INSA RENNES

Institut National
des Sciences Appliquées
Public Engineering School

ENGINEERING COURSE DESCRIPTION

ECTS credits

2013-2014

	Summary	Page
STPI	Courses in Science and Technology for Engineers	1
EII	Electronics and Computer Engineering	249
INFO	Computer Science	400
SRC	Communication Systems and Networks	552
GCU	Civil Engineering and Urban Planning	681
GMA	Materials Science and Engineering	799
SGM	Mechanical and Control Systems Engineering	881

Academic year 2013/2014

Courses offered by the programme

Sciences et Techniques Pour l'Ingénieur (STPI)
Science and Technology for the Engineer

Semester(s) : 1-2-3-4-5-6-7-8-9

Commonly used abbreviations
CM : Lectures
TD : Tutorials
TP : Laboratory Work
CONF : Conferences
TA : Personal Work
PR : Project
ST : Internship
DIV : Miscellaneous

Semestre 1

Parcours Formation Initiale STPI

1	**STP01-TCS-1**		**Fundamental Science MODULE**	**11.50**
	STP01-ALGL	C	Algebra 1	4.00
	STP01-ALGL_FIRE	C	Algebra 1 FIRE	4.00
	STP01-MECA	C	Mechanics 1	3.50
	STP01-MECA_FIRE	C	Mécanique du point et du solide FIRE	3.50
	STP01-ANAL	C	Analysis 1	4.00
	STP01-ANAL_FIRE	C	Analysis 1 FIRE	4.00
	STP01-TROMBI_A	C	Groupe_1A	0.00
	STP01-TROMBI_B	C	Groupe_1B	0.00
	STP01-TROMBI_C	C	Groupe_1C	0.00
	STP01-TROMBI_D	C	Groupe_1D	0.00
	STP01-TROMBI_E	C	Groupe_1E	0.00
	STP01-TROMBI_F	C	Groupe_1F	0.00
	STP01-TROMBI_G	C	Groupe_1G	0.00
	STP01-TROMBI_H	C	Groupe_1H	0.00
	STP01-TROMBI_I	C	Groupe_1I	0.00
	STP01-TROMBI_J	C	Groupe_1J	0.00
	STP01-TROMBI_K	C	Groupe_1K	0.00
2	**STP01-TCS-2**		**Experimental Science MODULE**	**11.50**
	STP01-ELEC	C	Electrokinetics 1	5.00
	STP01-ELEC_FIRE	C	Electrokinetics 1 FIRE	5.00
	STP01-CHIM	C	Chemistry 1 (From the atom to the molecule)	3.50
	STP01-CHIM_FIRE	C	Chemistry 1 FIRE	3.50
	STP01-IMAG	C	Optics	3.00
	STP01-IMAG_FIRE	C	Optics FIRE	3.00
3	**STP01-HUM**		**Humanities MODULE**	**7.00**
	STP01-ANGL	O	English	2.00
	STP01-CEC	C	Culture et communication	1.50
	STP01-FLECEC	C	French as a foreign language (FLE)	1.50
	STP01-EPS	C	Sport and physical Education	1.00
	STP01-FLE A	C	Français Langue Etrangère A	1.00
	STP01-SHESx	O	SHES	1.00
	STP01-PPI	O	Professional Project	0.50
	STP01-OI	C	Cross cultural opening	1.00
	STP01-FLE B	C	French as a foreign language (FLE)	1.00
	STP01-ALLDEB	C	English / Project	1.00
	STP01-ALL	C	German (second language)	1.00
	STP01-ALL+	C	German (first language) / Project	1.00
	STP01-ESPDEB	C	Espagnol Débutants 1 - STPI	1.00
	STP01-ESP	C	Espagnol Intermédiaire - 1STPI	1.00
	STP01-ESP+	C	Espagnol confirmé - 1STPI	1.00
	STP01-ARA	C	Arabic	1.00
	STP01-CHI	C	Chinese	1.00
	STP01-ITA	C	Italian	1.00

	STP01-JAP	C	Japanese	1.00
	STP01-RUS	C	Russian	1.00
4	**HUMT1-LANG3STP1**		**LANGUES VIV.3 STPI / sem.1**	**1.00**
	STP01-ALLDEB	C	English / Project	1.00
	STP01-ALL	C	German (second language)	1.00
	STP01-ALL+	C	German (first language) / Project	1.00
	STP01-ESPDEB	C	Espagnol Débutants 1 - STPI	1.00
	STP01-ESP	C	Espagnol Intermédiaire - 1STPI	1.00
	STP01-ESP+	C	Espagnol confirmé - 1STPI	1.00
	STP01-ARA	C	Arabic	1.00
	STP01-CHI	C	Chinese	1.00
	STP01-ITA	C	Italian	1.00
	STP01-JAP	C	Japanese	1.00
	STP01-RUS	C	Russian	1.00
5	**HUMT1-ELSA Mus**		**Music with studies**	**1.00**
	HUMT1-MUS	F	Music with studies	1.00
6	**HUMT1-ELSA Thea**		**Theatre with studies**	**1.00**
	HUMT1-THEA	F	Theatre with studies	1.00
7	**HUMT1-ELSA Tek**		**Light & sound engineering for theatre with studies**	**1.00**
	HUMT1-TEK	F	Light & sound engineering for theatre with studies	1.00
8	**HUMT1-ELSA ES**		**High-level sport with studies**	**1.00**
	HUMT1-ES	F	High-level sport with studies	1.00

O = compulsary, C= in choice , F= optional

Algebra 1	STP01-ALGL
Number of hours : 46.00 h	4.00 ECTS credit
CM : 20.00 h, TD : 26.00 h	
Reference Teacher(s) : BRIANE MARC	

Objectives :
Introduction to mathematical reasoning, basics of algebraic calculus and introduction to vector.

Content :
LOGIC AND SET THEORY
- Elements of logic (2h):
Propositions
Propositional functions and truth sets
Logical connectors
Quantifiers
Proof by contrapositive and by contradiction
- Introduction to set theory (1h30):
Operations on sets
Cardinal
Functions and properties
- The set of non-negative integers (1h30):
Principle of mathematical induction
Summation formulas

POLYNOMIALS (4h)
- Polynomial operations
- Degree of a polynomial
- Derivatives of a polynomial
- Roots of a polynomial and Taylor's formula
- Euclidian algorithm
- Greatest common divisor of two polynomials and Euclidian algorithm
- Irreducible polynomials
- Factorisation with irreducible polynomials

VECTOR SPACES (3h)
- Definitions and examples
- Vector subspaces
- Subspaces spanned by a subset
- Intersection, sum, direct sum of two subspaces

FINITE DIMENSION THEORY (4h)
- Generating sets and linearly independent vectors
- Basis and dimension
- Rank of a finite set of vectors, practical determination
- Dimension theorem and consequences

LINEAR MAPS (4h)
- Definitions and examples
- Kernel and image of a linear map
- Homothecies, projections and symmetries

Bibliography :

Requirements :

Organisation :
50h

Evaluation :
2 written examinations + Continuous assessment

Algebra 1 FIRE	STP01-ALGL_FIRE
Number of hours : 46.00 h	4.00 ECTS credit
CM : 20.00 h, TD : 26.00 h	
Reference Teacher(s) : LE GRUYER YVES	

Objectives :
Introduction to mathematical reasoning, basics of algebraic calculus and introduction to vector.

Content :
LOGIC AND SET THEORY
- Elements of logic (2h)
¿ Propositions
¿ Propositional functions and truth sets
¿ Logical connectors
¿ Quantifiers
¿ Proof by contrapositive and by contradiction
- Introduction to set theory (1h30)
¿ Operations on sets
¿ Cardinal
¿ Functions and properties
The set of non-negative integers (1h30)
¿ Principle of mathematical induction
¿ Summation formulas

POLYNOMIALS (4h)
- Polynomial operations
- Degree of a polynomial
- Derivatives of a polynomial
- Roots of a polynomial and Taylor's formula
- Euclidian division
- Greatest common divisor of two polynomials and Euclidian algorithm
- Irreducible polynomials
- Factorisation with irreducible polynomials

VECTOR SPACES (3h)
- Definitions and examples
- Vector subspaces
- Subspaces spanned by a subset
- Intersection, sum, direct sum of two subspaces

FINITE DIMENSION THEORY (4h)
- Generating sets and linearly independent vectors
- Basis and dimension
- Rank of a finite set of vectors, practical détermination
- Dimension theorem and consequences

LINEAR MAPS (4h)
- Definition and examples
- Kernel and range of a linear map
- Homothecies, projections and symmetries

Bibliography :

Requirements :
A-level mathematics and science programme.

Organisation :

Evaluation :
2 written examinations (1,5 hour each)

Continuous assessment

Target :
FIRE

Mechanics 1	STP01-MECA
Number of hours : 42.00 h	3.50 ECTS credit
CM : 16.00 h, TD : 20.00 h, TP : 6.00 h	
Reference Teacher(s) : JANCU JEAN-MARC	

Objectives :
The modelling of simple mechanical problems for rigid objects. Experimental validation. Fundamental laws of simple
mechanical phenomena.

Content :
Preliminary points. Geometry of mechanisms. Kinematics of mechanisms. Modelling of mechanical actions. Static study of
mechanisms. Dynamic study of mechanisms.

Bibliography :
Mécanique générale - cours et applications
- J.C. BONE, DUNOD Problèmes de mécanique générale
- J.C. BONE, DUNOD Mécanique du solide
- P. AGATI, DUNOD

Requirements :

Organisation :

Evaluation :
Three-hour written examination.
Two-hour written examination.
Continuous assessment on practical work.

Target :

Mécanique du point et du solide FIRE	STP01-MECA_FIRE
Number of hours : 42.00 h	3.50 ECTS credit
CM : 16.00 h, TD : 20.00 h, TP : 6.00 h	
Reference Teacher(s) : JANCU JEAN-MARC	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Analysis 1	STP01-ANAL
Number of hours : 52.00 h	4.00 ECTS credit
CM : 24.00 h, TD : 28.00 h	
Reference Teacher(s) : HADDOU MOUNIR	

Objectives :
Study of the fundamental properties of real sets. Study of real functions and sequences.

Content :
I. REAL NUMBERS AND REAL FUNCTIONS
Total order of the reals, Archimedes Axiom
Algebraic operations and partial order of functions, monotonous functions, bounded functions

II. LIMITS AND CONTINUITY
Properties and operations over functions with finite and infinite limits in a real point or at infinity
Definition and operations on continuous functions

III. REAL SEQUENCES
Monotonous sequences, majored, minored,
Definition of a limit and theorems on limits (algebraic operations, image of a sequence by a continuous function)
Study of some usual sequences

IV. SUPREMUM BOUNDED SETS AND APPLICATIONS
Properties of the inserted segments, adjacent sequences
Definition and characterization of the "supremum bounded set "
Limit of a sequence and monotonous functions
Subsequence, Bolzano-Weierstrass theorem
Fixed point theorem of contraction mapping applications

V. CONTINUOUS FUNCTIONS ON AN INTERVAL
Image of an interval : Bolzano theorem (intermediate values), Weierstrass (continuous function on a segment)
Continuously strictly monotonous function, inverse function
Examples of usual inverse functions: nth root, Arcsin, Arccos, Arctan
Log, exp, x^a functions, variation comparison
Inverse and direct hyperbolic functions

VI. DIFFERENTIAL CALCULUS
Derivable function at a point, derivative calculus : products, quotient, inverse function
Inverse trigonometric functions, successive derivatives, Leibniz's formula

VII. DIFFERENTIAL CALCULUS
Local extremum, Rolle's theorem; Lagrange's theorem 'equality of finite increments)

Bibliography :
Liret et Martinais. Analyse 1ère année.

Requirements :
A-level mathematics and science programme.

Organisation :

Evaluation :
2 ninety-minute written examinations.

Target :

Analysis 1 FIRE	STP01-ANAL_FIRE
Number of hours : 52.00 h	4.00 ECTS credit
CM : 24.00 h, TD : 28.00 h	
Reference Teacher(s) : MONIER LAURENT	

Objectives :
Study of the fundamental properties of real sets. Study of real functions and sequences.

Content :
I. REAL NUMBERS AND REAL FUNCTIONS
Total order of the reals, Archimedes Axiom
Algebraic operations and partial order of functions, monotonous functions, bounded functions

II. LIMITS AND CONTINUITY
Properties and operations over functions with finite and infinite limits in a real point or at infinity
Definition and operations on continuous functions

III. REAL SEQUENCES
Monotonous sequences, majored, minored,
Definition of a limit and theorems on limits (algebraic operations, image of a sequence by a continuous function)
Study of some usual sequences

IV. SUPREMUM BOUNDED SETS AND APPLICATIONS
Properties of the inserted segments, adjacent sequences
Definition and characterization of the "supremum bounded set "
Limit of a sequence and monotonous functions
Subsequence, Bolzano-Weierstrass theorem
Fixed point theorem of contraction mapping applications

V. CONTINUOUS FUNCTIONS ON AN INTERVAL
Image of an interval : Bolzano theorem (intermediate values), Weierstrass (continuous function on a segment)
Continuously strictly monotonous function, inverse function
Examples of usual inverse functions: nth root, Arcsin, Arccos, Arctan
Log, exp, x^a functions, variation comparison
Inverse and direct hyperbolic functions

VI. DIFFERENTIAL CALCULUS
Derivable function at a point, derivative calculus : products, quotient, inverse function
Inverse trigonometric functions, successive derivatives, Leibniz's formula

VII. DIFFERENTIAL CALCULUS
Local extremum, Rolle's theorem; Lagrange's theorem 'equality of finite increments)

Bibliography :
Liret et Martinais. Analyse 1ère année

Requirements :
A-level mathematics for Science option.

Organisation :

Evaluation :
2 ninety-minute written examinations.

Target :

Groupe_1A	STP01-TROMBI_A
Number of hours : 0.00 h	0.00 ECTS credit
TP : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_1B	STP01-TROMBI_B
Number of hours : 0.00 h	0.00 ECTS credit
TP : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_1C	STP01-TROMBI_C
Number of hours : 0.00 h	0.00 ECTS credit
TP : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_1D	STP01-TROMBI_D
Number of hours : 0.00 h	0.00 ECTS credit
TP : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_1E	STP01-TROMBI_E
Number of hours : 0.00 h	0.00 ECTS credit
TP : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_1F	STP01-TROMBI_F
Number of hours : 0.00 h	0.00 ECTS credit
TP : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_1G	STP01-TROMBI_G
Number of hours : 0.00 h	0.00 ECTS credit
TP : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_1H	STP01-TROMBI_H
Number of hours : 0.00 h	0.00 ECTS credit
TP : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_1I	STP01-TROMBI_I
Number of hours : 0.00 h	0.00 ECTS credit
TP : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_1J	STP01-TROMBI_J
Number of hours : 0.00 h	0.00 ECTS credit
TP : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_1K	STP01-TROMBI_K
Number of hours : 0.00 h	0.00 ECTS credit
TP : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Electrokinetics 1	STP01-ELEC
Number of hours : 59.00 h	5.00 ECTS credit
CM : 22.00 h, TD : 20.00 h, TP : 17.00 h	
Reference Teacher(s) : ROBINET SYLVIE	

Objectives :
Basics of continuous electro-kinetics: analysis methods for linear networks.

Content :
I. MODELLING PASSIVE AND ACTIVE COMMON DIPOLES.
Ohm's Law, Kirchoff's Laws, dipole Association.
Electrokinetic quantities: current, tension.
Definitions of Ohm law: branches, meshes, earth, dipoles. Examples of passive dipoles.
Examples of active dipoles: ideal and real sources of current and tension (Thévenin's and Norton's models).
II. DIPOLE ASSOCIATION.
Kirchhoff's laws. Passive and active dipole association. Exchanged power by dipoles.
III. ANALYSIS METHODS FOR LINEAR NETWORKS.
Superposing Thévenin and Norton's theorems, Millmann's theorem,
Kennely's theorem.

Bibliography :

Requirements :

Organisation :
2 hours per week. Preparation of Practical Work.

Evaluation :
Two-hour written examination.
Ninety-minute Practical Work examination.

Target :

Electrokinetics 1 FIRE	STP01-ELEC_FIRE
Number of hours : 59.00 h	5.00 ECTS credit
CM : 22.00 h, TD : 20.00 h, TP : 17.00 h	
Reference Teacher(s) : ROBINET SYLVIE	

Objectives :
Basics of continuous electro-kinetics: analysis methods for linear networks.

Content :
I. MODELLING PASSIVE AND ACTIVE COMMON DIPOLES.
Ohm's Law, Kirchoff's Laws, dipole Association.
Electrokinetic quantities: current, tension.
Definitions of Ohm law: branches, meshes, earth, dipoles. Examples of passive dipoles. Examples of active dipoles: ideal and real sources of current and voltage (Thévenin's and Norton's models).
II. DIPOLE ASSOCIATION Kirchhoff's laws. Passive and active dipole association. Exchanged power by dipoles.
III. ANALYSIS METHODS FOR LINEAR NETWORKS.
Superposing Thévenin and Norton's theorems, Millmann's theorem,
Kennely's theorem.

Bibliography :

Requirements :

Organisation :

Evaluation :
Two-hour examination on theory.
Ninety-minute practical-work examination.
Continuous assessment.

Target :

Chemistry 1 (From the atom to the molecule)	STP01-CHIM
Number of hours : 46.00 h	3.50 ECTS credit
CM : 14.00 h, TD : 20.00 h, TP : 12.00 h	
Reference Teacher(s) : GALL PHILIPPE	

Objectives :
Understanding the basics of the physicochemical characterisation of materials.

Content :
I. THE PERIODIC TABLE: The chemical element. Reading the periodic table: chemical families, block structures, evolution
of some chemical properties. Evolution of some atomic properties: ionization energy, electronic affinity and Mulliken's
electronegativity.
II. QUANTIZATION OF THE ENERGY IN THE HYDROGEN ATOM: Emission and absorption spectrums of the hydrogen
atom: Rydberg's constant. Electronic energy levels: En(eV) = -13,6/n2.
III. ELECTRONIC STRUCTURE OF THE ATOM: quantum notions: Existence of quantized energy levels in the atom,
degeneration of quantized energy levels, probability of the presence of an electron in a certain region of space. Quantum
numbers: n, l, ml, and ms, Pauli's principle. Electronic configuration of an atom in its fundamental state: rules on how to fill
the quantum squares up (Hund and Klechkowski), core electron, valency electron.
IV. ELECTRONIC STRUCTURE OF MOLECULES: localised covalent bond: byte rule, Lewis' formulas on molecules and
simple polyatomic ions, VSEPR method or Gillespie's rules, Inductive and mesomeric effects, Electronic relocation.
V. MOLECULAR ARCHITECTURE: Molecular stereochemistry, Newman and Cram's representations, Perspective,
Configuration stereo-isomery: Z and E, R and S, enantiomery and diastereo-isomery.
VI. SPECTROSCOPY: UV-Visible (complexes and unsaturation), Infra Red (fundamental notions, spectrum analysis).

