then prioritize it.
— Structure reasoning by mobilizing relevant knowledge and mastering causal relationships ; build an argumentation.
— Explore perspectives, provide a critical outlook and develop independent thinking.

PROGRAM

— The PadC protein from *Bacillus subtilis* :
  — Bacterial cloning.
  — Bacterial transformation.
  — Recombinant expression.
  — Extraction.
  — Enzyme purification.
  — Enzyme characterization.

BIBLIOGRAPHY

REQUIREMENTS

— Basic knowledge in microbiology (culture, types of microorganisms).
— Fundamental concepts in molecular biology (DNA, genes, expression).
— Basics in protein biochemistry (structure, enzymatic activity).
— Ability to work under sterile conditions and comply with laboratory safety rules.

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DEPARTMENT : *CPI*
SEMESTER : *S4*

IDENTIFICATION

Course code : E2CP4A6
ECTS : 1.5

DURATION

Lectures :	6
Tutorial classes :	0
Labs :	6
Total :	12

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h)

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : AGROALIMENTAIRE

COURSE : BPH / PRP

SCOPE OF THE COURSE

OBJECTIVES

— Identify regulatory and normative requirements related to BPH / PRP.
— Use Good Hygiene Practice Guides and sector-specific standards.
— Develop a practical evaluation grid for BPH / PRP.
— Assess BPH / PRP compliance on-site (visit to an agri-food company).
— Professionally report the results of a compliance assessment.

COMPETENCE AND SKILLS

— Identify regulatory and normative requirements related to BPH / PRP.
— Use Good Hygiene Practice Guides and sector-specific standards.
— Develop a practical evaluation grid for BPH / PRP.
— Assess BPH / PRP compliance on-site.
— Professionally report the result of a compliance assessment.

PROGRAM

1. Introduction and stakes : role of hygiene in the agri-food industry, reminders on foodborne illness outbreaks, definitions and vocabulary.
2. Regulatory framework and standards : Hygiene Package, HACCP, GBPH, Codex, ISO 22000 and ISO/TS 22002-X.
3. Types of hazards : physical, chemical, microbiological and allergens.
4. Focus on microbiological hazards.
5. Good Hygiene Practices in the agri-food industry.
6. Evaluation of Good Hygiene Practices in the agri-food industry : preparation, on-site audit, reporting.

BIBLIOGRAPHY

— O. Boutou, *From HACCP to ISO 22000*, 2023.
— D. Blanc, *ISO 22000, HACCP and food safety*, 2010.
— DGAL notes, CERVIA guides, ANSES hazard sheets.
— Codex Alimentarius.
— European regulations (Hygiene Package).
— Standards : ISO 22000 (v2018), ISO/TS 22002-X, NF V01-006 (HACCP, v2022).
— Sector-specific Good Hygiene Practice Guides (GBPH).

REQUIREMENTS

Basics of microbiology, physico-chemistry and food engineering

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IDENTIFICATION

Course code : E2CP4A7
ECTS : 2

DURATION

Lectures :	10
Tutorial classes :	10
Labs :	0
Total :	20

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : AGROALIMENTAIRE

COURSE : Metabolism and Bioenergetics

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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DEPARTMENT : *CPI*
SEMESTER : *S4*

IDENTIFICATION

Course code :	E2CP4A8
ECTS :	1.5

DURATION

Lectures :	8
Tutorial classes :	8
Labs :	0
Total :	16

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : AGROALIMENTAIRE

COURSE : Genetics

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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IDENTIFICATION

Course code :	E2CP4A9
ECTS :	2

DURATION

Lectures :	10
Tutorial classes :	4
Labs :	16
Total :	30

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h) + 1 Lab report

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : AGROALIMENTAIRE

COURSE : Physicochemical Analyses

SCOPE OF THE COURSE

OBJECTIVES

Students must be able to select and implement experimental techniques for analyzing liquid or solid samples. This module should be taught through problem-based learning (PBL) scenarios.