Bibliography :
Architecture moléculaire Chimie Organique - J. Mesplede, Symétrie et structure - J. Angenault,
Atomes et Liaisons - M.O. Delcourt

Requirements :

Organisation :

Evaluation :
2 written examinations.
1 Practical Work examination.

Target :

Chemistry 1 FIRE	STP01-CHIM_FIRE
Number of hours : 46.00 h	3.50 ECTS credit
CM : 14.00 h, TD : 20.00 h, TP : 12.00 h	
Reference Teacher(s) : GALL PHILIPPE	

Objectives :
Understanding the basics of the physicochemical characterisation of materials.

Content :
I. THE PERIODIC TABLE: The chemical element. Reading the periodic table: chemical families, block structures, evolution
of some chemical properties. Evolution of some atomic properties: ionization energy, electronic affinity and Mulliken's
electronegativity.
II. QUANTIZATION OF THE ENERGY IN THE HYDROGEN ATOM: Emission and absorption spectrums of the hydrogen
atom: Rydberg's constant. Electronic energy levels: En(eV) = -13,6/n2.
III. ELECTRONIC STRUCTURE OF THE ATOM: quantum notions: Existence of quantized energy levels in the atom,
degeneration of quantized energy levels, probability of the presence of an electron in a certain region of space. Quantum
numbers: n, l, ml, and ms, Pauli's principle. Electronic configuration of an atom in its fundamental state: rules on how to fill
the quantum squares up (Hund and Klechkowski), core electron, valency electron.
IV. ELECTRONIC STRUCTURE OF MOLECULES: localised covalent bond: byte rule, Lewis' formulas on molecules and
simple polyatomic ions, VSEPR method or Gillespie's rules, Inductive and mesomeric effects, Electronic relocation.
V. MOLECULAR ARCHITECTURE: Molecular stereochemistry, Newman and Cram's representations, Perspective,
Configuration stereo-isomery: Z and E, R and S, enantiomery and diastereo-isomery.
VI. SPECTROSCOPY: UV-Visible (complexes and unsaturation), Infra Red (fundamental notions, spectrum analysis).

Bibliography :
Architecture moléculaire Chimie Organique - J. Mesplede, Symétrie et structure - J. Angenault,
Atomes et Liaisons - M.O. Delcourt

Requirements :

Organisation :

Evaluation :
2 written examinations.
1 Practical Work examination.

Target :

Optics	STP01-IMAG
Number of hours : 36.00 h	3.00 ECTS credit
CM : 10.00 h, TD : 14.00 h, TP : 12.00 h	
Reference Teacher(s) : BENHLAL JAMAL	

Objectives :
Understanding the formation of images in optics. Establishment of the concepts which lead to laws governing the transportation of information through rays in order to form an optical image.

Content :
I)LAWS OF GEOMETRICAL OPTICS: Fermat principle, Wavefronts, Malus' Law, Descartes' Law, applications to antennas,
illumination and injection into a fibre.
II) MIRORS: Rigorous stigmatism: conditions, plane mirrors, laws of conjugation, practical use of parabolic-hyperbolic-elliptical mirrors (antennas, solar concentrators, light collectors, etc). Approach to stigmatism conditions:
Spherical mirrors, comparison with the parabolic mirror. Laws of conjugation and applications (lasers, light reflection,
measuring instruments).
III) DIOPTERS: Plane Diopters - Laws of conjugation and applications. Curved diopter - laws of conjugation with various
origins. Applications of curved diopters (thick lenses, balls, monochromats, etc). Centred systems.
IV)LENSES AND OPTICAL INSTRUMENTS: Physical description of different lens categories. Conjugation laws for thick
lenses. Conjugation laws for thin lenses. Drawing of rays for divergent and convergent lenses. Lens combinations: Optical
instruments (Microscope, etc).
V) Matrix processing to the formation of IMAGES: ABCD matrix transferring of an optical system. Applications to diopters,
mirrors, lenses and optical systems. Software principles for the drawing of rays.
VI) SIGHT,WEAKNESSES AND CORRECTION: Description, optical properties and physical limits, Listing's model,
Defects and correction.

Bibliography :
Photocopied handout of the INSA booklet: S. Loualiche, Handouts of FW and PW J.P. Parisot, P. Segonds, S. LeBoiteux,
Optics lessons exercises with solutions Dunod
J.M. Brebec, P. Deneve,
Optics 1st year and Corrected problems (Prépa H, Hachette)

Requirements :
Derivative, Differential, Euclidian geometry, Matrix and products.

Organisation :
Two hours per week

Evaluation :
Two-hour examination on theory. Ninety-minute practical-work examination.

Target :

Optics FIRE	STP01-IMAG_FIRE
Number of hours : 36.00 h	3.00 ECTS credit
CM : 10.00 h, TD : 14.00 h, TP : 12.00 h	
Reference Teacher(s) : BENHLAL JAMAL	

Objectives :
Understanding the formation of images in optics. Establishment of the concepts which lead to laws governing the transportation of information through rays in order to form an optical image.

Content :
I)LAWS OF GEOMETRICAL OPTICS: Fermat principle, Wavefronts, Malus' Law, Descartes' Law, applications to antennas,
illumination and injection into a fibre.
II) MIRORS: Rigorous stigmatism: conditions, plane mirrors, laws of conjugation, practical use of parabolic-hyperbolic-elliptical mirrors (antennas, solar concentrators, light collectors, etc). Approach to stigmatism conditions:
Spherical mirrors, comparison with the parabolic mirror. Laws of conjugation and applications (lasers, light reflection,
measuring instruments).
III) DIOPTERS: Plane Diopters - Laws of conjugation and applications. Curved diopter - laws of conjugation with various
origins. Applications of curved diopters (thick lenses, balls, monochromats, etc). Centred systems.
IV)LENSES AND OPTICAL INSTRUMENTS: Physical description of different lens categories. Conjugation laws for thick
lenses. Conjugation laws for thin lenses. Drawing of rays for divergent and convergent lenses. Lens combinations: Optical
instruments (Microscope, etc).
V) Matrix processing to the formation of IMAGES: ABCD matrix transferring of an optical system. Applications to diopters,
mirrors, lenses and optical systems. Software principles for the drawing of rays.
VI) SIGHT,WEAKNESSES AND CORRECTION: Description, optical properties and physical limits, Listing's model,
Defects and correction.

Bibliography :
Polycopié du cours INSA : S. Loualiche,
Polycopiés de TD et TP J.P. Parisot, P. Segonds, S. LeBoiteux,
Optique cours et exercices avec solutions Dunod J.M. Brebec, P. Deneve,
Optique 1ère année et Problèmes corrigés (Prépa H, Hachette)

Requirements :
Derivative, Differential, Euclidian geometry, Matrix and products.

Organisation :
Two hours per week

Evaluation :
Two-hour examination on theory. Ninety-minute practical-work examination. Continuous assessment.

Target :

English	STP01-ANGL
Number of hours : 24.00 h	2.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : KERSUSAN SYLVIA, LE TINNIER ANNE	

Objectives :
Improving communication skills in everyday life situations as well as in a professional or social context.

Language-oriented objectives
Obtaining or reinforcing B2 level, required for graduation and defined by CECRL.

Content :
Learning by doing: students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.

Expressing oneself accurately and fluently: students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
English Grammar in Use, Intermediate Edition (CUP)
Oxford Advanced Learners¿ Dictionary (online)

Requirements :
Good command of secondary education curriculum

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet.
Regular personal work is required. Students must be curious and practise their English outside the classroom.

Evaluation :
A two-hour test including written expression and writing

Target :

Culture et communication	STP01-CEC
Number of hours : 22.00 h	1.50 ECTS credit
TD : 22.00 h	
Reference Teacher(s) : ECHARD PHILIPPE, PRIGENT HELENE	

Objectives :
Engineers are becoming ever increasingly involved in large scientific, technological and industrial projects in a broad range of fields on a national and international scale: energy, transport, construction, environment, communications, climate, food. The core objective of the engineer is to find solutions for the best possible means to protect the public and society in general, while serving them to the maximum.
On the 14th of July 2013, the newly established Lauvergeon commission "Innovation Commission 2030" will publish its report identifying up to ten industrial challenges in such domains as healthcare, care for the elderly, climate change, and sustainable development. First-year STPI students will become familiar with these challenges with the objective of completing, for year's end, a dossier entitled "Innovation 2030 / INSA" in which they will suggest approaches and areas for consideration, drawing inspiration from modern society's thinkers and entrepreneurs: Michel Serres, Isabelle Stengers, (philosopher of science) Jean Monville (ex Director General of Spie, now President of l'Anvie -National Association for Interdisciplinary Development and Reserach in Social Sciences and the Humanities for Businesses), Esther Duflo (economist) , Jürgen Habermas (professor of ethics) , Judith Butler (gender theoretician).
Students will be encouraged to participate in INSA's week-long series of conferences in October dedicated to Telecommunications.

Content :
- The engineering profession: its role in today's society, and the benefit to the engineer of good Social and Human Sciences skills.
Reflection on the possible establishment of an "Order of the Engineer" in preparation for the CNISF's (National Council of Engineers and Scientists of France) second Engineer's Day on Thursday 3rd April 2014.
- Know-how and the conveyance thereof: How should one communicate knowledge?
- The Enterprise: Business culture and best practices; Tutorials in conjunction with INSA's Forum du Grand Ouest and the Direction of the bureau for Business Relations and Partners. Conferences and meetings with a selection of the many firms in attendance.
- Preparation for first-year internship: Establishment of a portfolio of skills. Curriculum vitae, cover letter, job interviews, social networking and new recruitment practices (tutorials in association with l'Association Pour l'Emploi des Cadres (The Association for Employment for Management)/ Pôle Enseignement Supérieur (Centre for Higher Education).
- Internship report & methodology (written expression and word processing skills)
- Initiation to economic intelligence and information monitoring (tutorials in association with the INSA library)
- General culture

Bibliography :
Nicolas Colin and Henri Verdier, L'âge de la multitude, entreprendre et gouverner après la révolution numérique, A. Colin, 2012.
Jacques Rancière, La haine de la démocratie, La Fabrique, 2005.
Paul Virilio, Le futurisme de l'instant, Galilée, 2009.

Requirements :

Organisation :
Each tutorial lasts two hours. Most rooms are equipped with video projectors. Students may be required to participate in external events such as the "Forum des enterprises" (Business Forum) or Conferences.
Consistent personal input is required

Evaluation :
Continuous Assessment (separate marks for oral and written work)

Target :

French as a foreign language (FLE)	STP01-FLECEC
Number of hours : 22.00 h	1.50 ECTS credit
TD : 22.00 h	
Reference Teacher(s) : FOURE DOMINIQUE	

Objectives :
To achieve level B1 of the European Common Language Reference by the end of the two semesters.

Content :
Understanding and sustaining everyday conversations. Describing events or personal experiences. Interacting in basic tasks.
Exchanging information Note-taking. Writing descriptive and argumentative texts.

Bibliography :
D.Abry, C.Fert, C. Parpette, J. Stauber, ICI 1 et ICI 2, méthodes de français, CLE International
C.Miquel, Communication progressive du français, niveau débutant, CLE International
M. Boularès, Conjugaison progressive du français, CLE International
C.Miquel, Vocabulaire progressif du français, niveau débutant, CLE International

Requirements :

Organisation :

Evaluation :
Continuous assessment: 50%.
Two-hour written examination: 50%

Target :

Sport and physical Education	STP01-EPS
Number of hours : 22.00 h	1.00 ECTS credit
TD : 22.00 h	
Reference Teacher(s) : LE LAGADEC PIERRE, VAILLANT GERARD	

Objectives :
1. Integrating the INSA/a group.
2. Knowing one's strengths and weaknesses.
3. Personal development: decision making, action and technique.

Content :
Climbing (14h): Risk and safety management. Knowing one's capabilities in dangerous situations. Responsibility. Climbing
motricity, belaying techniques, lead climbing, autonomous abseiling.
Badminton (14h): Principles of the search for balance and disequilibrium in individual head-to-head sports. Strength and
weakness recognition in one-to-one situations.
Organisation: Two half-modules of 14 hours each (groups remain unchanged).

Bibliography :
Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Français Langue Etrangère A	STP01-FLE A
Number of hours : 22.00 h	1.00 ECTS credit
TD : 22.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

SHES	STP01-SHESx
Number of hours : 10.00 h	1.00 ECTS credit
TD : 10.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Professional Project	STP01-PPI
Number of hours : 6.00 h	0.50 ECTS credit
PR : 4.00 h, TD : 2.00 h	
Reference Teacher(s) : LE BAIL SYLVIE	

Objectives :
Students are encouraged to reflect upon their career project by focusing on four main themes:
- self-knowledge
- Knowledge of the engineering profession.
- Knowledge of the firm.
- Knowledge of the markets.

Content :
Knowledge of the firm: The five main functions of the firm and how these functions are organised (design, production, sales,
people management, financial management).
Self-Knowledge: Human behaviour (emotion, mental strengths and weaknesses). First year work placement: objectives and
procedure.
Round table meeting with students who have recently gratuated.

Bibliography :

Requirements :

Organisation :
Search for a work placement.

Evaluation :
Overall mark.

Target :

Cross cultural opening	STP01-OI
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : KERSUSAN SYLVIA	

Objectives :
Help the students to understand and aprehand social, professional and family situations related to the experience will have as foreign students, while improving their English vocabulary.

Content :
Different topics and questions dealing with "Being a foreigner and living abroad". Also, working on what it means to be a foreigner in france.

Bibliography :
Newspaper and magazine articles - the internet
French or Foe? - Polly Platt

Requirements :
A good English level (B2)

Organisation :
rading of texts, debates personel research, vocabulary oral presentations.

Evaluation :
finale grade

Target :

French as a foreign language (FLE)	STP01-FLE B
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : FOURE DOMINIQUE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

English / Project	STP01-ALLDEB
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

German (second language)	STP01-ALL
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
-To consolidate language skills acquired during secondary education with the goal of achieving at least the B1 level by the end
of the first cycle
-To develop listening and reading skills using contemporary resources (largely literary).
-To develop speaking skills through pair work, group work and discussions involving the entire class.
-To prepare the student for autonomous progression.

Content :
1. This module follows the Schritte 5 method.
Themes: everyday life situations, the professional world, entertainment, health, multilingualism, the environment.
2. Revision of grammar basics (basic tenses, conjugation, pronouns, etc.).
3. Group work and role-plays.

Bibliography :
1. Silke Hilpert et al., Schritte 5 Kursbuch + Arbeitsbuch, Munich : Hueber, 2005.
2. Dictionnaire bilingue français-allemand / allemand-français Harraps Universal
3. Waltraud Legros, Ach so ! Les bases de la grammaire allemande : tout reprendre à zéro, Paris : Ellipses, 1999.

Requirements :
Finishing level in LV2.

Organisation :
Students are asked to regularly read publications and watch films in German. Each session reinforces the previous one and
prepares the student for the next.

Evaluation :
Oral examination in the second semester.

Target :

German (first language) / Project	STP01-ALL+
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol Débutants 1 - STPI	STP01-ESPDEB
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol Intermédiaire - 1STPI	STP01-ESP
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol confirmé - 1STPI	STP01-ESP+
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Arabic	STP01-ARA
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
According to the student's level: Beginners (A1), Intermediate (A2/B1), Advanced (B1/B2). Help the students to progress autonomously.

Content :
Written and oral communication. Firstly in everyday life situations, and secondly in other fields such as professional topics.
-Films and book extracts are used as a learning aid.
-Individual exercises and group work, oral presentations for intermediates
-Grammar
-Cinema, literature and civilization.

Bibliography :

Requirements :

Organisation :
Classes take place at SUPELEC (campus de Beaulieu)

Evaluation :
Final grade (under SUPELEC responsability).

Target :

Chinese	STP01-CHI
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
To acquire the basics of Chinese, Essential structures and vocabulary, Comprehension, expression ans pronunciation, Use of
everyday Chinese.

Content :
Oral skills : corrective phonetics (pinyin system), listening to and analysis of complex sentences and simple texts, oral
exercizes (student-student / student-teacher), introduction of new characters (pronunciation and tone accentuation).
Written skills : prose/translation, written production of complex sentences and simple texts, learning and reinforcement of
grammatical ans vocabulary mechanisms, oral and written Chinese, learning of new characters (order of lines, basic
ideograms), reading and analysis of texts, text commentary.

Bibliography :
1. Interactive chinese, Sinolingua, 2004
2. Le chinois contemporain, WU Zhongwei, Sinolingua, 2010
3. Faire l'expérience du chinois, ZHANG Rumei, AI Xin, Higher Education Press, 2006
Other documents will be added to these basic books to provide the students with a wide panel of practical exercises.

Requirements :

Organisation :
Students are required to read the texts from the lessons (in character form), to rewrite the new characters, to work on the
application exercices on grammar, lexical and morphological points, to ask questions on the texts from the lessons, to do prose
and translation exercises.

Evaluation :
Written test

Target :

Italian	STP01-ITA
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
Beginners: discover the Italian language and culture, learn how to communicate and express simple ideas.
Intermediate:
improve oral and written skills in order to reach a good level of communication. Advanced: Cultural and everyday life themes.
Cinema, literature and civilization.

Content :
Oral expression and comprehension
Reading and writing
Phonetics
Films and book extracts
Articles from the local news.

Bibliography :
La lingua italiana per Stranieri 1, 2, 3 PK.Katerinov
La prova orale 1, 2, 3 T.Marin
Rete 1 and Rete 2, Marco Mezzadri and Paolo Balboni, Guerra Edizioni
Newspaper clips and articles, films, book extracts.

Requirements :
Beginners: none
Intermediate: at least one year of Italian.
Advanced: good level of written and spoken Italian.

Organisation :
Reading and written exercises.

Evaluation :
Final grade.

Target :

Japanese	STP01-JAP
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
Basic user : breakthrough or beginner (A1) :
- Discovering the linguistic specificities of the language (phonetics, syntax)
- Discovering Japanese culture, traditions and customs
- Learning about two writing systems (Hiragana and Katakana)
- Good command of basic conversational skills in everyday life context.

Basic user : waystage or elementary (A2) :
- Introduction to ideograms (60 kanji)
- Reading simple texts (Manga etc.)
- Writing simple texts.
- Good command of oral skills in everyday life context.

Independent User (B1, B2) :
- Learning Kanji (60-200)
- Good command of reading, writing skills as well s oral comprehension and expression skills to study in Japan or visit the country.

Content :
Basic user: breakthrough or beginner (A1) :
- General introduction to Japanese
- Command of two Japanese alphabets : 46 hiragana and 46 katakana.
    Lesson 1 : introducing oneself
    Lesson 2 : likes / dislikes
    Lesson 3 : where do I live ?
    Lesson 4 : everyyday life.

Basic user : waystage or elementary (A2) :
- Introduction to ideograms
- Learning kanji (30)
- Understanding a simple video (anime/cartoon)
- Basic grammar skills
- Reading and writing simple texts
- Learning how to communicate in everyday life context.

Independent User (B1, B2) :
- Good command of more than 30 kanji
- Understanding a simple video (anime/ cartoon)
- Command of reading, writing skills as well as oral comprehension and expression skills.

Bibliography :
- Beginner level (A1) : Marugoto, 3A Network, to be published soon, Japan
- Basic user (A2) : Daichi, 1, 3A Network, 2008, Japan
- Independent user (B1, B2) : Minna no Nihongo, I and II, 3A Network, 1998, Japan & Satoru Koyama, J. Bridge, Bonjinsha, 2007, Japan

Requirements :
Basic user (A1) : none.

Organisation :
The course is a tutorial. Each time, notions will be explained and then illustrated by a series of relevant examples, tasks and oral activities involving the students.

Evaluation :
- Writing test at the end of each semester

- Oral test at the end of each semester
- Attendance, student's involvment.

Target :

Russian	STP01-RUS
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
Set according to level: Beginners (A1), Intermediate (A2/B1), Advanced (B1/B2). Help the students to progress autonomously.

Content :
Written and oral communication. Firstly, in everyday life situations, and secondly in other fields such as professional topics.
-Films and book extracts are used as a learning aid.
-Individual exercices and group work, oral presentations for intermediates
-Grammar
-Cinema, literature and civilization.

Bibliography :

Requirements :

Organisation :
Classes take place at SUPELEC (Campus de Beaulieu)

Evaluation :
Final grade (overseen by SUPELEC).

Target :

English / Project	STP01-ALLDEB
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

German (second language)	STP01-ALL
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
-To consolidate language skills acquired during secondary education with the goal of achieving at least the B1 level by the end
of the first cycle
-To develop listening and reading skills using contemporary resources (largely literary).
-To develop speaking skills through pair work, group work and discussions involving the entire class.
-To prepare the student for autonomous progression.

Content :
1. This module follows the Schritte 5 method.
Themes: everyday life situations, the professional world, entertainment, health, multilingualism, the environment.
2. Revision of grammar basics (basic tenses, conjugation, pronouns, etc.).
3. Group work and role-plays.

Bibliography :
1. Silke Hilpert et al., Schritte 5 Kursbuch + Arbeitsbuch, Munich : Hueber, 2005.
2. Dictionnaire bilingue français-allemand / allemand-français Harraps Universal
3. Waltraud Legros, Ach so ! Les bases de la grammaire allemande : tout reprendre à zéro, Paris : Ellipses, 1999.

Requirements :
Finishing level in LV2.

Organisation :
Students are asked to regularly read publications and watch films in German. Each session reinforces the previous one and
prepares the student for the next.

Evaluation :
Oral examination in the second semester.

Target :

German (first language) / Project	STP01-ALL+
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol Débutants 1 - STPI	STP01-ESPDEB
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol Intermédiaire - 1STPI	STP01-ESP
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol confirmé - 1STPI	STP01-ESP+
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Arabic	STP01-ARA
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
According to the student's level: Beginners (A1), Intermediate (A2/B1), Advanced (B1/B2). Help the students to progress autonomously.

Content :
Written and oral communication. Firstly in everyday life situations, and secondly in other fields such as professional topics.
-Films and book extracts are used as a learning aid.
-Individual exercises and group work, oral presentations for intermediates
-Grammar
-Cinema, literature and civilization.

Bibliography :

Requirements :

Organisation :
Classes take place at SUPELEC (campus de Beaulieu)

Evaluation :
Final grade (under SUPELEC responsability).

Target :

Chinese	STP01-CHI
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
To acquire the basics of Chinese, Essential structures and vocabulary, Comprehension, expression ans pronunciation, Use of
everyday Chinese.

Content :
Oral skills : corrective phonetics (pinyin system), listening to and analysis of complex sentences and simple texts, oral
exercizes (student-student / student-teacher), introduction of new characters (pronunciation and tone accentuation).
Written skills : prose/translation, written production of complex sentences and simple texts, learning and reinforcement of
grammatical ans vocabulary mechanisms, oral and written Chinese, learning of new characters (order of lines, basic
ideograms), reading and analysis of texts, text commentary.

Bibliography :
1. Interactive chinese, Sinolingua, 2004
2. Le chinois contemporain, WU Zhongwei, Sinolingua, 2010
3. Faire l'expérience du chinois, ZHANG Rumei, AI Xin, Higher Education Press, 2006
Other documents will be added to these basic books to provide the students with a wide panel of practical exercises.

Requirements :

Organisation :
Students are required to read the texts from the lessons (in character form), to rewrite the new characters, to work on the
application exercices on grammar, lexical and morphological points, to ask questions on the texts from the lessons, to do prose
and translation exercises.

Evaluation :
Written test

Target :

Italian	STP01-ITA
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
Beginners: discover the Italian language and culture, learn how to communicate and express simple ideas.
Intermediate:
improve oral and written skills in order to reach a good level of communication. Advanced: Cultural and everyday life themes.
Cinema, literature and civilization.

Content :
Oral expression and comprehension
Reading and writing
Phonetics
Films and book extracts
Articles from the local news.

Bibliography :
La lingua italiana per Stranieri 1, 2, 3 PK.Katerinov
La prova orale 1, 2, 3 T.Marin
Rete 1 and Rete 2, Marco Mezzadri and Paolo Balboni, Guerra Edizioni
Newspaper clips and articles, films, book extracts.

Requirements :
Beginners: none
Intermediate: at least one year of Italian.
Advanced: good level of written and spoken Italian.

Organisation :
Reading and written exercises.

Evaluation :
Final grade.

Target :

Japanese	STP01-JAP
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
Basic user : breakthrough or beginner (A1) :
- Discovering the linguistic specificities of the language (phonetics, syntax)
- Discovering Japanese culture, traditions and customs
- Learning about two writing systems (Hiragana and Katakana)
- Good command of basic conversational skills in everyday life context.

Basic user : waystage or elementary (A2) :
- Introduction to ideograms (60 kanji)
- Reading simple texts (Manga etc.)
- Writing simple texts.
- Good command of oral skills in everyday life context.

Independent User (B1, B2) :
- Learning Kanji (60-200)
- Good command of reading, writing skills as well s oral comprehension and expression skills to study in Japan or visit the country.

Content :
Basic user: breakthrough or beginner (A1) :
- General introduction to Japanese
- Command of two Japanese alphabets : 46 hiragana and 46 katakana.
    Lesson 1 : introducing oneself
    Lesson 2 : likes / dislikes
    Lesson 3 : where do I live ?
    Lesson 4 : everyyday life.

Basic user : waystage or elementary (A2) :
- Introduction to ideograms
- Learning kanji (30)
- Understanding a simple video (anime/cartoon)
- Basic grammar skills
- Reading and writing simple texts
- Learning how to communicate in everyday life context.

Independent User (B1, B2) :
- Good command of more than 30 kanji
- Understanding a simple video (anime/ cartoon)
- Command of reading, writing skills as well as oral comprehension and expression skills.

Bibliography :
- Beginner level (A1) : Marugoto, 3A Network, to be published soon, Japan
- Basic user (A2) : Daichi, 1, 3A Network, 2008, Japan
- Independent user (B1, B2) : Minna no Nihongo, I and II, 3A Network, 1998, Japan & Satoru Koyama, J. Bridge, Bonjinsha, 2007, Japan

Requirements :
Basic user (A1) : none.

Organisation :
The course is a tutorial. Each time, notions will be explained and then illustrated by a series of relevant examples, tasks and oral activities involving the students.

Evaluation :
- Writing test at the end of each semester

- Oral test at the end of each semester
- Attendance, student's involvment.

Target :

Russian	STP01-RUS
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
Set according to level: Beginners (A1), Intermediate (A2/B1), Advanced (B1/B2). Help the students to progress autonomously.

Content :
Written and oral communication. Firstly, in everyday life situations, and secondly in other fields such as professional topics.
-Films and book extracts are used as a learning aid.
-Individual exercices and group work, oral presentations for intermediates
-Grammar
-Cinema, literature and civilization.

Bibliography :

Requirements :

Organisation :
Classes take place at SUPELEC (Campus de Beaulieu)

Evaluation :
Final grade (overseen by SUPELEC).

Target :

Music with studies	HUMT1-MUS
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
- This module aims to enable students who have already reached a good level in music to continue practicing. - Group rehearsals. - Music as a means of developing the collaborative and adaptive abilities that are essential to any teamwork situation.

Content :
- Weekly group rehearsals.
- Classical, jazz or folk music taught by music teachers.
- Use of facilities at INSA-Rennes.
- At least 2 concerts per year.

Bibliography :

Requirements :
At least 5 years of practice.
The ability to read sheet music.
Admission to the "Music with Studies" section is decided upon through an audition conducted by the music teachers.

Organisation :
2 hours per week

Evaluation :
Validation of first semester : no mark awarded

Target :

Theatre with studies	HUMT1-THEA
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
- The art of oral expression.
- Performing before an audience.
- Further improve one's general knowledge.

Content :
- Reading and analysis of modern and classical drama.
- Theatre workshops run by professionals.
- Live performance.

Students may choose this optional module at the beginning of the first, second, third or fourth year of studies. In doing so, an engagement is undertaken to complete two semesters (For evaluation see below).
The module covers both semesters of the academic year and is concluded by a performance.
There are two parts to the "Theatre with Studies" module:
1) Drama culture: Reading of works (one complete work and extracts which are likely to reveal the various facets of dramatic repertory). The fundamentals of drama history and acting techniques (Classic Greek drama, Diderot and Brecht dramas, etc).
Philosophical thought on "the world of the Theatre" and "the theatre of our World". The economics of setting up and running a theatre play.
Valérie Derrien-Remeur, PhD in French language and literature and head of the Department of Théâtre-Etudes oversees this module. The sessions take place on Thursday afternoons. The INSA library is associated with this module with the objective of building a corpus of works which students may consult and borrow.
2) In preparation for the end-of-year performance, every two weeks there are professionally-supervised drama-practice workshops. The professional (recruited by Valérie Derrien-Remeur) not only directs the show but is also in charge of the decor, costumes, sound and lighting, and furthermore, manages casting through specifically designed exercises.
Note: The "Theatre with Studies" section is open to all INSA students, however, given that the ultimate objective of the module is the theatre performance and that the means at our disposal are limited, we regret that no more than 30 students can enrol; each module is open to a maximum of 15 students.

Bibliography :
Bernardy M. : Traité de diction française à l'usage de l'honnête homme. Editions de l'aube, 1994. Boal A. : Jeux pour l'acteur et le non acteur. Editions La Découverte, 1997.

Requirements :

Organisation :

Evaluation :
Validation of first semester (no mark awarded)

Target :

Light & sound engineering for theatre with studies	HUMT1-TEK
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
Teach students how to deal with the technical aspects of theatre plays, concerts, public-address systems for conferences, recordings...

Content :
Microphones, sound recording, sound software,stage/light mixing techniques, lighting desks and sound control systems : theoretical and practical experience.

Bibliography :

Requirements :
None

Organisation :
Workshops on Thurday afternoon in local venues or at INSA

Evaluation :
Validation of first semester (no mark awarded)

Target :
Any year

High-level sport with studies	HUMT1-ES
Number of hours : 6.00 h	1.00 ECTS credit
CM : 6.00 h	
Reference Teacher(s) : VAILLANT GERARD	

Objectives :
Students must set out and structure a personal project to establish the best possible coherence between engineering studies at
INSA and a career as a high-level athlete. Acquisition of specific knowledge and know-how.

Content :
- Lessons and conferences on the tools of project management.
- Guided work on project building (personal career).
- Stress management. Relaxation therapy. Action type profiling. Mental preparation. Athletic traumatology. Motivation.
Dietetics. Physical preparation.
Organisation : Lessons, and evening conferences.

Bibliography :
Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education website.

Requirements :

Organisation :

Evaluation :
Validation of first semester : no mark awarded

Target :
Maximum 4 semestrial registrations throughout the whole cursus.

Semestre 2

Parcours Formation Initiale STPI

1	**STP02-TCS-1**		**Fundamental Science MODULE**	**12.50**
	STP02-ALGL	C	Algebra 2	4.00
	STP02-ALGL_FIRE	C	Algebra 2 FIRE	4.00
	STP02-INFO	O	Computer science 2	3.50
	STP02-ANAL	C	Analysis 2	5.00
	STP02-ANAL_FIRE	C	Analysis 2 FIRE	5.00
2	**STP02-TCS-2**		**Experimental Science MODULE**	**10.50**
	STP02-SIND	C	Sciences Industrielles	3.00
	STP02-SIND_FIRE	C	Sciences Industrielles FIRE	3.00
	STP02-ELEC	C	Electrokinetics 2	4.00
	STP02-ELEC_FIRE	C	Electrokinetics 2 FIRE	4.00
	STP02-CHIM	C	Chemistry 2 (from solution to solid)	3.50
	STP02-CHIM_FIRE	C	Chemistry 2 FIRE	3.50
3	**STP02-HUM**		**Humanities MODULE**	**7.00**
	STP02-ANGL	O	English	2.00
	STP02-MS	C	Culture et communication	1.50
	STP02-FLEMS	C	French as a foreign language (FLE)	1.50
	STP02-EPS	C	Sport and physical Education	1.00
	STP02-FLE A	C	Français Langue Etrangère A - 1STPI	1.00
	STP02-SHESx	O	SHES	1.00
	STP02-PPI	O	Professional Project	0.50
	STP02-OI	C	Cross cutural opening	1.00
	STP02-FLE B	C	Français Langue Etrangère B - 1STPI	1.00
	STP02-ALLDEB	C	German (first language) / Project	1.00
	STP02-ALL	C	German (second language)	1.00
	STP02-ALL+	C	German (first language)	1.00
	STP02-ESPDEB	C	Espagnol Débutants - 1STPI	1.00
	STP02-ESP	C	Espagnol Intermédiaire - 1STPI	1.00
	STP02-ESP+	C	Espagnol confirmé - 1STPI	1.00
	STP02-ARA	C	Arabic	1.00
	STP02-CHI	C	Chinese	1.00
	STP02-ITA	C	Italian	1.00
	STP02-JAP	C	Japanese	1.00
	STP02-RUS	C	Russian	1.00
4	**HUMT2-LANG3STP2**		**LANGUES VIV.3 STPI / sem.2**	**1.00**
	STP02-ALLDEB	C	German (first language) / Project	1.00
	STP02-ALL	C	German (second language)	1.00
	STP02-ALL+	C	German (first language)	1.00
	STP02-ESPDEB	C	Espagnol Débutants - 1STPI	1.00
	STP02-ESP	C	Espagnol Intermédiaire - 1STPI	1.00
	STP02-ESP+	C	Espagnol confirmé - 1STPI	1.00
	STP02-ARA	C	Arabic	1.00
	STP02-CHI	C	Chinese	1.00
	STP02-ITA	C	Italian	1.00

	STP02-JAP	C	Japanese	1.00
	STP02-RUS	C	Russian	1.00
5	**HUMT2-ELSA Mus**		**Music with Studies**	**1.00**
	HUMT2-MUS	C	Music With Studies	1.00
6	**HUMT2-ELSA Thea**		**Theatre with Studies**	**1.00**
	HUMT2-THEA	C	Theatre With Studies	1.00
7	**HUMT2-ELSA ES**		**High Level Sport with Studies / Sports Management MODULE**	**1.00**
	HUMT2-ES	F	High-Level sport with studies	1.00
8	**HUMT2-SAM(1)**		**"SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility)**	**1.00**
	HUMT2-APES	F	APES	1.00
9	**HUMT2-ELSA Tek**		**Light & sound engineering for theatre with studies**	**1.00**
	HUMT2-TEK	F	Light & sound engineering for theatre with studies	1.00

O = compulsary, C= in choice , F= optional

Algebra 2	STP02-ALGL
Number of hours : 48.00 h	4.00 ECTS credit
CM : 20.00 h, TD : 28.00 h	
Reference Teacher(s) : DUPUY JEAN-FRANCOIS, LE GRUYER YVES	

Objectives :
The course covers matrix theory and finite-dimensional vector spaces, emphasizing topics useful in engineering problems. Matrices are studied first, starting with simple matrix operations. Then the association between linear maps and matrices is introduced. Vector spaces are then studied in an abstract setting (illustrated with engineering applications): inner product, orthogonality, determinant.

Content :
MATRICES (5h)
¿ Matrices, matrix operations, algebraic properties
¿ Special types of matrices (diagonal, triangular, unit matrix¿)
¿ Matrix of a linear map
¿ Matrix of the composition of linear maps
¿ Inverse of a matrix
¿ Change of basis
¿ Rank and trace of a matrix

INNER PRODUCT AND EUCLIDEAN SPACES (5h)
- Inner product and Euclidean spaces :
¿ Inner product in the plane and space : high school reminders
¿ Definitions and examples
¿ Norm, Cauchy-Schwarz inequality, triangle inequality, angle
- Orthogonal and orthonormal bases :
¿ Orthogonal and orthonormal sets of vectors
¿ Coordinates in an orthonormal basis
¿ Gram-Schmidt process
- Orthogonality of subspaces :
¿ Orthogonal of a subspace : definition, examples
¿ Supplementary subspaces
¿ Orthogonality of a vector to an hyperplane

ORTHOGONAL PROJECTION AND SYMMETRY (2h)
¿ Orthogonal projection
¿ Distance to a subspace
¿ Orthogonal symmetry

DETERMINANTS (6h)
¿ Systems of linear equations
¿ Determinant (of a set of vectors, of an endomorphism, of a square matrix)
¿ Determinant and volume
¿ Multilinear maps
¿ Applications (rank of a matrix, inverse matrix)

ENGINEERING APPLICATION : LINEAR REGRESSION (2h)

Bibliography :
F. Cottet-Emard. Algèbre linéaire et bilinéaire. De boeck, 2006.
J.-P. Escofier. Toute l¿algèbre du 1er cycle. Dunod, 2002.