COMPETENCE AND SKILLS

- Be able to perform solvent extraction.
- Be able to perform fractional distillation.
- Be able to perform recrystallization.
- Be able to use a rotary evaporator (Rotavap) and describe its operation.
- Be able to use a Kofler bench.
- Be able to measure an optical index.
- Be able to analyze an NMR spectrum.

PROGRAM

1. **Extraction Techniques**
   - Separating funnel.
   - Continuous extraction using a Soxhlet apparatus.
2. **Purification Techniques**
   - Fractional distillation.
   - Recrystallization.
   - Rotary evaporator.
3. **Identification Techniques**
   - Melting point.
   - Optical index.
   - Optical rotation.
   - TLC (Thin Layer Chromatography).
   - Spectroscopy : analysis of provided IR and NMR spectra.
4. **Titration Methods**
   - Calibration-based titration.
   - Direct or indirect titration.

BIBLIOGRAPHY

REQUIREMENTS

Chemical equilibria (TC)Organic Chemistry II

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DEPARTMENT : *CPI*
SEMESTER : *S4*

IDENTIFICATION

Course code : E2CP4B1
ECTS : 2.5

DURATION

Lectures :	8
Tutorial classes :	12
Labs :	8
Total :	28

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : BATIMENT-ENERGIE

COURSE : Bioclimatic Design and Comfort 24

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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DEPARTMENT : *CPI*
SEMESTER : *S4*

IDENTIFICATION

Course code : E2CP4B2
ECTS : 1

DURATION

Lectures :	0
Tutorial classes :	0
Labs :	0
Total :	0

Project :
Personnal work :

ASSESSMENT

Report + Oral presentation (20 min)

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : BATIMENT-ENERGIE

COURSE : PROJECT S-IV

SCOPE OF THE COURSE

OBJECTIVES

Engineer's life simulator. Students must demonstrate that they can not only solve a technical problem but also manage its resolution within constrained conditions (time, resources, team).

COMPETENCE AND SKILLS

- **Project management mastery** : ability to plan, lead, and monitor a project (defining a specifications document, managing a Gantt chart, identifying risks, and meeting deadlines).
- **Technical application** : applying scientific and technical knowledge acquired in courses to design, model, or implement a concrete solution (prototype, software, technical study).
- **Teamwork and collaboration** : demonstrating the ability to organize collectively, allocate tasks, manage group interactions, and work effectively in a team.
- **Autonomy and initiative** : ability to research information, learn new tools, and make proactive decisions to overcome obstacles.
- **Professional communication** : documenting the project (reports) and presenting work (oral defenses), justifying technical choices and the approach clearly and convincingly.

PROGRAM

1. Introduction to project management : specifications document, planning, Gantt chart, and risk management.
2. Technical design and development : applying scientific knowledge and creating a prototype, model, or study.
3. Teamwork organization : task allocation, coordination, progress checkpoints, and managing interactions.
4. Autonomy and problem-solving : information research, tool mastery, technical choices, and reasoned decision-making.
5. Writing and presentation : producing the report, preparing the oral defense, justifying choices, and showcasing the project.

BIBLIOGRAPHY

REQUIREMENTS

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IDENTIFICATION

Course code : E2CP4B3
ECTS : 2.5

DURATION

Lectures :	8
Tutorial classes :	10
Labs :	12
Total :	30

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h) + 1 Lab report

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : BATIMENT-ENERGIE

COURSE : Numerical Analysis and Scientific Computing

SCOPE OF THE COURSE

OBJECTIVES

1. Solving an algebraic equation : bisection method ; Newton's method ; comparison of the two methods.
2. Approximate solution of an ordinary differential equation : Euler's method ; Runge–Kutta method ; comparison of results with an analytical solution (accuracy and computation time).
3. Multidimensional linear discrete problem leading to the solution of an invertible (or Cramer) linear system using Gaussian elimination with partial pivoting.