Requirements :
Program of the course of Algebra 1

Organisation :
Students are expected to spend about 50h on this course.

Evaluation :

2 assignments (1h30 each) + continuous monitoring

Target :

Algebra 2 FIRE	STP02-ALGL_FIRE
Number of hours : 48.00 h	4.00 ECTS credit
CM : 20.00 h, TD : 28.00 h	
Reference Teacher(s) : LE GRUYER YVES	

Objectives :
The course covers matrix theory and finite-dimensional vector spaces, emphasizing topics useful in engineering problems. Matrices are studied first, starting with simple matrix operations. Then the association between linear maps and matrices is introduced. Vector spaces are then studied in an abstract setting (illustrated with engineering applications): inner product, orthogonality, determinant.

Content :
MATRICES (5h)
- Matrices, matrix operations, algebraic properties
- Special types of matrices (diagonal, triangular, unit matrix¿)
- Matrix of a linear map
- Matrix of the composition of linear maps
- Inverse of a matrix
- Change of basis
- Rank and trace of a matrix

INNER PRODUCT AND EUCLIDEAN SPACES (5h)
- Inner product and Euclidean spaces :
  - Inner product in the plane and space : high school reminders
  - Definitions and examples
  - Norm, Cauchy-Schwarz inequality, triangle inequality, angle
- Orthogonal and orthonormal bases :
  - Orthogonal and orthonormal sets of vectors
  - Coordinates in an orthonormal basis
  - Gram-Schmidt process
- Orthogonality of subspaces :
  - Orthogonal of a subspace : definition, examples
  - Supplementary subspaces
  - Orthogonality of a vector to an hyperplane

ORTHOGONAL PROJECTION AND SYMMETRY (2h)
- Orthogonal projection
- Distance to a subspace
- Orthogonal symmetry

DETERMINANTS (6h)
- Systems of linear equations
- Determinant (of a set of vectors, of an endomorphism, of a square matrix)
- Determinant and volume
- Multilinear maps
- Applications (rank of a matrix, inverse matrix)

ENGINEERING APPLICATION : LINEAR REGRESSION (2h)

Bibliography :
F. Cottet-Emard. Algèbre linéaire et bilinéaire. De boeck, 2006.
J.-P. Escofier. Toute l¿algèbre du 1er cycle. Dunod, 2002.

Requirements :
Program of the course of Algebra 1

Organisation :
Each student is expected to spend about 35 hours on this course

Evaluation :

2 assignments (1h30 each) + continuous monitoring

Target :

Computer science 2	STP02-INFO
Number of hours : 42.00 h	3.50 ECTS credit
TD : 22.00 h, TP : 20.00 h	
Reference Teacher(s) : BERTIER MARIN	

Objectives :
Second part of the introduction to algorithms (continued from the previous semester).
Introduction to imperative programming
and object programming. Problem decomposition.

Content :
PART I : Learning the Java Language - types, expressions, variables, conditional computing, static functions, displaying, iterations (while and for), reading, overflow, rounding errors, arrays, arrays of arrays, scope of identifiers, parameter passing modes. Introduction to the notion of objects, and methods (for example class files, sets).
PART II : Modelling of concrete problems. Very diverse subject areas are covered. Some subjects are too vast for the students to complete entirely. The lectures-exercise sessions help to present the problem globally and the students only encode part of it ; the rest being supplied by the teacher.
The students are introduced to component programming: - Calculation of the shortest path through a network: implementation of a Graph class; Dijkstra's algorithm - processing of a genealogy file: encoding of an analyser based on a grammar; re-use of the graphs and the Dijkstra
Algorithm, digital image filtering: edge detection, noise minimising, realisation of an orthographic corrector: editing distance,
Introduction to image synthesis: visualisation of 3-dimensional scenes, etc.

Bibliography :

Requirements :
Le livre de Java premier langage. Anne Tasso. Eyrolles.

Organisation :

Evaluation :
2 two-hour written examinations.

Target :

Analysis 2	STP02-ANAL
Number of hours : 58.00 h	5.00 ECTS credit
CM : 24.00 h, TD : 26.00 h, TP : 8.00 h	
Reference Teacher(s) : HERVE LOIC, LEY OLIVIER	

Objectives :
Detailed definition of the Riemann integral; link this definition to the notion of primitive functions.
Basic calculus: solving linear systems, solving linear ordinary diffrential equations, approximation of the zeros of a real valued
function.
Use of Maple or Mathlab to solve some of the above problems.

Content :
I - RIEMANN INTEGRAL ON A SEGMENT
Integral of a staged function; integrable functions: monotonic functions and piecewise continuous functions; properties of the integral: linearity and positivity, Mean Value Theorems; numerical calculation of integrals: Midpoint, trapezium and Simpson formulas.

II - PRIMITIVE FUNCTIONS AND INTEGRALS
Primitive function of a continuous function, fundamental theorem of calculus. Common primitive functions, integration by parts and by substitution; Primitive function of a rational function or of functions which can be brought to this case by substitution.

III SYSTEMS OF LINEAR EQUATIONS.
LU Decomposition, Gaussian elimination, inverting a matrix, solving linear systems.

IV ¿ ORDINARY LINEAR DIFFERENTIAL EQUATIONS.
Ordinary linear differential equations with constant coefficients, method of variations of parameters.
Examples: simple and damped harmonic oscillator.

V ¿ APPROXIMATION OF ZEROES OF A REAL VALUED FUNCTION
Dichotomy, fixed point iteration, Cauchy sequences, Newton-Raphson method.

Mathematic practical on computer to solve problems of chapters III, IV, V.

Bibliography :
Liret et Martinais. Analyse 1ère année. Ed; Dunod.

Requirements :
A-level Science programme. Basic knowledge of calculus with real numbers, first year year linear algebra.

Organisation :

Evaluation :
2 ninety-minute written examinations + 1 assessment grade + 1 math practical grade.

Target :

Analysis 2 FIRE	STP02-ANAL_FIRE
Number of hours : 58.00 h	5.00 ECTS credit
CM : 24.00 h, TD : 26.00 h, TP : 8.00 h	
Reference Teacher(s) : HERVE LOIC, LEY OLIVIER	

Objectives :
Detailed definition of the Riemann integral; link this definition to the notion of primitive functions.
Basic calculus: solving linear systems, solving linear ordinary diffrential equations, approximation of the zeros of a real valued function.
Use of Maple or Mathlab to solve some of the above problems.

Content :
I - RIEMANN INTEGRAL ON A SEGMENT
Integral of a staged function; integrable functions: monotonic functions and piecewise continuous functions; properties of the integral: linearity and positivity, Mean Value Theorems; numerical calculation of integrals: Midpoint, trapezium and Simpson formulas.

II - PRIMITIVE FUNCTIONS AND INTEGRALS
Primitive function of a continuous function, fundamental theorem of calculus. Common primitive functions, integration by parts and by substitution; Primitive function of a rational function or of functions which can be brought to this case by substitution.

III . SYSTEMS OF LINEAR EQUATIONS.
LU Decomposition, Gaussian elimination, inverting a matrix, solving linear systems.

IV . ORDINARY LINEAR DIFFERENTIAL EQUATIONS.
Ordinary linear differential equations with constant coefficients, method of variations of parameters.
Examples: simple and damped harmonic oscillator.

V . APPROXIMATION OF ZEROES OF A REAL VALUED FUNCTION
Dichotomy, fixed point iteration, Cauchy sequences, Newton-Raphson method.

Mathematic practical on computer to solve problems of chapters III, IV, V.

Bibliography :

Requirements :
A-level Science programme. Basic knowledge of calculus with real numbers, first year year linear algebra.

Organisation :

Evaluation :
2 ninety-minute written examinations + 1 assessment grade + 1 math practical grade.

Target :

Sciences Industrielles	STP02-SIND
Number of hours : 36.00 h	3.00 ECTS credit
CM : 8.00 h, TD : 10.00 h, TP : 18.00 h	
Reference Teacher(s) : DEBLAISE DOMINIQUE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Sciences Industrielles FIRE	STP02-SIND_FIRE
Number of hours : 36.00 h	3.00 ECTS credit
CM : 8.00 h, TD : 10.00 h, TP : 18.00 h	
Reference Teacher(s) : DEBLAISE DOMINIQUE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Electrokinetics 2	STP02-ELEC
Number of hours : 49.00 h	4.00 ECTS credit
CM : 16.00 h, TD : 17.00 h, TP : 16.00 h	
Reference Teacher(s) : BOYER SOLINE	

Objectives :
Study of linear networks in sinusoidal and transient regimes.

Content :
Linear networks in sinusoidal mode: Use of compound numbers and Fresnel vectors. Impedance, mean and root-mean square
value. Analysis methods (Thévenin, Norton, Kennely, Millmann, Helmholtz theorems, etc.). Power in sinusoidal mode,
Boucherot theorem, power factor, matching. Transient regime: RC, RL and RLC circuits (aperiodic and pseudo periodic
regimes). Power balance.

Bibliography :

Requirements :
Compound numbers (modulus, argument). Differential calculus and differential equations of the 1st order with constant
coefficients. Analysis methods of linear circuits in continuous mode.

Organisation :
2 to 3 hours per week + preparation of the practical work.

Evaluation :
Two-hour written examination.
Ninety-minute Practical work examination.

Target :

Electrokinetics 2 FIRE	STP02-ELEC_FIRE
Number of hours : 49.00 h	4.00 ECTS credit
CM : 16.00 h, TD : 17.00 h, TP : 16.00 h	
Reference Teacher(s) : BOYER SOLINE	

Objectives :
Study of linear networks in sinusoidal and transient regimes.

Content :
Linear networks in sinusoidal mode: Use of complex numbers and Fresnel vectors. Impedance, mean and root-mean square
value. Analysis methods (Thévenin, Norton, Kennely, Millmann, Helmholtz theorems, etc.). Power in sinusoidal mode,
Boucherot theorem, power factor, matching. Transient regime: RC, RL and RLC circuits (aperiodic and pseudo periodic
regimes). Power balance.

Bibliography :

Requirements :
Calculation with compound numbers (modulus, argument). Differentials and differential equations of the 1st order with
constant coefficients. Analysis methods of linear circuits in continuous mode.

Organisation :
2 to 3 hours per week.

Evaluation :
Two-hour written examination.
Ninety-minute Practical work examination.

Target :

Chemistry 2 (from solution to solid)	STP02-CHIM
Number of hours : 46.00 h	3.50 ECTS credit
CM : 14.00 h, TD : 16.00 h, TP : 16.00 h	
Reference Teacher(s) : CALVEZ GUILLAUME	

Objectives :
The study of acid-base balance, complexation and precipitation in aqueous solutions. Understanding solid state structures.

Content :
I. REACTION AND CHEMICAL EQUILIBRIUM: Law of Mass action. Reaction quotient. Predominance zones of conjugate
species as a function of pH. Study of equilibrium problems in solutions. pH calculations.
II. COMPLEXES: Nomenclature in mineralogical chemistry. Complex formation reactions. Stability of complexes according
to the environment.
III. Heterogeneous environment. Comprehension of phenomena. Dissolution, precipitation, calculation of solubility. pH/complex/dissolution interactions.
IV. CRYSTALLINE SYSTEMS: Amorphous and crystal solid state. Model of the perfect crystal. Elementary definitions of
the crystalline structure: lattice, unit cells, lattice site and motifs. crystalline systems. Number of motifs per conventional unit
cell, coordinancy, density and compactness.
V. COMPACT PACKING OF IDENTICAL SPHERES AND SITES: {AB} hexagonal close-packed and {ABC] face-centred
cubic structures. Tetrahedral and octahedral sites in face-centred cubic structures.
VI. THE MAIN TYPES OF CRYSTALS: Close-packed crystals (cubic and hexagonal close-packed structures) and non
close-packed structures (face-centred cubic structures). Description of three structure types derived from cubic systems: CsCl,
NaCl and ZnS. Definition of the coordinancy of anions (relative to cations); Diamonds, Graphite, Ice.
VII. OTHER STATES OF MATTER.

Bibliography :
ARNAUD (Dunod 1990) : Cours de chimie physique ; BEYNIER, MESPLEDE (Bréal 1993) : Solutions aqueuses BARLET (Dunod 1995) : La réaction chimique ; FABRITIUS (Ellipses 1991) : La réaction chimique ; MALLET, FOURNIE (Dunod 1995) : Cours de chimie 1ère année ; Symétrie et structure - J. Angenault.

Requirements :

Organisation :

Evaluation :
2 written examinations.
1 practical work test.

Target :

Chemistry 2 FIRE	STP02-CHIM_FIRE
Number of hours : 46.00 h	3.50 ECTS credit
CM : 14.00 h, TD : 16.00 h, TP : 16.00 h	
Reference Teacher(s) : CALVEZ GUILLAUME	

Objectives :
The study of acid-base balance, complexation and precipitation in aqueous solutions. Understanding solid state structures.

Content :
I. REACTION AND CHEMICAL EQUILIBRIUM: Law of Mass action. Reaction quotient. Predominance zones of conjugate
species as a function of pH. Study of equilibrium problems in solutions. pH calculations.
II. COMPLEXES: Nomenclature in mineralogical chemistry. Complex formation reactions. Stability of complexes according
to the environment.
III. Heterogeneous environment. Comprehension of phenomena. Dissolution, precipitation, calculation of solubility. pH/complex/dissolution interactions.
IV. CRYSTALLINE SYSTEMS: Amorphous and crystal solid state. Model of the perfect crystal. Elementary definitions of
the crystalline structure: lattice, unit cells, lattice site and motifs. crystalline systems. Number of motifs per conventional unit
cell, coordinancy, density and compactness.
V. COMPACT PACKING OF IDENTICAL SPHERES AND SITES: {AB} hexagonal close-packed and {ABC] face-centred
cubic structures. Tetrahedral and octahedral sites in face-centred cubic structures.
VI. THE MAIN TYPES OF CRYSTALS: Close-packed crystals (cubic and hexagonal close-packed structures) and non
close-packed structures (face-centred cubic structures). Description of three structure types derived from cubic systems: CsCl,
NaCl and ZnS. Definition of the coordinancy of anions (relative to cations); Diamonds, Graphite, Ice.
VII. OTHER STATES OF MATTER.

Bibliography :
ARNAUD (Dunod 1990) : Cours de chimie physique ; BEYNIER, MESPLEDE (Bréal 1993) : Solutions aqueuses BARLET (Dunod 1995) : La réaction chimique ; FABRITIUS (Ellipses 1991) : La réaction chimique ; MALLET, FOURNIE (Dunod 1995) : Cours de chimie 1ère année ; Symétrie et structure - J. Angenault.

Requirements :

Organisation :

Evaluation :
2 written examinations.
1 practical work test.

Target :

English	STP02-ANGL
Number of hours : 24.00 h	2.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : KERSUSAN SYLVIA, LE TINNIER ANNE	

Objectives :
General Objectives

-Improving communication skills in everyday life situations as well as in a professional or social context.

Language-oriented objectives

-Obtaining or reinforcing B2 level, required for graduation and defined by CEFRL.

Content :
-Learning by doing: students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.

-Expressing oneself accurately and fluently: students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
-English Grammar in Use, Intermediate Edition (CUP)
-Oxford Advanced Learners¿ Dictionary (online)

Requirements :
-Good command of secondary education curriculum

Organisation :
-Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.

-Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet.

-Regular personal work is required. Students must be curious and practise their English outside the classroom.

Evaluation :
A 15-minute oral exam
A two-hour test including oral comprehension and written expression

Target :

Culture et communication	STP02-MS
Number of hours : 24.00 h	1.50 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : ECHARD PHILIPPE, PRIGENT HELENE	

Objectives :
Scientific and technological mediation: discover through the practice and teaching of science.
Real scientific reflection required when partaking in exercises, some of which, particularly the production of posters, serve the common good of economic growth and contribute to the social appropriation of science.
Students are introduced to the world of scientific research through collaboration with the INSA laboratories.
The 4th Biennial Equality Summit (Biennale de l¿Egalité) organised by the Brittany Regional Council (Région Bretagne) is to be held in Lorient in 2014. INSA students who have followed this course may be invited to represent the school (stands, exhibits, workshops, etc).

Learning outcomes:
.Familiarisation with the principal learning mechanisms (contribution of scientific education);
.Familiarisation with some important didactic methods;
.Identifying the main characteristics of an audience;
.Discovery of some contributions of the epistemology of science;
.Discovery of the nature and scope of scientific and technological knowledge;
.Introduction to questions which agitate the relationship between techno-science and society;
.Conception, implementation and evaluation of a project on scientific meditation;
.Acquisition of the fundamentals of document retrieval;
.Acquisition of some scientific and technological tools and aids;
.Elucidation (datavision concepts);
.Clear and concise written and oral expression;
.Acquisition of the fundamentals of non-verbal communication.

Content :
Learning supports for this tutorial are obtained via L¿association des Petits Débrouillards, the Centre for Scientific and Technological Culture (Centre de Culture Scientifique et Technique) « Armor Science », or L¿Espace des Sciences.
In pairs, students participate in the following activities:
.Make a poster and exhibit it at the INSA (possible themes: sustainable development, the hybridisation of art and science, social responsibility, innovation processes in businesses, etc);
.Visit the INSA poster exhibition with a view to analysing and criticising the mediation devices;
.Attend conferences with a view to analysing and criticising the mediation devices;
.Write a critical account following a filmed oral presentation.
.Argumentative writing and debating skills.
The move towards a digital society is in accordance with the objectives outlined in C2i:
-B1 : Teamwork and data exchange.
1. Adapt resources of different origin in order to pool, exploit or transmit them.
2. Manage the life-cycle and version of documents.
3. Contribute to a collaborative professional project implementing best practices.
4. Conduct a collaborative professional project
- B4 : Restitution, dissemination of knowledge
1. Norms and standards relative to the publishing and distribution of digital documents.
2. Compliance with the semiological rules currently in use for the production of graphic documents.
3. Devise and create communication media adapted in accordance with a target audience.

General culture.

Bibliography :
David Mac Candless, Datavision, Robert Laffont, 2011.
Fontenelle, Entretiens sur la pluralité des mondes, Marcel Didier, 1966.
Marie-Louise Pierson, L'image de soi, Eyrolles, 2005

Requirements :
Completion of the Culture and Communication module of Semester 1

Organisation :

Each tutorial lasts two hours. Most rooms are equipped with video projectors. Students may be required to participate in external events such as the « Forum des enterprises » (Business Forum) or Conferences. Consistent personal input is required.

Evaluation :
Continuous Assessment (separate marks for oral and written work)

Target :

French as a foreign language (FLE)	STP02-FLEMS
Number of hours : 24.00 h	1.50 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : FOURE DOMINIQUE	

Objectives :
To achieve level B1 of the European Common Language Reference by the end of the two semesters.

Content :
Understanding and sustaining everyday conversations. Describing events or personal experiences. Interacting in basic tasks.
Exchanging information Note-taking. Writing descriptive and argumentative texts.

Bibliography :
D.Abry, C.Fert, C. Parpette, J. Stauber, ICI 1 et ICI 2, méthodes de français, CLE International
C.Miquel, Communication progressive du français, niveau débutant, CLE International
M. Boularès, Conjugaison progressive du français, CLE International
C.Miquel, Vocabulaire progressif du français, niveau débutant, CLE International

Requirements :

Organisation :

Evaluation :
Continuous assessment: 50%.
Two-hour written examination: 50%

Target :

Sport and physical Education	STP02-EPS
Number of hours : 20.00 h	1.00 ECTS credit
TD : 20.00 h	
Reference Teacher(s) : LE LAGADEC PIERRE, VAILLANT GERARD	

Objectives :
1. Integrating the INSA/a group.
2. Knowing one's strengths and weaknesses. Finding a position/role best suited to one's abilities.
3. Review of the principles of action and technique in sport.
4. Teamwork and communication.
5. Warm up procedures for any physical activity.

Content :
-Rugby (compulsory, 14hours): Player cooperation and group project, handling threats to one's physical integrity. Organisation: Defining the various types of tactics (bypass, penetration, etc.).
-Team sport, chosen by group and played on small pitches (14hours): Principles of balance and disequilibrium in team sports.
Organisation of physical education schedule: Classes grouped into two semi-modules of 14hours.
Rugby: Discovery of the fundamental principles of the only contact team-sport played, awareness of the socio-motive aspect
and of the importance of support within the group. Tactics - the static overload of a zone followed by bypass of the zone.
Technical work - handling of the ball, framing-overflowing, tackling. Psychological aspects - emphasis on improved stress
management with consideration given to physical equilibrium and the possible violation of one's private space.

Bibliography :
Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Français Langue Etrangère A - 1STPI	STP02-FLE A
Number of hours : 20.00 h	1.00 ECTS credit
TD : 20.00 h	
Reference Teacher(s) : FOURE DOMINIQUE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

SHES	STP02-SHESx
Number of hours : 10.00 h	1.00 ECTS credit
TD : 10.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Professional Project	STP02-PPI
Number of hours : 6.00 h	0.50 ECTS credit
PR : 4.00 h, TD : 2.00 h	
Reference Teacher(s) : LE BAIL SYLVIE	

Objectives :
Students must give thought to their professional ambition.

Content :
- Interviews with qualified engineers.
- Company visits.
- Round-table discussions.
- Search for a work-placement.

Bibliography :

Requirements :

Organisation :
Search for a work-placement.
Writing of a report (re: interviews with engineers).
Establishment of a concrete professional project.

Evaluation :
Oral examination (during which the student will present his thoughts on his professional project).

Target :

Cross cutural opening	STP02-OI
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : KERSUSAN SYLVIA	

Objectives :
Help the students to understand and aprehand social, professional and family situations related to the experience will have as foreign students, while improving their English vocabulary.

Content :
Different topics and questions dealing with "Being a foreigner and living abroad". Also, working on what it means to be a foreigner in france.

Bibliography :
Newspaper and magazine articles - the internet
French or Foe? - Polly Platt

Requirements :
A good English level (B2)

Organisation :
rading of texts, debates personel research, vocabulary oral presentations.

Evaluation :
finale grade

Target :

Français Langue Etrangère B - 1STPI	STP02-FLE B
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : FOURE DOMINIQUE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

German (first language) / Project	STP02-ALLDEB
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

German (second language)	STP02-ALL
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
-To consolidate language skills acquired during secondary education with the goal of achieving at least the B1 level by the end
of the first cycle
-To develop listening and reading skills using contemporary resources (largely literary).
-To develop speaking skills through pair work, group work and discussions involving the entire class.
-To prepare the student for autonomous progression.

Content :
1. This module follows the Schritte 5 method.
Themes: everyday life situations, the professional world, entertainment, health, multilingualism, the environment.
2. Revision of grammar basics (basic tenses, conjugation, pronouns, etc.).
3. Group work and role-plays.

Bibliography :
1. Silke Hilpert et al., Schritte 5 Kursbuch + Arbeitsbuch, Munich : Hueber, 2005.
2. Dictionnaire bilingue français-allemand / allemand-français Harraps Universal
3. Waltraud Legros, Ach so ! Les bases de la grammaire allemande : tout reprendre à zéro, Paris : Ellipses, 1999.

Requirements :
Finishing level in LV2.

Organisation :
Students are asked to regularly read publications and watch films in German. Each session reinforces the previous one and
prepares the student for the next.

Evaluation :
Oral examination in the second semester.

Target :

German (first language)	STP02-ALL+
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
-To achieve a minimum of level B2/C1 by the end of the first cycle.
-To improve reading and listening skills using contemporary resources (largely non literary) with a view to preparing for the ZMP test.
-To develop writing and speaking skills through exercises in small groups and discussions involving the entire class.
-Students should be prepared to advance autonomously.

Content :
1. This module is largely based on the study of TV and radio broadcasts, newspaper articles and films. The realisation of
projects also plays an important role. Exercises prepare the students for the demands of the ZMP test (Global and detailed
comprehension, argumentation, etc.).
2. General revision of grammar: verbal group.
3. Group work, role plays.
4. Preparation for placements abroad.
5. Preparation for a trip abroad every other year.

Bibliography :
1. Eva-Maria Willkop et al., Auf neuen Wegen. Deutsch als Fremdsprache für die Mittelstufe und Oberstufe, Munich : Hueber, 2003.
2. Dictionnaire bilingue français-allemand / allemand-français Harraps Universal
3. Waltraud Legros, Ach so ! Les bases de la grammaire allemande : tout reprendre à zéro, Paris : Ellipses, 1999.

Requirements :
Finishing level in LV1.

Organisation :
Students are asked to regularly read publications and watch films in German. Each session reinforces the previous one and
prepares the student for the next.

Evaluation :
Written examination and oral examination in the first semester.

Target :

Espagnol Débutants - 1STPI	STP02-ESPDEB
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol Intermédiaire - 1STPI	STP02-ESP
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol confirmé - 1STPI	STP02-ESP+
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Arabic	STP02-ARA
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
According to level : Beginners (A1), Intermediate (A2/B1), Advanced (B1-B2). Help the students to progress autonomously.

Content :
Written and oral communication. Firstly, in everyday life situations, and secondly in other fields such as professional topics.
- Films and book extracts are used as a learning aid.
- Individual exercices and group work, oral presentations for intermediates
- Grammar
- Cinema, literature and civilization.

Bibliography :

Requirements :

Organisation :
Classes take place at SUPELEC (campus de Beaulieu)

Evaluation :
Final grade (overseen by SUPELEC)

Target :

Chinese	STP02-CHI
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
To acquire the basics of Chinese, Essential structures and vocabulary, Comprehension, expression ans pronunciation, Use of
everyday Chinese.

Content :
Oral skills : corrective phonetics (pinyin system), listening to and analysis of complex sentences and simple texts, oral
exercizes (student-student / student-teacher), introduction of new characters (pronunciation and tone accentuation).
Written skills : prose/translation, written production of complex sentences and simple texts, learning and reinforcement of
grammatical ans vocabulary mechanisms, oral and written Chinese, learning of new characters (order of lines, basic
ideograms), reading and analysis of texts, text commentary.

Bibliography :
1. Interactive chinese, Sinolingua, 2004
2. Le chinois contemporain, WU Zhongwei, Sinolingua, 2010
3. Faire l'expérience du chinois, ZHANG Rumei, AI Xin, Higher Education Press, 2006
Other documents will be added to these basic books to provide the students with a wide panel of practical exercises.

Requirements :

Organisation :
Students are required to read the texts from the lessons (in character form), to rewrite the new characters, to work on the
application exercices on grammar, lexical and morphological points, to ask questions on the texts from the lessons, to do prose
and translation exercices.

Evaluation :
Oral test

Target :

Italian	STP02-ITA
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
Beginners : discover the Italian language and culture, learn how to communicate and express simple ideas.
Intermediate :
improve oral and written skills in order to reach a good level of communication. Advanced : Cultural and everyday life themes.
Cinema, literature and civilization.

Content :
Oral expression and comprehension
Reading and writing
Phonetics
Films and book extracts
Articles from the local news.

Bibliography :
La lingua italiana per Stranieri 1, 2, 3 P K.Katerinov
La prova orale 1, 2, 3 T. Marin
Rete 1 and Rete 2, Marco Mezzadri and Paolo Balboni, Guerra Edizioni
Newspaper clips and articles, films, book extracts.

Requirements :
Beginners : none.
Intermediate : at least one year of Italian.
Advanced : good level of written and spoken Italian.

Organisation :
Reading and written exercizes.

Evaluation :
Oral examination

Target :

Japanese	STP02-JAP
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
Basic user : breakthrough or beginner (A1) :
- Discovering the linguistic specificities of the language (phonetics, syntax)
- Discovering Japanese culture, traditions and customs
- Learning about two writing systems (Hiragana and Katakana)
- Good command of basic conversational skills in everyday life context.

Basic user : waystage or elementary (A2) :
- Introduction to ideograms (60 kanji)
- Reading simple texts (Manga etc.)
- Writing simple texts.
- Good command of oral skills in everyday life context.

Independent User (B1, B2) :
- Learning Kanji (60-200)
- Good command of reading, writing skills as well s oral comprehension and expression skills to study in Japan or visit the country.

Content :
Basic user : breakthrough or beginner (A1) :
- Improving / reinforcing Hiragana and Katakana
- Manga reading
    - Lesson 5 : hobbies
    - Lesson 6 : using public transport
    - Lesson 7 : shopping
    - Lesson 8 : expressing how I feel.

Basic user : waystage or elementary (A2) :
- Good command of 30 kanji
- Manga reading
- Basic grammar skills
- Reading and writing simple texts
- How to communicate in everyday life context.

Independent user (B1, B2) :
- Good command of over 30 kanji
- Manga reading
- Command of reading, writing skills as well as oral comprehension and expression skills.

Bibliography :
- Beginner level (A1) : Marugoto, 3A Network, to be published soon, Japan
- Basic user (A2) : Daichi, 1, 3A Network, 2008, Japan
- Independent user (B1, B2) : Minna no Nihongo, I and II, 3A Network, 1998, Japan & Satoru Koyama, J. Bridge, Bonjinsha, 2007, Japan

Requirements :
Beginner (A1) : None

Organisation :
The course is a tutorial. Each time, notions will be explained and then illustrated by a series of relevant examples, tasks and oral activities involving the students.

Evaluation :
- Writing test at the end of each semester
- Face-to-face individual oral (15 mn)

- Attendance, student's involvment.

Target :

Russian	STP02-RUS
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
According to level: Beginners (A1), Intermediate (A2/B1), Advanced (B1-B2). Help the students to progress autonomously.

Content :
Written and oral communication. Firstly in everyday life situations, and secondly in other fields such as professional topics.
-Films and book extracts are used as a learning aid
-Individual exercices and group work, oral presentations for intermediates
-Grammar
-Cinema, literature and civilization.

Bibliography :

Requirements :

Organisation :
Classes take place at SUPELEC (Campus de Beaulieu)

Evaluation :
Final grade (overseen by SUPELEC).

Target :

German (first language) / Project	STP02-ALLDEB
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

German (second language)	STP02-ALL
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
-To consolidate language skills acquired during secondary education with the goal of achieving at least the B1 level by the end
of the first cycle
-To develop listening and reading skills using contemporary resources (largely literary).
-To develop speaking skills through pair work, group work and discussions involving the entire class.
-To prepare the student for autonomous progression.

Content :
1. This module follows the Schritte 5 method.
Themes: everyday life situations, the professional world, entertainment, health, multilingualism, the environment.
2. Revision of grammar basics (basic tenses, conjugation, pronouns, etc.).
3. Group work and role-plays.

Bibliography :
1. Silke Hilpert et al., Schritte 5 Kursbuch + Arbeitsbuch, Munich : Hueber, 2005.
2. Dictionnaire bilingue français-allemand / allemand-français Harraps Universal
3. Waltraud Legros, Ach so ! Les bases de la grammaire allemande : tout reprendre à zéro, Paris : Ellipses, 1999.

Requirements :
Finishing level in LV2.

Organisation :
Students are asked to regularly read publications and watch films in German. Each session reinforces the previous one and
prepares the student for the next.

Evaluation :
Oral examination in the second semester.

Target :

German (first language)	STP02-ALL+
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
-To achieve a minimum of level B2/C1 by the end of the first cycle.
-To improve reading and listening skills using contemporary resources (largely non literary) with a view to preparing for the ZMP test.
-To develop writing and speaking skills through exercises in small groups and discussions involving the entire class.
-Students should be prepared to advance autonomously.

Content :
1. This module is largely based on the study of TV and radio broadcasts, newspaper articles and films. The realisation of
projects also plays an important role. Exercises prepare the students for the demands of the ZMP test (Global and detailed
comprehension, argumentation, etc.).
2. General revision of grammar: verbal group.
3. Group work, role plays.
4. Preparation for placements abroad.
5. Preparation for a trip abroad every other year.

Bibliography :
1. Eva-Maria Willkop et al., Auf neuen Wegen. Deutsch als Fremdsprache für die Mittelstufe und Oberstufe, Munich : Hueber, 2003.
2. Dictionnaire bilingue français-allemand / allemand-français Harraps Universal
3. Waltraud Legros, Ach so ! Les bases de la grammaire allemande : tout reprendre à zéro, Paris : Ellipses, 1999.

Requirements :
Finishing level in LV1.

Organisation :
Students are asked to regularly read publications and watch films in German. Each session reinforces the previous one and
prepares the student for the next.

Evaluation :
Written examination and oral examination in the first semester.

Target :

Espagnol Débutants - 1STPI	STP02-ESPDEB
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol Intermédiaire - 1STPI	STP02-ESP
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol confirmé - 1STPI	STP02-ESP+
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Arabic	STP02-ARA
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
According to level : Beginners (A1), Intermediate (A2/B1), Advanced (B1-B2). Help the students to progress autonomously.

Content :
Written and oral communication. Firstly, in everyday life situations, and secondly in other fields such as professional topics.
- Films and book extracts are used as a learning aid.
- Individual exercices and group work, oral presentations for intermediates
- Grammar
- Cinema, literature and civilization.

Bibliography :

Requirements :

Organisation :
Classes take place at SUPELEC (campus de Beaulieu)

Evaluation :
Final grade (overseen by SUPELEC)

Target :

Chinese	STP02-CHI
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
To acquire the basics of Chinese, Essential structures and vocabulary, Comprehension, expression ans pronunciation, Use of
everyday Chinese.

Content :
Oral skills : corrective phonetics (pinyin system), listening to and analysis of complex sentences and simple texts, oral
exercizes (student-student / student-teacher), introduction of new characters (pronunciation and tone accentuation).
Written skills : prose/translation, written production of complex sentences and simple texts, learning and reinforcement of
grammatical ans vocabulary mechanisms, oral and written Chinese, learning of new characters (order of lines, basic
ideograms), reading and analysis of texts, text commentary.

Bibliography :
1. Interactive chinese, Sinolingua, 2004
2. Le chinois contemporain, WU Zhongwei, Sinolingua, 2010
3. Faire l'expérience du chinois, ZHANG Rumei, AI Xin, Higher Education Press, 2006
Other documents will be added to these basic books to provide the students with a wide panel of practical exercises.

Requirements :

Organisation :
Students are required to read the texts from the lessons (in character form), to rewrite the new characters, to work on the
application exercices on grammar, lexical and morphological points, to ask questions on the texts from the lessons, to do prose
and translation exercices.

Evaluation :
Oral test

Target :

Italian	STP02-ITA
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
Beginners : discover the Italian language and culture, learn how to communicate and express simple ideas.
Intermediate :
improve oral and written skills in order to reach a good level of communication. Advanced : Cultural and everyday life themes.
Cinema, literature and civilization.

Content :
Oral expression and comprehension
Reading and writing
Phonetics
Films and book extracts
Articles from the local news.

Bibliography :
La lingua italiana per Stranieri 1, 2, 3 P K.Katerinov
La prova orale 1, 2, 3 T. Marin
Rete 1 and Rete 2, Marco Mezzadri and Paolo Balboni, Guerra Edizioni
Newspaper clips and articles, films, book extracts.

Requirements :
Beginners : none.
Intermediate : at least one year of Italian.
Advanced : good level of written and spoken Italian.

Organisation :
Reading and written exercizes.

Evaluation :
Oral examination

Target :

Japanese	STP02-JAP
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
Basic user : breakthrough or beginner (A1) :
- Discovering the linguistic specificities of the language (phonetics, syntax)
- Discovering Japanese culture, traditions and customs
- Learning about two writing systems (Hiragana and Katakana)
- Good command of basic conversational skills in everyday life context.

Basic user : waystage or elementary (A2) :
- Introduction to ideograms (60 kanji)
- Reading simple texts (Manga etc.)
- Writing simple texts.
- Good command of oral skills in everyday life context.

Independent User (B1, B2) :
- Learning Kanji (60-200)
- Good command of reading, writing skills as well s oral comprehension and expression skills to study in Japan or visit the country.

Content :
Basic user : breakthrough or beginner (A1) :
- Improving / reinforcing Hiragana and Katakana
- Manga reading
    - Lesson 5 : hobbies
    - Lesson 6 : using public transport
    - Lesson 7 : shopping
    - Lesson 8 : expressing how I feel.

Basic user : waystage or elementary (A2) :
- Good command of 30 kanji
- Manga reading
- Basic grammar skills
- Reading and writing simple texts
- How to communicate in everyday life context.

Independent user (B1, B2) :
- Good command of over 30 kanji
- Manga reading
- Command of reading, writing skills as well as oral comprehension and expression skills.

Bibliography :
- Beginner level (A1) : Marugoto, 3A Network, to be published soon, Japan
- Basic user (A2) : Daichi, 1, 3A Network, 2008, Japan
- Independent user (B1, B2) : Minna no Nihongo, I and II, 3A Network, 1998, Japan & Satoru Koyama, J. Bridge, Bonjinsha, 2007, Japan

Requirements :
Beginner (A1) : None

Organisation :
The course is a tutorial. Each time, notions will be explained and then illustrated by a series of relevant examples, tasks and oral activities involving the students.