COMPETENCE AND SKILLS

— Study the effect of parameter variations on computation time, result accuracy, and solution shapes.
— Use standard computational libraries to solve a scientific problem expressed as equations.
— Use standard libraries to display results graphically.
— Consider practical aspects : impact of rounding errors, computation time, and memory storage.

PROGRAM

1. Sensitivity analysis : studying the influence of parameters on computation time, accuracy, and solution shapes.
2. Implementation of computational libraries for the numerical solution of modeled scientific problems.
3. Use of display libraries for graphical representation of results.
4. Consideration of numerical constraints : rounding errors, computational cost, and memory management.

BIBLIOGRAPHY

REQUIREMENTS

Thermodynamics, Balances and TransfersHeat TransferAlgorithms and Programming

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP4B4
ECTS : 2.5

DURATION

Lectures :	10
Tutorial classes :	10
Labs :	12
Total :	32

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h) + 1 Lab report

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Philippe LAURET
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Modifié le : 14 juillet 2026

UE : BATIMENT-ENERGIE

COURSE : Control and Command

SCOPE OF THE COURSE

OBJECTIVES

To enable students : - to acquire concepts of control and command of physical systems. - to distinguish between open-loop and closed-loop control. - to calculate the parameters of a PID controller based on user specifications. - to analyze the performance of the regulated system (Stability, accuracy, and speed).

COMPETENCE AND SKILLS

— To know the vocabulary associated with control and command.
— To be able to control a microcontroller.
— To be able to regulate and servo-control a process (temperature control, solar tracker, heating control, etc.) using a P / PI / PID controller.

PROGRAM

1. Open-loop and closed-loop control.
2. Study of 1st and 2nd order systems.
3. Closed-loop transfer function.
4. Performance analysis of the servo-controlled system.
5. PID correction of systems and disturbance rejection.

BIBLIOGRAPHY

REQUIREMENTS

Mathematics and computer science, programming, algorithms, general physics/chemistry, electrical engineering

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP4B5
ECTS : 2.5

DURATION

Lectures :	6
Tutorial classes :	10
Labs :	12
Total :	28

Project :
Personnal work :

ASSESSMENT

2 written exams (2h/2h) + 1 lab report

TEACHING MATERIALS

Course slides + tutorial booklets + lab work booklets available on Moodle

LANGUAGE

English

CONTACT

Alexandre DOUYERE
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Modifié le : 14 juillet 2026

UE : BATIMENT-ENERGIE

COURSE : Electrical Engineering

SCOPE OF THE COURSE

OBJECTIVES

The objective of this course is to learn how to size, model, and analyze magnetic circuits (applied to coils, electromagnets, and transformers) as well as electro-mechanical conversions (DC machines and AC machines).

COMPETENCE AND SKILLS

- To have general knowledge of electromechanical converters (rotating machines).
- To know the basic properties of the three types of motors : direct-current motor, alternating-current motor, and stepper motor.
- To be able to identify which electrical quantity (voltage U, current I, or frequency f) affects which mechanical quantity (torque T or rotational speed Ω).
- To understand the concepts of active and reactive power.

PROGRAM

1. **Static power conversion**
   - Active and reactive power.
   - Transformers.
2. **Electromechanical power conversion : rotating machines**
   - Principles and overall structure of rotating electrical machines.
   - Direct-current machines : structure and operation.
   - Alternating-current machines :
     - Synchronous machines.
     - Asynchronous machines.
   - Machine description concepts : electrical part, mechanical part, efficiency, torque, etc.

BIBLIOGRAPHY

REQUIREMENTS

Mathematics, general physics, electricity.