Evaluation :
- Writing test at the end of each semester
- Face-to-face individual oral (15 mn)

- Attendance, student's involvment.

Target :

Russian	STP02-RUS
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
According to level: Beginners (A1), Intermediate (A2/B1), Advanced (B1-B2). Help the students to progress autonomously.

Content :
Written and oral communication. Firstly in everyday life situations, and secondly in other fields such as professional topics.
-Films and book extracts are used as a learning aid
-Individual exercices and group work, oral presentations for intermediates
-Grammar
-Cinema, literature and civilization.

Bibliography :

Requirements :

Organisation :
Classes take place at SUPELEC (Campus de Beaulieu)

Evaluation :
Final grade (overseen by SUPELEC).

Target :

Music With Studies	HUMT2-MUS
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
- This module aims to enable students who have already reached a good level in music to continue practicing. - Group rehearsals. - Music as a means of developing the collaborative and adaptive abilities that are essential to any teamwork situation.

Content :
- Weekly group rehearsals
- Classical, jazz or folk music taught by music teachers
- Use of facilities at INSA-Rennes.
- At least 2 concerts per year.

Bibliography :

Requirements :
At least 5 years of practice.
The ability to read sheet music.
Admission to the "Music with Studies" section is decided upon through an audition conducted by the music teachers.

Organisation :
2 hours per week

Evaluation :
Continuous assessment: musical ability.

Target :

Theatre With Studies	HUMT2-THEA
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
- The art of oral expression.
- Performing before an audience.
- Further improve one's general knowledge.

Content :
- Reading and analysis of modern and classical drama.
- Theatre workshops run by professionals.
- Discovery of theatre professions.
- Live performance.

Students may choose this optional module at the beginning of the first, second, third or fourth year of studies. In doing so, an engagement is undertaken to complete two semesters (For evaluation see below).
The module covers both semesters of the academic year and is concluded by a performance.
There are two parts to the "Theatre with Studies" module:
1) Drama culture: Reading of works (one complete work and extracts which are likely to reveal the various facets of dramatic repertory). The fundamentals of drama history and acting techniques (Classic Greek drama, Diderot and Brecht dramas, etc).
Philosophical thought on "the world of the Theatre" and "the theatre of our World". The economics of setting up and running a theatre play.
Valérie Derrien-Remeur, PhD in French language and literature and head of the Department of Théâtre-Etudes oversees this module. The sessions take place on Thursday afternoons. The INSA library is associated with this module with the objective of building a corpus of works which students may consult and borrow.
2) In preparation for the end-of-year performance, every two weeks there are professionally-supervised drama-practice workshops. The professional (recruited by Valérie Derrien-Remeur) not only directs the show but is also in charge of the decor, costumes, sound and lighting, and furthermore, manages casting through specifically designed exercises.

Note: The "Theatre with Studies" section is open to all INSA students, however, given that the ultimate objective of the module is the theatre performance and that the means at our disposal are limited, we regret that no more than 30 students can enrol; each module is open to a maximum of 15 students.

Bibliography :
Bernardy M. : Traité de diction française à l'usage de l'honnête homme. Editions de l'aube, 1994. Boal A. : Jeux pour l'acteur et le non acteur. Editions La Découverte, 1997.
Collard G. : L'art de s'exprimer en toutes circonstances. Editions Presses de la Renaissance, 1999. Ubersfeld A. : Lire le théâtre. Editions Messidor, 1980.

Requirements :

Organisation :

Evaluation :
- Continuous assessment: participation in the everyday life of the section (possibility involving the organisation of a cultural event).
- Written document: (file, poster, invitation card, communication campaign, blog, etc).

Target :

High-Level sport with studies	HUMT2-ES
Number of hours : 6.00 h	1.00 ECTS credit
CM : 6.00 h	
Reference Teacher(s) : VAILLANT GERARD	

Objectives :
Students must set out and structure a personal project to establish the best possible coherence between engineering studies at
INSA and a career as a high-level athlete. Acquisition of specific knowledge and know-how.

Content :
- Lessons and conferences on the tools of project management.
- Guided work on project building (personal career).
- Stress management. Relaxation therapy. Action type profiling. Mental preparation. Athletic traumatology. Motivation.
Dietetics. Physical preparation.
Organisation : Lessons, and evening conferences.

Bibliography :
Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education website.

Requirements :

Organisation :

Evaluation :
Production of a personal-career dossier. Oral presentation (30 minutes).
The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :
Maximum 4 semestrial registrations throughout the whole cursus.

APES	HUMT2-APES
Number of hours : 30.00 h	1.00 ECTS credit
DIV : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Light & sound engineering for theatre with studies	HUMT2-TEK
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
Teach students how to deal with the technical aspects of theatre plays, concerts, public-address systems for conferences, recordings...
Put into practise knowledge and know-how acquired during the first semester through participation in "Art-with-studies" theatre plays, concerts and other events organised by the department of Modern Humanities.

Content :
Microphones, sound recording, sound software, stage/light mixing techniques, lighting desks and sound control systems : theoretical and practical experience.

Bibliography :

Requirements :
Students must have followed first semester classes

Organisation :
Workshops on Thursday afternoon in local venues or at INSA.

Evaluation :
Final mark

Target :
Any year

Semestre 3

Parcours Formation Initiale STPI

1	**STP03-TCS-1**		**Fundamental Science MODULE**	**7.00**
	STP03-PROBA	O	Introduction to probability	2.50
	STP03-INFO	O	Computer Science 3 (Databases)	2.00
	STP03-ANAL4	O	Analysis 4	2.50
2	**STP03-TCS-2**		**Experimental Science MODULE**	**11.00**
	STP03-MECA	O	Mechanics 2	3.00
	STP03-THPH	O	Thermophysics	3.00
	STP03-CHIM	O	Chemistry 3 (thermochemistry and electrochemistry)	3.00
	STP03-ELEC	O	Electronics 1	2.00
	STP03-TROMBI_A	F	Groupe_2A	3.00
	STP03-TROMBI_B	F	Groupe_2B	3.00
	STP03-TROMBI_C	F	Groupe_2C	3.00
	STP03-TROMBI_D	F	Groupe_2D	3.00
	STP03-TROMBI_E	F	Groupe_2E	3.00
	STP03-TROMBI_F	F	Groupe_2F	3.00
	STP03-TROMBI_G	F	Groupe_2G	3.00
	STP03-TROMBI_H	F	Groupe_2H	3.00
	STP03-TROMBI_I	F	Groupe_2I	3.00
	STP03-TROMBI_J	F	Groupe_2J	3.00
	STP03-TROMBI_K	F	Groupe_2K	3.00
3	**STP03-SENSI**		**Pre-Specialisation MODULE**	**3.00**
	EII03-SENSIB	C	Introduction to EII	1.00
	SRC03-SENSIB	C	Introduction to SRC	1.00
	GCU03-SENSIB	C	Sensibilisation GCU	1.00
	GMA03-SENSIB	C	Sensibilisation Génie Mécanique et Automatique	1.00
	SGM03-SENSIB	C	Sensibilisation Matériaux et Nanotechnologies	1.00
	INF03-SENSIB	C	Introduction to Computer Science	1.00
	MAT03-SENSIB	C	Sensibilisation Analyse de Risques, Optimisation et Modélisation	1.00
4	**STP03-STAG**		**Work Placement**	**4.00**
	STP03-STAG	O	Stage	4.00
5	**STP03-HUM**		**Humanities MODULE**	**5.00**
	STP03-ANGL	O	English 3	1.50
	STP03-COMM	O	Culture and communication 3	1.50
	STP03-PPI	O	Professional Project	0.00
	STP03-EPS	O	Sport and physical Education	1.00
	STP03-SHESx	O	Sciences Humaines Economiques et Sociales	1.00
6	**HUMT1-LANG2STP3**		**2nd Foreign Language MODULE**	**1.50**
	STP03-ALLDEB	C	Allemand Débutant - STPI	1.50
	STP03-ALL	C	German (second language)	1.50
	STP03-ALL+	C	German (First language)	1.50
	STP03-ESPDEB	C	Espagnol Débutant - STPI	1.50
	STP03-ESP	C	Espagnol 3 - 2STPI	1.50
	STP03-ESP+	C	Espagnol 3 confirmé - 2STPI	1.50

	STP03-FLE	C	French as a foreign language (FLE)	1.50
	HUMT1-ITA	C	Italian	1.50
	HUMT1-JAP	C	Japanese	1.50
	HUMT1-CHI	C	Chinese	1.50
	HUMT1-ARA	C	Arabic	1.50
	HUMT1-POR	C	Portuguese	1.50
	HUMT1-RUS	C	Russian	1.50
7	**HUMT1-LANG3STP3**		**3rd Foreign Language MODULE**	**1.50**
	STP03-ALLDEB	C	Allemand Débutant - STPI	1.50
	STP01-ALL	C	German (second language)	1.00
	STP03-ALL	C	German (second language)	1.50
	STP01-ALL+	C	German (first language) / Project	1.00
	STP03-ALL+	C	German (First language)	1.50
	STP03-ESPDEB	C	Espagnol Débutant - STPI	1.50
	STP01-ESP	C	Espagnol Intermédiaire - 1STPI	1.00
	STP03-ESP	C	Espagnol 3 - 2STPI	1.50
	STP01-ESP+	C	Espagnol confirmé - 1STPI	1.00
	STP03-ESP+	C	Espagnol 3 confirmé - 2STPI	1.50
	STP01-FLE B	C	French as a foreign language (FLE)	1.00
	STP03-FLE	C	French as a foreign language (FLE)	1.50
	HUMT1-ITA	C	Italian	1.50
	HUMT1-JAP	C	Japanese	1.50
	HUMT1-CHI	C	Chinese	1.50
	HUMT1-ARA	C	Arabic	1.50
	HUMT1-POR	C	Portuguese	1.50
	HUMT1-RUS	C	Russian	1.50
8	**HUMT1-ELSA ES**		**High-level sport with studies**	**1.00**
	HUMT1-ES	F	High-level sport with studies	1.00
9	**HUMT1-ELSA Mus**		**Music with studies**	**1.00**
	HUMT1-MUS	F	Music with studies	1.00
10	**HUMT1-ELSA Thea**		**Theatre with studies**	**1.00**
	HUMT1-THEA	F	Theatre with studies	1.00
11	**HUMT1-ELSA Tek**		**Light & sound engineering for theatre with studies**	**1.00**
	HUMT1-TEK	F	Light & sound engineering for theatre with studies	1.00

O = compulsary, C= in choice , F= optional

Introduction to probability	STP03-PROBA
Number of hours : 28.00 h	2.50 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : LEDOUX JAMES	

Objectives :
The objective of the module are twofold : use the basic tools of analysis in a new context and acquire a basic understanding of probability.

Content :
I - PROBABILITY SPACES. BASIC EXAMPLES
Notions of event and probability.
Discrete probability spaces
II - CONDITIONAL PROBABILITY AND INDEPENDENCE
Conditional probability. Independence of events
Three basic discrete models : Bernoulli, binomial, geometric distributions
III - DISCRETE RANDOM VARIABLES
Probability distribution of a random variable.
Joint probability distribution.
Independence of random variables.
Probability distribution of sums of random variables
IV - MOMENTS. VARIANCE. STANDARD INEQUALITIES.
Expectation of discrete random variables
Approximation of a random variable by a constant. Variance and covariance
Markov's and Tchebychev's inequalities
V - LINEAR REGRESSION. CORRELATION
Affine approximation of random variable
Correlation coefficient.
VI - PROBABILITY ON CONTINUOUS SPACES
Continuous probability spaces.Distribution function. Probability density : basic examples.
Probability distribution of continuous random variables. Moments

Bibliography :
C. Vigneron et Elisabeth Logak. - Probabilités discrètes. Diderot Editeur 1996
C. Vigneron et Elisabeth Logak. - Probabilités continues. Diderot Editeur 1996
J. -P Lecoutre - Statistique et probabilités, Dunod 2006
G. Saporta - Prababilités, analyse des données et statistique. Technip. 2066

Requirements :
Basic concepts in analysis of first year STPI

Organisation :

Evaluation :
two examinations. (90 mns)

Target :

Computer Science 3 (Databases)	STP03-INFO
Number of hours : 28.00 h	2.00 ECTS credit
PR : 0.00 h, TD : 14.00 h, TP : 14.00 h	
Reference Teacher(s) : SEBILLOT PASCALE	

Objectives :
To understand the usefulness of database management systems (DBMSs); to create and manipulate relational databases (DBs);
to program applications from different domains that use DBs.

Content :
The module focuses on the followings notions: DBMSs vs spreadsheets; querying of DBs using relational algebra; creation
and manipulation of relational DBs using SQL; mono-user and competitive access; conceptual modelling and its translation to
the relational DB framework; normalization elements; programming of a Java application using a server via the API JDBC.
Exact organization:
1. Relations, relational algebra, comparison with spreadsheets. Exemplification with Practical Work on spreadsheets.
2. Querying of databases in relational algebra.
3. Querying in SQL. Exemplification with Practical Work on simple interrogations.
4. Creation of a DB, access rights, modifications of relations, more complex interrogations (group by, division). Exemplification with Practical Work: Creating, manipulating and modifying a DB.
5. Competitive use, transactions, locking, integrity constraints, functional dependencies, normalization elements. Exemplification with Practical Work : Creation of a DB and competitive access.
6. Introduction to conception, conceptual data model (CDM).
7. Transformation of a conceptual model into the relational DB framework, Java interface. Exemplification with a series of
three practical works (mini-project) based on the CDM conception of an application, the creation of the corresponding DB, the
programming of an application software using this DB (Java interface, JDBC programming).

Bibliography :
- G. Gardarin : Bases de données. Eyrolles, 5e tirage, 2003
- J.-L. Hainaut : Bases de données et modèles de calcul. Cours et exercices (Premier cycle, IUT, BTS) Dunod, 2002

Requirements :
Mathematics: set theory, calculation of predicates.
INFO2 Module: object programming (Java).

Organisation :
Revision of class notes.
Preparation of the practical work.

Evaluation :
Two one-hour written examinations.

Target :

Analysis 4	STP03-ANAL4
Number of hours : 32.00 h	2.50 ECTS credit
CM : 16.00 h, TD : 16.00 h	
Reference Teacher(s) : LEY OLIVIER	

Objectives :
Consolidation of the basic notions of analysis ; in particular : functions of several real variables, numerical series, improper
integrals.

Content :
I - IMPROPER INTEGRALS
Unbounded Domain Integrals
Integrals of unbounded functions.
II - NUMERICAL SERIES
Series with positive terms.
General series.
III - FOURIER SERIES
Computation of the Fourier coefficients, convergence of the series
Parseval's equality
III - FUNCTIONS OF SEVERAL VARIABLES
Continuity.
Differentiability.
Extremums.
Implicit function theorem.
A first step in optimization

Bibliography :
- "Analyse (2ème année)" F. LIRET, D. MARTINAIS
- "Calculus III" J. MARSDEN, A. WEINSTEIN
- "Analysis" S. LANG
- "A first course in calculus" S. LANG

Requirements :
Elementary real analysis. Properties of real numbers. Functions of one real variable.

Organisation :
22 hours

Evaluation :
Two ninety-minute written examinations.

Target :

Mechanics 2	STP03-MECA
Number of hours : 28.00 h	3.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : BURGUIERE ANDRE	

Objectives :
This module completes the Mechanics I module by considering notions relative to: The behaviour of fluids, the characterisation of flow in a circuit. The behaviour of materials, the proportioning of simple structures subjected to elementary stresses.
The objective is to learn through participation in a project. There are no traditional classes or Practical Work. Several teams work in parallel on the same subject. Each team is free to carry out the project as it sees fit within the boundaries of the original specifications and the teacher's guidelines. Every year, a subject is chosen to encourage the students to investigate the scientific concepts they must acquire in order to validate the module.

Content :
I. INTRODUCTION TO FLUID MECHANICS: Essential properties of fluids. Deformability. Compressibility. Viscosity.
Notion of pressure. Fluid statics. Fundamental principle of fluid statics. Pascal's theorem. Archimedes' theorem. Incompressible fluid dynamics: General points. Permanent flow of a perfect fluid. Permanent flow of a real fluid. Study of
hydraulic circuits: Components and proportioning. Pumps. Determining characteristics of a circuit. Functioning poin.
II. PRACTICAL WORK: Study of Bernoulli's law (application on a Venturi tube). Study of regular pressure drop. Study of
singular pressure drop. Study of a centrifugal pump.
III. INTRODUCTION TO THE STRENGTH OF MATERIALS: General points. Objectives. Common problems. Implemented
means. Principal developments. Hypotheses of the strength of materials and modelling. Notion of fictive cut. Cohesion torsion.
Notion of stress. Study of simple stress. Tensile load. Compression. Plane bending: pure and simple. Study of straight sections.
Plane isostatic truss. Superposing theorem. Wording and applications to: the proportioning of a girder subjected to a composed
stress; the resolution of hyperstatic problems.
IV. PRACTICAL WORK: Tensile strength test. Tensile strength test in a linear static domain. Study of a plane isostatic truss.
Girder under simple bending: normal stress distribution in a straight section. Distortion of a girder subjected to plane simple
bending.

Bibliography :
Mécanique appliquée - P.Agati - DUNOD ; Mécanique des fluides appliquée - Régis Joulié

Requirements :
Mechanics 1: Modelling of the mechanical actions (Torsion). Statics. Mechanics.

Organisation :
A considerable amount of personal input is necessary.

Evaluation :

Target :

Thermophysics	STP03-THPH
Number of hours : 38.50 h	3.00 ECTS credit
CM : 14.00 h, TD : 14.00 h, TP : 10.50 h	
Reference Teacher(s) : LE CORRE ALAIN	

Objectives :
Introduction to microscopic thermodynamics with focus on heat machines.

Content :
Kinetic theory of gases: Microscopic model of perfect gases. Kinetic pressure of a gas. State equation of a perfect gas. Inner
energy and kinetic temperature. Equal distribution of energy. Calorific capacity of a perfect gas at constant volume. Real gas
according to Van der Waals. Energy results: Microscopic and macroscopic contribution to mechanical energy. Introduction
of inner energy. Work and thermal energy. Wording of the first principle. Work of pressure forces. Particular transformations
and Clapeyron's representation. Carnot's cycle of a perfect gas and output or efficiency coefficient of a heat machine. Entropy
results: Insufficiency of the 1st principle and wording of the 2nd principle. Entropy of a perfect gas. Entropic results of
reversible and irreversible transformations. Pressure and thermodynamic temperature. Statistical entropy and information.
Consequences of the 2nd principle. System coupled to the exterior environment (thermostat and pressure pool).

Bibliography :
""Introduction à la Thermodynamique"" J.P. Pérez, P. Laffont, MASSON (1996), ISBN 2-225-85377-0
""Thermodynamique"" J.M. Brébec 1ére année MPSI-PCSI-PTSI, Hprépa, Hachette (1995), ISBN 2.01.14.5147.7
""Réussir en Beauté sa Physique"" D. Damman, Prépas scientifiques, Ellipses (2001), ISBN 2-7298-0520-6

Requirements :

Organisation :
2hrs/week. Multiple choice questionnaire available on the internet (educ.insa) to revise the lectures.

Evaluation :
Three-hour written examination.
Ninety-minute Practical Work examination at the end of the semester.

Target :

Chemistry 3 (thermochemistry and electrochemistry)	STP03-CHIM
Number of hours : 42.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 14.00 h, TP : 14.00 h	
Reference Teacher(s) : GUILLOU OLIVIER	

Objectives :
Basics of thermochemistry. Determining reaction quantities at constant volume and pressure. Application to common industrial
processes.

Content :
I. DEFINITIONS AND FUNDAMENTAL ASPECTS SPECIFIC TO THERMOCHEMISTRY: Energy in transit. Work and
heat. Internal energy. State function of the system. State of advancement of a chemical system. The standard reaction
quantities.
II. FUNDAMENTAL RELATIONS DEDUCED FROM FIRST PRINCIPLES: Change of physical state of a pure entity.
Chemical reaction at a temperature T, at V, and P constant. Calorimetric elements. Relationship between the quantities Qp and
Qv. Molar standard enthalpy of formation. Calculation of reaction heats from tables.
III. FUNDAMENTAL RELATIONSHIPS DEDUCED FROM THE SECOND PRINCIPLE: Limits of the first principle. Spontaneous and resulting transformations. Entropy variation during a change of physical state and during a chemical reaction.
Gibbs free energy.
IV. PREDICTIONS OF THE DIRECTION OF EVOLUTION OF A REACTION. CALCULATION OF THE CHEMICAL
EQUILIBRIUM IN PERFECT SYSTEMS: Reaction between pure phases that stay this way. Reaction between several gases.
Shifting of the equilibrium. Determining the composition of a system at equilibrium.
V. ENLARGEMENT TO REAL SYSTEMS General notion of solution (solid/liquid/gas). The law of mass action in the
general case of solutions and in the particular case of diluted solutions.
VI. APPLICATION TO REDOX SYSTEMS: Oxidation number. Oxidised form,. Reduced form. Notion of battery. Reference
battery, EMF, Standard EMF. Electrode potential. NERNST equation,. Normal potential. Interaction between pH/complex/precipitation/redox. Predominance diagram function of pH. Predominance diagram E(pH) (Pourbaix diagram).
VII. PREDOMINANCE DIAGRAM OF PHASES: General case (P,V,T,xi). Particular case of binary diagrams (T, xi).
Eutectic and peritectic reaction. Azeotropes. Total or partial miscibility of various phases. Moments rule.

Bibliography :
ARNAUD (Dunod 1990) : Cours de chimie physique ; FABRITIUS (Ellipses 1990) : Thermodynamique chimique ; GRUGER
(Dunod 1997) : Thermodynamique chimique ; DIDIER (Technique et documentation - 1997 - Lavoisier - 6ième édition) Chimie Générale

Requirements :
From solution to solid. From atom to molecule.

Organisation :

Evaluation :
Two ninety-minute examinations.
Two thirty-minute Practical Work examinations.

Target :

Electronics 1	STP03-ELEC
Number of hours : 27.00 h	2.00 ECTS credit
CM : 7.00 h, TD : 8.00 h, TP : 12.00 h	
Reference Teacher(s) : ROBINET SYLVIE	

Objectives :
Basics of linear electronics.

Content :
I. FREQUENCY RESPONSE OF LINEAR NETWORKS IN SINUSOID STEADY-STATE: Quadrapoles (input and output
impedance). Transfer function. Gain in dB. Sizes of perfect real filters: low-pass, high-pass, band-pass, band-cutting.
Frequency analysis: Bode's diagram, cut-off frequencies and pass band at -3 dB for first order filters. RLC circuit in series:
resonance, overvoltage.
II. LINEAR OPERATIONAL AMPLIFIER: Description. Gain in open loop and properties of the ideal O.A. Basic circuits
with the ideal linear A.O.: follower, reverser and non reverser amplifier. Examples of active filters: low-pass integrator,
high-pass derivator, Sallen-Key.
III. REAL OPERATIONAL AMPLIFIER: Description and properties. Non linearity phenomena: open and closed loop saturation, limit scanning speed, current output limit. Flaws in linear steady-state: gain in open loop as a function of frequency. Influence on the behaviour of some real circuits.
IV. HARMONIC ANALYSIS OF PERIODIC SIGNALS: Root mean square and average values. Continuous component and
undulation. Fourier's theorem: examples of Fourier series decompositions, creation of a signal from a finished number of terms
of its Fourier Series. Bessel-Parseval's identity. Transmission of a periodic signal through a first order filter. Notion of spectrum
analyser.

Bibliography :

Requirements :
Electro-kinetics: linear networks analysis methods.
Mathematical tools: differential calculation and resolution of 1st order differential equations; complex numbers (argument and
modulus).

Organisation :
2 to 3 hrs/week + preparation of the Practical Work.

Evaluation :
Two-hour written examination.
Ninety-minute Practical Work examination.

Target :

Groupe_2A	STP03-TROMBI_A
Number of hours : 0.00 h	3.00 ECTS credit
TD : 2.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_2B	STP03-TROMBI_B
Number of hours : 0.00 h	3.00 ECTS credit
TD : 2.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_2C	STP03-TROMBI_C
Number of hours : 0.00 h	3.00 ECTS credit
TD : 2.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_2D	STP03-TROMBI_D
Number of hours : 0.00 h	3.00 ECTS credit
TD : 2.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_2E	STP03-TROMBI_E
Number of hours : 0.00 h	3.00 ECTS credit
TD : 2.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_2F	STP03-TROMBI_F
Number of hours : 0.00 h	3.00 ECTS credit
TD : 2.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_2G	STP03-TROMBI_G
Number of hours : 0.00 h	3.00 ECTS credit
TD : 2.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_2H	STP03-TROMBI_H
Number of hours : 0.00 h	3.00 ECTS credit
TD : 2.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_2I	STP03-TROMBI_I
Number of hours : 0.00 h	3.00 ECTS credit
TD : 2.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_2J	STP03-TROMBI_J
Number of hours : 0.00 h	3.00 ECTS credit
TD : 2.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Groupe_2K	STP03-TROMBI_K
Number of hours : 0.00 h	3.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Introduction to EII	EII03-SENSIB
Number of hours : 14.00 h	1.00 ECTS credit
CM : 1.00 h, TD : 1.00 h, TP : 12.00 h	
Reference Teacher(s) : COAT VERONIQUE	

Objectives :
- Second year students discover the department of Electronics and Computer Engineering (EII) through participation in
practical work. - Students are also introduced to various jobs and career prospects when they meet former EII students now
working in industry.

Content :
The module is split into 4 sessions of 3 hours (= one half day) + 2 informations sessions +one evening (after the fourth session) :

Sessions 1 to 4 cover Practical Work to discover:
- Electronics.
- Logic and Architecture.
- Automation and Signal processing.
- Image processing.
+
First information session (before session 1) is dedicated to practical module organization.
+
Second information session (before session 2) is devoted to additional information about EII Department International relationships.
+
Planning of the evening event :
Evening starts at 18H15:
- Students meet EII alumni.
- Presentation of EII engineers now working in companies (about 30mn).
- Questions and answers: Discussion between students and engineers (about 1h to 1h30).
- The discussion continues around a buffet to the restaurant of the INSA

Bibliography :

Requirements :
None.

Organisation :

Evaluation :
Practical Work (12 points) + participation in the evening event (8 points).

Target :

Introduction to SRC	SRC03-SENSIB
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) : MARY PHILIPPE	

Objectives :
An introduction to the work of the Department of Communication Systems and Networks (Ref Fr: SRC).
- Disciplines and related applications.
- Career prospects.

Content :
This module is split into 4 sessions (4 half-days) with workgroups of about ten students ; four sessions are dedicated to the
discovery of the themes studied in the SRC department. An introduction about half an hour to the module is provided before the start of the first session lab. The four sessions are closed by a conclusuion of the director of the department.

Introduction :
- Presentation of the SRC department, its fundamental teaching. Broad overview of industrial domains and jobs related to the department. Presentation of the session labs.

Session Labs1, 2, 3 and 4 : Workgroups :
- Electronics workgroup : making of simple circuits to exemplify the design principle of an electronic processing chain.
- Signal and communication workgroup : Study of fundamental signal processing functions in signal transmission using MATLAB demonstration chains. Discovery of the principles of signal processing platforms used for digital signal processing (DSP).
- Network workgroup : Discovery of network protocol principles.
- Radiofrequency workgroup : Discovery of the fundamental principles of radiance and propagation of waves through the study of antennas, the use of a spectrum analyser, etc.

Conclusion :
Detailed presentation of the SRC department. Detailed presentation of industrial sectors hiring engineers from the SRC department. Statistics from previous promotions.

Bibliography :
None.

Requirements :
None.

Organisation :
Revision of workgroup notes.

Evaluation :
The validation is based on the student assiduity and an active participation.

Target :

Sensibilisation GCU	GCU03-SENSIB
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) : DUPONT PASCAL	

Objectives :
Overview of the educational program of the GCU department in relation to the professional activities in the civil engineering : building, road, materials, ...

Content :
The program is divided into 4 parts :
- Structure basis : theoretical presentation of the mechanical stability of bridges structures and personal work around simple exercices
- Material science : practical activities to discorver some behaviors of granular materials
- Soil and fluid mechanics : practical activities to discover the importance of fluids
- Conference and visit of a construction site

Bibliography :

Requirements :

Organisation :

Evaluation :
Presence and report on each activities

Target :

Sensibilisation Génie Mécanique et Automatique	GMA03-SENSIB
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) : SOHIER CHRISTOPHE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Sensibilisation Matériaux et Nanotechnologies	SGM03-SENSIB
Number of hours : 14.00 h	1.00 ECTS credit
CM : 1.50 h, TP : 12.50 h	
Reference Teacher(s) : DURAND OLIVIER	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Introduction to Computer Science	INF03-SENSIB
Number of hours : 14.00 h	1.00 ECTS credit
TD : 7.00 h, TP : 7.00 h	
Reference Teacher(s) : GARCIA PASCAL	

Objectives :
Second year students are introduced to the Department of Computer Science. Presentations are given by professionals.
Students carry out a project on a specific application field.

Content :
Awareness programme:
Meetings with protagonists (7h):
* Teachers present an overview of the various study programmes and activities at the department.
* 4th year students present one of their projects.
* Discussion with engineers trained in the department.
* Visit IRISA. Meet students who are preparing their thesis.
Project in a field of application of the student's choice (21h):
* Image processing: Counting cars.
* Bioinformatics: Research on patterns. Alignment of sequences. Phylogeny.
* Artificial intelligence: Othello game.
Presentation of the project by the teacher (9h):
Execution of project in practical work rooms. Supervision by the teacher and 5th year students who play the role of project
leader (12h).

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Sensibilisation Analyse de Risques, Optimisation et Modélisation	MAT03-SENSIB
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) : DUPUY JEAN-FRANCOIS	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Stage	STP03-STAG
Number of hours : 0.00 h	4.00 ECTS credit
TD : 0.00 h	
Reference Teacher(s) : BENHLAL JAMAL	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

English 3	STP03-ANGL
Number of hours : 26.00 h	1.50 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : MORAN GARRETT	

Objectives :
General Objectives
Improving communication skills in everyday life situations, both at work and in informal environments. The module aims to consolidate skills developed during the first two semesters.

Language-oriented objectives
Obtaining or reinforcing B2 level, required for graduation and defined by CECRL.

Content :
Speaking and listening skills are focused upon first and foremost.

The ability to write and develop arguments using the appropriate grammar, syntax and vocabulary is also an area of skill that must be improved.

A level of oral expression that is as accurate and fluent as possible is the ultimate aim. Group activities that require spontaneity must be carried out, usually involving role-plays and discussions.

Being able to relay information to an audience in a coheherent and interesting way must be mastered. Group oral presentations are organised.

Bibliography :
A good dictionary (Oxford, Chambers, etc), preferably a paper version.

Requirements :
A reasonable level of English

Organisation :
- class duration is two hours. Video can be used to add variety to learning.

- teaching resources include written documents, grammar and vocabulary exercises, and other accessories as the need arises.

- passive behaviour among students can only reinforce a sentiment of failure.

- without at least 5 hours of personal work per week, students cannot expect to progress.

Evaluation :
A two-hour listening and written test involving a listening exercise and some written expression.

Target :
FIRE et filière classique

Culture and communication 3	STP03-COMM
Number of hours : 24.00 h	1.50 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
Context : Today's society exhibits an ever increasing tendency towards the written word. With the widespread use of communication technologies, we find ourselves dedicating a considerable amount of our time to reading and writing messages. This digital hypergraphia comprises many form of written expression, whether it be destined for an individual or a wider audience, and appears in various forms from an online chat to a tweet or form a blog to social networking. This convergence of the written word and technology has led to a never-before-witnessed mass circulation of messages of all types, some carefully written, others in time-saving shorthand, etc.

Knowledge of and practice of : digital writing, collaborative writing, informative writing and creative writing.

Individual writing project (French reference: PEP).

Writing for an audience.

Discover potentially lesser-known aspects of the language (and in doing so, find out more about yourself)

Content :
History of writing.

Ideas for writing and the organisation thereof.

Writing for an audience.

Specific aspects of writing on the web: hypertext, multimedia, interactivity, dissemination.

Basic principles of intellectual property rights and the responsibility associated with digital publication.

What is writing style ?

Participation in either the ¿Tweet¿Haïkus¿ event (in collaboration with ¿la Cantine Numérique¿) or in a novel-writing competition.

Spelling, syntax, grammar.

In 2013/2014 it will be possible to present projects at the Voltaire Certificate exam (included as a result of popular demand).
The objective of sitting the Voltaire Certificate exam is for each candidate to get a reliable and objective evaluation of how well he/she can master the difficulties of the French language in its written form. What¿s more, for prospective employers, the inclusion of the Voltaire Certificate in a CV is attractive because it attests to the candidate¿s competence in written French; its value is equivalent to that of the TOEIC®, TOEFL®, CLES® or IELTS® in English. It comprises the following: approximately 65% grammar rules, 15% semantic rules, 15% lexical rules, and 5% syntactic rules. With few exceptions, it proves knowledge of difficulties not yet mastered by spell-check software.

Produce texts from various writing constraints and boosters: as in constrained writing.

Writing for the Cinema ; visits to Brest and Clermont-Ferrand short film festivals. Scenario-writing for short films.

Writing and Photography: describing an image.

Writing and Reading: extracts from various works.

What is literature ?

Bibliography :
HADDAD Hubert, Le Nouveau Magasin d¿Ecriture, Zulma, 2006 and 2007.
MONOD Jean-Claude, Ecrire, à l¿heure du tout-message, Flammarion, 2013.

PICARD Georges, Tout le monde devrait écrire, éd.José Corti, 2006.
TREUSSARD Françoise, Le Dictionnaire des Papous dans la tête, Gallimard/France Culture, 2007.

Requirements :
None.

Organisation :
Each lesson lasts two hours.
Consistent personal input is required.

Evaluation :
Continuous Assessment (one mark)

Target :

Professional Project	STP03-PPI
Number of hours : 0.00 h	0.00 ECTS credit
PR : 4.00 h, TD : 4.00 h	
Reference Teacher(s) : LE BAIL SYLVIE	

Objectives :
Students are asked to reflect upon their professional project; in particular, on their choice of department of specialisation.

Content :
- Debriefing at the end of first year work placement.
- Updating of CV.
- Practice interview and presentation skills.
- Follow-up on internship reports in connection with the AIIR and the CEIP (With the support of CEIP).
- Conferences: personal development, business world, company creation, recruitment, etc.
- First steps in the detailed discovery of the various engineering professions.

Bibliography :

Requirements :

Organisation :
- Research into the various engineering professions.
- Organisation of meetings with engineers.

Evaluation :

Target :

Sport and physical Education	STP03-EPS
Number of hours : 22.00 h	1.00 ECTS credit
TD : 22.00 h	
Reference Teacher(s) : HINAULT YVAN	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice from three sports or physical activities for each period. Personality and responsibility development by adapting to
destabilising situations and taking responsibility when risk is involved. Speaking to groups. Leading group stretching
exercises.
- Climbing (1 for entrants and 2 for non-entrants) or coaching of a badminton team. The relationship between coach and
individual athlete.
- Outdoor activity: orienteering or kayak canoeing or golf.
Organisation: Two 14-hour sports or physical activity programmes in groups of twenty-four.

Bibliography :
Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Sciences Humaines Economiques et Sociales	STP03-SHESx
Number of hours : 10.00 h	1.00 ECTS credit
TD : 10.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Allemand Débutant - STPI	STP03-ALLDEB
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

German (second language)	STP03-ALL
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
- To achieve a minimum of level B2/C1 by the end of the first cycle.
- Improvement of reading and listening skills using contemporary resources (largely non-literary) in preparation for the ZMP test.
- Development of writing and speaking skills by working on exercises in small groups and holding discussions involving the entire class.
- Preparation for autonomous progress.

Content :
1. This module is largely based on the study of newspaper articles, films and TV and radio broadcasts. Projects also play an
important role. Exercises prepare the students for the demands of the ZMP test (Global and detailed comprehension, study of
argumentation, etc.).
2. General revision of grammar: verbal group.
3. Group work, role plays.
4. Preparation for placements abroad.
5. Preparation for a trip abroad every other year.

Bibliography :
1. Eva-Maria Willkop et al., Auf neuen Wegen. Deutsch als Fremdsprache für die Mittelstufe und Oberstufe, Munich : Hueber, 2003.
2. Dictionnaire bilingue français-allemand / allemand-français Harraps Universal
3. Waltraud Legros, Ach so ! Les bases
de la grammaire allemande : tout reprendre à zéro, Paris : Ellipses, 1999.

Requirements :
Finishing level in LV1

Organisation :
Students are asked to regularly read publications and watch films in German. Each session reinforces the previous one and
prepares the student for the next.

Evaluation :
Written examination and oral examination in the first semester.