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40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP4B6
ECTS : 2.5

DURATION

Lectures :	8
Tutorial classes :	8
Labs :	8
Total :	24

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : BATIMENT-ENERGIE

COURSE : Introduction to Strength of Materials (RDM)

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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IDENTIFICATION

Course code : E2CP4B7
ECTS : 2.5

DURATION

Lectures :	10
Tutorial classes :	12
Labs :	8
Total :	30

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h) + 1 Lab report

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Didier CALOGINE
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Modifié le : 14 juillet 2026

UE : BATIMENT-ENERGIE

COURSE : Advanced Heat Transfer I

SCOPE OF THE COURSE

OBJECTIVES

1. Heat transfer equation in an immobile and isotropic solid.
2. Thermal resistances and conductances.
3. **Convection**
   - Newton's law.
   - Principle of convection.
   - Characteristic numbers.
4. **Thermal radiation**
   - Radiation quantities ; Planck's, Wien's, Stefan–Boltzmann, and Kirchhoff's laws.
   - Exchanges between black bodies and between grey bodies.
5. **Laboratory work**
   - Measurement of heat transfer coefficients.
   - Simulation of thermodynamic systems.

COMPETENCE AND SKILLS

- Propose a simplified model for a thermal system in steady state.
- Solve a 1D steady-state heat transfer problem under classical boundary conditions (convection, imposed temperature, imposed flux).
- Evaluate a convective heat transfer coefficient using standard experimental correlations.

PROGRAM

- Review and framework : steady-state 1D conduction, heat equation in steady state, boundary conditions (Dirichlet, Neumann, Robin).
- Thermal resistance method : plane, cylindrical, and spherical walls ; multilayer systems ; simple volumetric generation ; thermal contact.
- Solving typical 1D cases : imposed temperature or flux, convection at the boundary (Robin condition), superposition and balance verification.
- Convection : Newton's law, dimensional analysis and dimensionless numbers (Re, Pr, Nu) ; flow regimes (laminar/turbulent) ; introduction to standard correlations (internal/external flows).
- Evaluation of the coefficient h : step-by-step procedure (regime selection, properties, characteristic length, correlation, calculation of Nu then h) ; uncertainty estimation.
- Integrated application : calculation of a wall with convection on both sides (simplified model, resistance network, 1D resolution, order-of-magnitude check).
- Guided exercises and mini-project (spreadsheet/script) : solving and validating real-world cases, concise presentation of results.

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BIBLIOGRAPHY

REQUIREMENTS

— Balances and transfers.
— Partial derivatives and differential equations.

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Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP4B8
ECTS : 3

DURATION

Lectures :	16
Tutorial classes :	16
Labs :	8
Total :	40

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h) + 1 Lab report

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Kamal EL OMARI
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Modifié le : 14 juillet 2026

UE : BATIMENT-ENERGIE

COURSE : Solid Mechanics

SCOPE OF THE COURSE

OBJECTIVES

This course enables students to study the motion of a rigid body.

1. **Kinematics of rigid bodies** : rigid body in mechanics, velocity and acceleration fields, Varignon's theorem, change of reference frame (inertial and accelerated frames).
2. **Elements of kinetics** : mass of a material system, center of inertia of a rigid body, moments of inertia, kinetic energy.
3. **Dynamic study of material systems** : modeling of mechanical actions, laws of dynamics in a Galilean reference frame.
4. **Energy study of material systems**.

COMPETENCE AND SKILLS

— Know and apply Newton's laws to rigid bodies in motion.
— Understand basic concepts : position, velocity, acceleration, force, moment, and kinetic energy.
— Analyze the motion of points and rigid bodies in translation and rotation, and apply motion equations.
— Master motion descriptions (trajectories, velocities, accelerations) in fixed and moving frames.
— Understand and use concepts of moment of inertia and torque.
— Calculate the work done by forces and torques on rigid bodies.
— Apply energy and momentum conservation principles (impulse and angular momentum).
— Apply solid dynamics principles to real-world engineering problems (vehicle mechanics, rotating machines, moving structures, etc.).

PROGRAM

1. Kinematics of points and rigid bodies : trajectories, velocities, accelerations, fixed and moving frames.
2. Newton's laws applied to rigid bodies : forces, moments, motion equations.
3. Kinetics of rigid bodies : mass, center of inertia, moment of inertia, kinetic energy.
4. Work of forces and torques, mechanical power, energy balances.
5. Conservation of energy, linear momentum, and angular momentum.
6. Applications to engineering systems : machine motions, mechanisms, rotating structures.

BIBLIOGRAPHY

REQUIREMENTS

Point Mechanics

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP4HM1
ECTS : 1.5

DURATION

Lectures :	0
Tutorial classes :	15
Labs :	0
Total :	15

Project :
Personnal work :

ASSESSMENT

Oral (1.5h)

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : HUMANITES

COURSE : Sport IV

SCOPE OF THE COURSE

OBJECTIVES

BADMINTON

— Acquire knowledge related to the practice of physical and sports activities (engineering and culture of physical activities).
— Develop and refine physical and energy capacities.
— Gain a better self-awareness.
— Commit to a process of progress.
— Know how to surpass oneself and achieve personal growth.
— Develop a better understanding of others and oneself within a group.

COMPETENCE AND SKILLS

— Commit to gaining the point by making relevant technical and tactical choices based on an analysis of the balance of power.
— Identify and/or create open spaces to produce a targeted attack ; generate fast and/or downward trajectories to speed up play.
— Defend by seeking to neutralise an unfavourable balance of power in order to regain the upper hand.
— Prepare and know how to train individually to conduct and master a confrontation, in order to tip the balance of power in one's favour.
— Get into the right mindset, alone, to engage in a confrontation and know how to recover afterwards.
— Identify, using indicators and independently, the state of the balance of power and one's own level of practice in attack and defence.
— Choose and implement, alone, one or more individual technical-tactical projects to create the conditions for winning the point and protecting the target.

PROGRAM

Badminton

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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IDENTIFICATION

Course code : E2CP4HM2
ECTS : 4

DURATION

Lectures :	0
Tutorial classes :	30
Labs :	0
Total :	30

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h)

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : HUMANITES

COURSE : English IV

SCOPE OF THE COURSE

OBJECTIVES

Consolidation of pragmatic, socio-linguistic and linguistic skills (vocabulary, syntax, grammar, phonology) necessary for understanding authentic documents and for oral and written interaction in authentic communication situations, particularly professional, scientific and technical ones. General English (press and media) + business English (TOEIC)

COMPETENCE AND SKILLS

- B2 level in listening comprehension (LC) and reading comprehension (RC) *(TOEIC)*
- B2 level in written production (WP) and oral interaction (OI) *(CLES)*
- Media and business English
- Completion of tasks involving strategies, sometimes within a project/mission approach (CLES type) **[Level 4]**
- Technical and scientific English

PROGRAM

- **LC/RC (TOEIC B2)** : targeted training using authentic audio/text extracts; identification of explicit and implicit information; regular mini-tests.
- **WP/OI (CLES B2)** : drafting professional emails and memos; brief meeting simulations (explanation, justification, negotiation).
- **Media and business English** : analysis of articles/press releases; short summaries; structured presentation of a news item.
- **Integrated task (CLES type)** : completion of a short mission (analysis, information selection, written summary + structured oral presentation).
- **Technical and scientific English** : understanding of technical notices/texts; simplified summary of 150–200 words for a non-specialist.

BIBLIOGRAPHY

REQUIREMENTS

- Basic grammatical and lexical skills at B1+ level (main tenses, modals, logical connectors).
- Ability to understand the general idea of a simple text or oral message.
- Skills in quick note-taking and selection of relevant information.
- Ability to write a structured paragraph (main idea + examples).
- Ability to participate in a short oral exchange (questions, reformulations, clarification).

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ESIROI
ÉCOLE D'INGÉNIEURS
UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S4*

IDENTIFICATION

Course code : E2CP4I1
ECTS : 1

DURATION

Lectures :	0
Tutorial classes :	0
Labs :	0
Total :	0

Project :
Personnal work :

ASSESSMENT

Report + Oral presentation (20 min)

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Alexandre DOUYERE
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Modifié le : 14 juillet 2026

UE : INFORMATIQUE

COURSE : PROJECT S-IV

SCOPE OF THE COURSE

OBJECTIVES

Engineer's life simulator. Students must demonstrate that they can not only solve a technical problem but also manage its resolution within constrained conditions (time, resources, team).

COMPETENCE AND SKILLS

- **Project management skills** : ability to plan, lead, and monitor a project (defining specifications, managing a Gantt chart, identifying risks, and meeting deadlines).
- **Technical application** : applying scientific and technical knowledge acquired in courses to design, model, or implement a concrete solution (prototype, software, technical study).
- **Teamwork and collaboration** : demonstrating the ability to organize collectively, distribute tasks, manage group interactions, and work effectively in a team.
- **Autonomy and initiative** : ability to research information, learn new tools, and make decisions to overcome obstacles without passively waiting for solutions.
- **Professional communication** : documenting the project (reports) and presenting the work (oral defenses), clearly and convincingly justifying technical choices and the approach.

PROGRAM

1. Introduction to project management : specifications, planning, Gantt chart, risk identification.
2. Design and implementation : applying scientific and technical knowledge to develop a solution (prototype, model, study).
3. Team organization : task distribution, coordination, managing interactions, and progress tracking.
4. Autonomy and problem-solving : information research, tool mastery, decision-making, and adapting to obstacles.
5. Documentation and presentation : writing a structured report and delivering an oral defense with justified technical choices.

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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ESIROI
ÉCOLE D'INGÉNIEURS
UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S4*

IDENTIFICATION

Course code :	E2CP4I2
ECTS :	2

DURATION

Lectures :	10
Tutorial classes :	12
Labs :	12
Total :	34

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h) + 1 Lab report

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Denis PAYET
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Modifié le : 14 juillet 2026

UE : INFORMATIQUE

COURSE : Software Development

SCOPE OF THE COURSE

OBJECTIVES

This course aims to provide students with essential methodological and practical foundations for designing, implementing, and maintaining high-quality software applications. By the end of this course, students will be able to integrate into a standard software development process, use collaborative tools, and produce more organized, tested, and maintainable code, thus laying the groundwork for their future careers as computer engineers.

COMPETENCE AND SKILLS

- **Analyze** a requirement and **draft** a functional specification document.
- **Design** the software architecture and **model** the main components of the application.
- **Develop** and **version** the source code using a version control system such as `Git`.
- **Test**, **debug**, and **validate** the software through continuous integration tools (`CI/CD`).
- **Deploy** the application in a production environment and **document** the deployment process.

PROGRAM

- Introduction to the software lifecycle : from requirement analysis to production deployment.
- Requirement analysis and drafting of a functional specification document.
- Applying software design principles (e.g., modularity, reusability, separation of concerns) and basic architecture.
- Mastering modern developer tools and environments (version control systems like Git, integrated development environments - IDEs).
- Developing initial software features (implementation, unit testing).
- Raising awareness of user experience to design relevant UIs that align perfectly with the intended functionalities.
- Error handling, input validation, and coding best practices.
- Synthesis project : full development, production deployment, and final documentation.

BIBLIOGRAPHY

REQUIREMENTS

Programming in C and C++

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
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UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S4*

IDENTIFICATION

Course code :	E2CP4I3
ECTS :	2.5

DURATION

Lectures :	8
Tutorial classes :	8
Labs :	8
Total :	24

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h) + 1 Lab report

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : INFORMATIQUE

COURSE : Introduction to Data Analysis

SCOPE OF THE COURSE

OBJECTIVES

— Process and analyze data.
— Store and use data.
— Learn SQL language and relational databases.

COMPETENCE AND SKILLS

— **Analyze** and **process** data from structured or unstructured sources.
— **Model** data by identifying entities, attributes, and relationships.
— **Use** the `SQL` language to create, query, and manipulate relational databases.
— **Store** and **exploit** data efficiently using a database management system (DBMS).
— **Verify** the consistency, integrity, and quality of the manipulated data.

PROGRAM

— Introduction to databases : concepts, roles, and types of DBMS.
— Data modeling : entities, attributes, relationships, and entity-relationship diagrams.
— Transition from the conceptual model to the relational model : primary and foreign keys.
— Creating a database and tables using the `SQL` language.
— Inserting, modifying, and deleting data (`INSERT`, `UPDATE`, `DELETE`).
— Simple selection queries with `SELECT`, `WHERE`, `ORDER BY`.
— Advanced queries : joins, subqueries, and aggregate functions.
— Integrity constraints, indexes, and user management.
— Introduction to normalization and query optimization.
— Synthesis project : design and operation of a complete database.

BIBLIOGRAPHY

REQUIREMENTS

— Algorithmic and Programming
— Programming in C and C++

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UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S4*

IDENTIFICATION

Course code :	E2CP4I4
ECTS :	2.5

DURATION

Lectures :	8
Tutorial classes :	8
Labs :	12
Total :	28

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : INFORMATIQUE

COURSE : Cryptography and Cybersecurity

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S4*

IDENTIFICATION

Course code :	E2CP4I5
ECTS :	2.5

DURATION

Lectures :	8
Tutorial classes :	8
Labs :	8
Total :	24

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : INFORMATIQUE

COURSE : Introduction to Embedded Systems

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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DEPARTMENT : *CPI*
SEMESTER : *S4*

IDENTIFICATION

Course code :	E2CP4I6
ECTS :	3

DURATION

Lectures :	20
Tutorial classes :	20
Labs :	0
Total :	40

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : INFORMATIQUE

COURSE : Set Theory and Algebra

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

ESIROI - Campus de Terre Sainte
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Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

IDENTIFICATION

Course code : E2CP4I7
ECTS : 2.5

DURATION

Lectures :	10
Tutorial classes :	10
Labs :	4
Total :	24

Project :
Personnal work :

ASSESSMENT

TEACHING MATERIALS

LANGUAGE

English

CONTACT

Modifié le : 14 juillet 2026

UE : INFORMATIQUE

COURSE : Computer Architecture

SCOPE OF THE COURSE

OBJECTIVES

COMPETENCE AND SKILLS

PROGRAM

BIBLIOGRAPHY

REQUIREMENTS

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DEPARTMENT : *CPI*
SEMESTER : *S4*

IDENTIFICATION

Course code :	E2CP4I8
ECTS :	3

DURATION

Lectures :	14
Tutorial classes :	24
Labs :	0
Total :	38

Project :
Personnal work :

ASSESSMENT

2 Written exams (1h/1h)

TEACHING MATERIALS

Course slides + TD handouts + TP handouts available on Moodle

LANGUAGE

English

CONTACT

Joel GROUFFAUD
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Modifié le : 14 juillet 2026

UE : INFORMATIQUE

COURSE : Mathematics for Computer Science

SCOPE OF THE COURSE

OBJECTIVES

Provide engineering students with the essential mathematical foundations required to solve common problems across all optimization domains in computer science.

COMPETENCE AND SKILLS

- Ability to model a real-world problem (logistics, networks, machine learning, etc.) as an optimization problem (choice of variables, objective function, constraints) and express this model in appropriate mathematical language.
- Master discrete/combinatorial optimization issues : modeling via linear programming, integer programming, graphs, flows.
- Analyze the algorithmic complexity of optimization problems and distinguish easy vs. hard cases (e.g., NP-complete, pseudo-polynomial).

PROGRAM

- Mathematical modeling of optimization problems.
- Graph Theory.
- Landau notation and complexity theory.
- Linear optimization (linear programming, ILP, gradient descent).
- Dynamic programming.

BIBLIOGRAPHY

An Introduction to Linear Programming and Game Theory, Third Edition (2008) - Paul R. Thie, G. E. Keough - Wiley

REQUIREMENTS

Set theory and algebra

ESIROI - Campus de Terre Sainte
40 Avenue de Soweto, 97455 Saint-Pierre, Cedex
Tel.: +262 262 81 83 01 / 02 ; www.esiroi-reunion.fr

ESIROI
ÉCOLE D'INGÉNIEURS
UNIVERSITÉ DE LA RÉUNION

DEPARTMENT : *CPI*
SEMESTER : *S4*

IDENTIFICATION

Course code : E2CP4PC1
ECTS : 4

DURATION

Lectures :	12
Tutorial classes :	12
Labs :	12
Total :	36

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h) + 1 Lab report

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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Modifié le : 14 juillet 2026

UE : PHYSIQUE-CHIMIE

COURSE : Bilans and Transfers

SCOPE OF THE COURSE

OBJECTIVES

Study of open systems and balance physics

COMPETENCE AND SKILLS

- To be able to define the phenomenon of particle diffusion and convection.
- To be able to define the particle current density vector and the particle flux.
- To know Fick's law (with units) and its limitations.
- To know the method for performing balances for 1D diffusion.
- To know the local formulation of 3D diffusion as well as its integral formulation.
- To be able to demonstrate that diffusion is an irreversible phenomenon.
- To be able to solve the diffusion equation in steady-state 1D (Cartesian coordinates).
- To know the consequences of steady-state : conservation of flux.
- To know that, for time-dependent regimes, the form of the solution depends on the boundary conditions.
- To be able to derive characteristic quantities of diffusion from the equation.
- To be able to define the ARQS (quasi-static approximation).
- To know the general principle of osmosis.
- To know the three main modes of transfer : convection, conduction, and radiation, and their characteristics.
- To be able to define the heat flux and the thermal current density vector.
- To know Fourier's law (with units) and the meaning of its terms.
- To be able to derive the conservation equation and the 1D heat diffusion equation.
- To be able to generalize the equation to 3D ; to know the concept of thermal diffusivity and its unit.
- To recognize the link between particle diffusion and heat conduction.
- To be able to demonstrate the irreversibility of the phenomenon.
- To be able to derive the temperature profile and the entropy balance in the case of a 1D bar.
- To know the first law of thermodynamics (differential or power form).
- To be able to simplify it in steady-state ; to express it in mass-specific form.
- To be able to solve simple examples : Bernoulli's theorem, mixer with heating, heat exchangers, condenser, evaporator, turbine, nozzle, compressor.
- To know the industrial second law of thermodynamics.
- To be able to simplify it in steady-state ; to express it in mass-specific form.
- To know the example of Joule–Thomson expansion : energy and entropy balances (case of a perfect gas).

PROGRAM

1. **Methodology of balances** System identification, choice of reference frame, writing local and integrated balances, closure hypotheses.

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2. **Thermal energy transfer** Conduction, convection, radiation ; heat flux, thermal current density, Fourier's law, thermal diffusion equations.
3. **Energy and entropy balances in open systems** First and second laws in steady or unsteady regimes, power and mass forms, irreversibility, entropy production.
4. **Mass balances** Mass conservation, scalar and vector balances, diffusion, convection, mass flux, Fick's law, 1D resolution.

BIBLIOGRAPHY

— D. Kondepudi, I. Prigogine, *Thermodynamics : From Heat Engines to Dissipative Structures*, Wiley.
— P. Colonna, S. van der Stappen, *Introduction to Thermodynamics*, TU Delft OpenCourseWare.
— F. Incropera, D. DeWitt et al., *Fundamentals of Heat and Mass Transfer*, Wiley.
— Y. Demirel, *Nonequilibrium Thermodynamics : Transport and Rate Processes in Physical, Chemical and Biological Systems*, Elsevier.
— J. Thome, *Engineering Heat Transfer*, EPFL Press.

REQUIREMENTS

— Basics of differentiation and integration.
— Elementary knowledge of thermodynamics (1st and 2nd laws).
— Basic concepts in fluid mechanics (flow and pressure).
— Unit manipulation and order-of-magnitude estimation.

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