Target :

German (First language)	STP03-ALL+
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol Débutant - STPI	STP03-ESPDEB
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol 3 - 2STPI	STP03-ESP
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol 3 confirmé - 2STPI	STP03-ESP+
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

French as a foreign language (FLE)	STP03-FLE
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : FOURE DOMINIQUE	

Objectives :
To achieve level B1-B2 of the European Common Language Reference by the end of the semester.

Content :
- Understanding an informative text.
- Presenting and expressing one's opinion about the contents of a document.
- Understanding the methods of composing and the actual writing of an argumentative text.
- Presenting and defending your opinion orally.
- The development of listening skills when confronted with a long speech (lectures, presentations, etc.).
- Reading articles and reports on contemporary subjects.

Bibliography :
ICI2 CLE International CAMPUS 2 et 3 CLE International.

Requirements :

Organisation :

Evaluation :
Continuous examination 50%.
Final evaluation 50%.

Target :

Italian	HUMT1-ITA
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : KERSUSAN SYLVIA	

Objectives :
Beginners: discover the Italian language and culture, learn how to communicate and express simple ideas.
Intermediate:
improve oral and written skills in order to reach a good level of communication. Advanced: Cultural and everyday life themes.
Cinema, literature and civilization.

Content :
Oral expression and comprehension
Reading and writing
Phonetics
Films and book extracts
Articles from the local news.

Bibliography :
La lingua italiana per Stranieri 1, 2, 3 PK.Katerinov
La prova orale 1, 2, 3 T.Marin
Rete 1 and Rete 2, Marco Mezzadri and Paolo Balboni, Guerra Edizioni
Newspaper clips and articles, films, book extracts.

Requirements :
Beginners: none
Intermediate: at least one year of Italian.
Advanced: good level of written and spoken Italian.

Organisation :
Reading and written exercises.

Evaluation :
Final grade.

Target :

Japanese	HUMT1-JAP
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) :	

Objectives :
Basic user : breakthrough or beginner (A1) :
- Discovering the linguistic specificities of the language (phonetics, syntax)
- Discovering Japanese culture, traditions and customs
- Learning about two writing systems (Hiragana and Katakana)
- Good command of basic conversational skills in everyday life context.

Basic user : waystage or elementary (A2) :
- Introduction to ideograms (60 kanji)
- Reading simple texts (Manga etc.)
- Writing simple texts.
- Good command of oral skills in everyday life context.

Independent User (B1, B2) :
- Learning Kanji (60-200)
- Good command of reading, writing skills as well s oral comprehension and expression skills to study in Japan or visit the country.

Content :
Basic user: breakthrough or beginner (A1) :
- General introduction to Japanese
- Command of two Japanese alphabets : 46 hiragana and 46 katakana.
  Lesson 1 : introducing oneself
  Lesson 2 : likes / dislikes
  Lesson 3 : where do I live ?
  Lesson 4 : everyyday life.

Basic user : waystage or elementary (A2) :
- Introduction to ideograms
- Learning kanji (30)
- Understanding a simple video (anime/cartoon)
- Basic grammar skills
- Reading and writing simple texts
- Learning how to communicate in everyday life context.

Independent User (B1, B2) :
- Good command of more than 30 kanji
- Understanding a simple video (anime/ cartoon)
- Command of reading, writing skills as well as oral comprehension and expression skills.

Bibliography :
- Beginner level (A1) : Marugoto, 3A Network, to be published soon, Japan
- Basic user (A2) : Daichi, 1, 3A Network, 2008, Japan
- Independent user (B1, B2) : Minna no Nihongo, I and II, 3A Network, 1998, Japan & Satoru Koyama, J. Bridge, Bonjinsha, 2007, Japan

Requirements :
Basic user (A1) : none.

Organisation :
The course is a tutorial. Each time, notions will be explained and then illustrated by a series of relevant examples, tasks and oral activities involving the students.

Evaluation :
- Writing test at the end of each semester

- Oral test at the end of each semester
- Attendance, student's involvment.

Target :

Chinese	HUMT1-CHI
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) :	

Objectives :
To acquire the basics of Chinese, Essential structures and vocabulary, Comprehension, expression ans pronunciation, Use of
everyday Chinese.

Content :
Oral skills : corrective phonetics (pinyin system), listening to and analysis of complex sentences and simple texts, oral
exercizes (student-student / student-teacher), introduction of new characters (pronunciation and tone accentuation).
Written skills : prose/translation, written production of complex sentences and simple texts, learning and reinforcement of
grammatical ans vocabulary mechanisms, oral and written Chinese, learning of new characters (order of lines, basic
ideograms), reading and analysis of texts, text commentary.

Bibliography :
1. Interactive chinese, Sinolingua, 2004
2. Le chinois contemporain, WU Zhongwei, Sinolingua, 2010
3. Faire l'expérience du chinois, ZHANG Rumei, AI Xin, Higher Education Press, 2006
Other documents will be added to these basic books to provide the students with a wide panel of practical exercises.

Requirements :

Organisation :
Students are required to read the texts from the lessons (in character form), to rewrite the new characters, to work on the
application exercices on grammar, lexical and morphological points, to ask questions on the texts from the lessons, to do prose
and translation exercises.

Evaluation :
Written test

Target :

Arabic	HUMT1-ARA
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
According to the student's level: Beginners (A1), Intermediate (A2/B1), Advanced (B1/B2). Help the students to progress autonomously.

Content :
Written and oral communication. Firstly in everyday life situations, and secondly in other fields such as professional topics.
-Films and book extracts are used as a learning aid.
-Individual exercises and group work, oral presentations for intermediates
-Grammar
-Cinema, literature and civilization.

Bibliography :

Requirements :

Organisation :
Classes take place at SUPELEC (campus de Beaulieu)

Evaluation :
Final grade (under SUPELEC responsability).

Target :

Portuguese	HUMT1-POR
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
Portuguese language is taught at Rennes 2 University

Content :

Bibliography :

Requirements :

Organisation :
Classes take place at Rennes 2 University.

Evaluation :

Target :

Russian	HUMT1-RUS
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
Set according to level: Beginners (A1), Intermediate (A2/B1), Advanced (B1/B2). Help the students to progress autonomously.

Content :
Written and oral communication. Firstly, in everyday life situations, and secondly in other fields such as professional topics.
-Films and book extracts are used as a learning aid.
-Individual exercices and group work, oral presentations for intermediates
-Grammar
-Cinema, literature and civilization.

Bibliography :

Requirements :

Organisation :
Classes take place at SUPELEC (Campus de Beaulieu)

Evaluation :
Final grade (overseen by SUPELEC).

Target :

Allemand Débutant - STPI	STP03-ALLDEB
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

German (second language)	STP01-ALL
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
-To consolidate language skills acquired during secondary education with the goal of achieving at least the B1 level by the end
of the first cycle
-To develop listening and reading skills using contemporary resources (largely literary).
-To develop speaking skills through pair work, group work and discussions involving the entire class.
-To prepare the student for autonomous progression.

Content :
1. This module follows the Schritte 5 method.
Themes: everyday life situations, the professional world, entertainment, health, multilingualism, the environment.
2. Revision of grammar basics (basic tenses, conjugation, pronouns, etc.).
3. Group work and role-plays.

Bibliography :
1. Silke Hilpert et al., Schritte 5 Kursbuch + Arbeitsbuch, Munich : Hueber, 2005.
2. Dictionnaire bilingue français-allemand / allemand-français Harraps Universal
3. Waltraud Legros, Ach so ! Les bases de la grammaire allemande : tout reprendre à zéro, Paris : Ellipses, 1999.

Requirements :
Finishing level in LV2.

Organisation :
Students are asked to regularly read publications and watch films in German. Each session reinforces the previous one and
prepares the student for the next.

Evaluation :
Oral examination in the second semester.

Target :

German (second language)	STP03-ALL
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
- To achieve a minimum of level B2/C1 by the end of the first cycle.
- Improvement of reading and listening skills using contemporary resources (largely non-literary) in preparation for the ZMP test.
- Development of writing and speaking skills by working on exercises in small groups and holding discussions involving the entire class.
- Preparation for autonomous progress.

Content :
1. This module is largely based on the study of newspaper articles, films and TV and radio broadcasts. Projects also play an
important role. Exercises prepare the students for the demands of the ZMP test (Global and detailed comprehension, study of
argumentation, etc.).
2. General revision of grammar: verbal group.
3. Group work, role plays.
4. Preparation for placements abroad.
5. Preparation for a trip abroad every other year.

Bibliography :
1. Eva-Maria Willkop et al., Auf neuen Wegen. Deutsch als Fremdsprache für die Mittelstufe und Oberstufe, Munich : Hueber, 2003.
2. Dictionnaire bilingue français-allemand / allemand-français Harraps Universal
3. Waltraud Legros, Ach so ! Les bases
de la grammaire allemande : tout reprendre à zéro, Paris : Ellipses, 1999.

Requirements :
Finishing level in LV1

Organisation :
Students are asked to regularly read publications and watch films in German. Each session reinforces the previous one and
prepares the student for the next.

Evaluation :
Written examination and oral examination in the first semester.

Target :

German (first language) / Project	STP01-ALL+
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

German (First language)	STP03-ALL+
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol Débutant - STPI	STP03-ESPDEB
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol Intermédiaire - 1STPI	STP01-ESP
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol 3 - 2STPI	STP03-ESP
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol confirmé - 1STPI	STP01-ESP+
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol 3 confirmé - 2STPI	STP03-ESP+
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

French as a foreign language (FLE)	STP01-FLE B
Number of hours : 19.00 h	1.00 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : FOURE DOMINIQUE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

French as a foreign language (FLE)	STP03-FLE
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : FOURE DOMINIQUE	

Objectives :
To achieve level B1-B2 of the European Common Language Reference by the end of the semester.

Content :
- Understanding an informative text.
- Presenting and expressing one's opinion about the contents of a document.
- Understanding the methods of composing and the actual writing of an argumentative text.
- Presenting and defending your opinion orally.
- The development of listening skills when confronted with a long speech (lectures, presentations, etc.).
- Reading articles and reports on contemporary subjects.

Bibliography :
ICI2 CLE International CAMPUS 2 et 3 CLE International.

Requirements :

Organisation :

Evaluation :
Continuous examination 50%.
Final evaluation 50%.

Target :

Italian	HUMT1-ITA
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : KERSUSAN SYLVIA	

Objectives :
Beginners: discover the Italian language and culture, learn how to communicate and express simple ideas.
Intermediate:
improve oral and written skills in order to reach a good level of communication. Advanced: Cultural and everyday life themes.
Cinema, literature and civilization.

Content :
Oral expression and comprehension
Reading and writing
Phonetics
Films and book extracts
Articles from the local news.

Bibliography :
La lingua italiana per Stranieri 1, 2, 3 PK.Katerinov
La prova orale 1, 2, 3 T.Marin
Rete 1 and Rete 2, Marco Mezzadri and Paolo Balboni, Guerra Edizioni
Newspaper clips and articles, films, book extracts.

Requirements :
Beginners: none
Intermediate: at least one year of Italian.
Advanced: good level of written and spoken Italian.

Organisation :
Reading and written exercises.

Evaluation :
Final grade.

Target :

Japanese	HUMT1-JAP
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) :	

Objectives :
Basic user : breakthrough or beginner (A1) :
- Discovering the linguistic specificities of the language (phonetics, syntax)
- Discovering Japanese culture, traditions and customs
- Learning about two writing systems (Hiragana and Katakana)
- Good command of basic conversational skills in everyday life context.

Basic user : waystage or elementary (A2) :
- Introduction to ideograms (60 kanji)
- Reading simple texts (Manga etc.)
- Writing simple texts.
- Good command of oral skills in everyday life context.

Independent User (B1, B2) :
- Learning Kanji (60-200)
- Good command of reading, writing skills as well s oral comprehension and expression skills to study in Japan or visit the country.

Content :
Basic user: breakthrough or beginner (A1) :
- General introduction to Japanese
- Command of two Japanese alphabets : 46 hiragana and 46 katakana.
    Lesson 1 : introducing oneself
    Lesson 2 : likes / dislikes
    Lesson 3 : where do I live ?
    Lesson 4 : everyyday life.

Basic user : waystage or elementary (A2) :
- Introduction to ideograms
- Learning kanji (30)
- Understanding a simple video (anime/cartoon)
- Basic grammar skills
- Reading and writing simple texts
- Learning how to communicate in everyday life context.

Independent User (B1, B2) :
- Good command of more than 30 kanji
- Understanding a simple video (anime/ cartoon)
- Command of reading, writing skills as well as oral comprehension and expression skills.

Bibliography :
- Beginner level (A1) : Marugoto, 3A Network, to be published soon, Japan
- Basic user (A2) : Daichi, 1, 3A Network, 2008, Japan
- Independent user (B1, B2) : Minna no Nihongo, I and II, 3A Network, 1998, Japan & Satoru Koyama, J. Bridge, Bonjinsha, 2007, Japan

Requirements :
Basic user (A1) : none.

Organisation :
The course is a tutorial. Each time, notions will be explained and then illustrated by a series of relevant examples, tasks and oral activities involving the students.

Evaluation :
- Writing test at the end of each semester

- Oral test at the end of each semester
- Attendance, student's involvment.

Target :

Chinese	HUMT1-CHI
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) :	

Objectives :
To acquire the basics of Chinese, Essential structures and vocabulary, Comprehension, expression ans pronunciation, Use of
everyday Chinese.

Content :
Oral skills : corrective phonetics (pinyin system), listening to and analysis of complex sentences and simple texts, oral
exercizes (student-student / student-teacher), introduction of new characters (pronunciation and tone accentuation).
Written skills : prose/translation, written production of complex sentences and simple texts, learning and reinforcement of
grammatical ans vocabulary mechanisms, oral and written Chinese, learning of new characters (order of lines, basic
ideograms), reading and analysis of texts, text commentary.

Bibliography :
1. Interactive chinese, Sinolingua, 2004
2. Le chinois contemporain, WU Zhongwei, Sinolingua, 2010
3. Faire l'expérience du chinois, ZHANG Rumei, AI Xin, Higher Education Press, 2006
Other documents will be added to these basic books to provide the students with a wide panel of practical exercises.

Requirements :

Organisation :
Students are required to read the texts from the lessons (in character form), to rewrite the new characters, to work on the
application exercices on grammar, lexical and morphological points, to ask questions on the texts from the lessons, to do prose
and translation exercises.

Evaluation :
Written test

Target :

Arabic	HUMT1-ARA
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
According to the student's level: Beginners (A1), Intermediate (A2/B1), Advanced (B1/B2). Help the students to progress autonomously.

Content :
Written and oral communication. Firstly in everyday life situations, and secondly in other fields such as professional topics.
-Films and book extracts are used as a learning aid.
-Individual exercises and group work, oral presentations for intermediates
-Grammar
-Cinema, literature and civilization.

Bibliography :

Requirements :

Organisation :
Classes take place at SUPELEC (campus de Beaulieu)

Evaluation :
Final grade (under SUPELEC responsability).

Target :

Portuguese	HUMT1-POR
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
Portuguese language is taught at Rennes 2 University

Content :

Bibliography :

Requirements :

Organisation :
Classes take place at Rennes 2 University.

Evaluation :

Target :

Russian	HUMT1-RUS
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
Set according to level: Beginners (A1), Intermediate (A2/B1), Advanced (B1/B2). Help the students to progress autonomously.

Content :
Written and oral communication. Firstly, in everyday life situations, and secondly in other fields such as professional topics.
-Films and book extracts are used as a learning aid.
-Individual exercices and group work, oral presentations for intermediates
-Grammar
-Cinema, literature and civilization.

Bibliography :

Requirements :

Organisation :
Classes take place at SUPELEC (Campus de Beaulieu)

Evaluation :
Final grade (overseen by SUPELEC).

Target :

High-level sport with studies	HUMT1-ES
Number of hours : 6.00 h	1.00 ECTS credit
CM : 6.00 h	
Reference Teacher(s) : VAILLANT GERARD	

Objectives :
Students must set out and structure a personal project to establish the best possible coherence between engineering studies at
INSA and a career as a high-level athlete. Acquisition of specific knowledge and know-how.

Content :
- Lessons and conferences on the tools of project management.
- Guided work on project building (personal career).
- Stress management. Relaxation therapy. Action type profiling. Mental preparation. Athletic traumatology. Motivation.
Dietetics. Physical preparation.
Organisation : Lessons, and evening conferences.

Bibliography :
Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education website.

Requirements :

Organisation :

Evaluation :
Validation of first semester : no mark awarded

Target :
Maximum 4 semestrial registrations throughout the whole cursus.

Music with studies	HUMT1-MUS
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
- This module aims to enable students who have already reached a good level in music to continue practicing. - Group rehearsals. - Music as a means of developing the collaborative and adaptive abilities that are essential to any teamwork situation.

Content :
- Weekly group rehearsals.
- Classical, jazz or folk music taught by music teachers.
- Use of facilities at INSA-Rennes.
- At least 2 concerts per year.

Bibliography :

Requirements :
At least 5 years of practice.
The ability to read sheet music.
Admission to the "Music with Studies" section is decided upon through an audition conducted by the music teachers.

Organisation :
2 hours per week

Evaluation :
Validation of first semester : no mark awarded

Target :

Theatre with studies	HUMT1-THEA
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
- The art of oral expression.
- Performing before an audience.
- Further improve one's general knowledge.

Content :
- Reading and analysis of modern and classical drama.
- Theatre workshops run by professionals.
- Live performance.

Students may choose this optional module at the beginning of the first, second, third or fourth year of studies. In doing so, an engagement is undertaken to complete two semesters (For evaluation see below).
The module covers both semesters of the academic year and is concluded by a performance.
There are two parts to the "Theatre with Studies" module:
1) Drama culture: Reading of works (one complete work and extracts which are likely to reveal the various facets of dramatic repertory). The fundamentals of drama history and acting techniques (Classic Greek drama, Diderot and Brecht dramas, etc).
Philosophical thought on "the world of the Theatre" and "the theatre of our World". The economics of setting up and running a theatre play.
Valérie Derrien-Remeur, PhD in French language and literature and head of the Department of Théâtre-Etudes oversees this module. The sessions take place on Thursday afternoons. The INSA library is associated with this module with the objective of building a corpus of works which students may consult and borrow.
2) In preparation for the end-of-year performance, every two weeks there are professionally-supervised drama-practice workshops. The professional (recruited by Valérie Derrien-Remeur) not only directs the show but is also in charge of the decor, costumes, sound and lighting, and furthermore, manages casting through specifically designed exercises.
Note: The "Theatre with Studies" section is open to all INSA students, however, given that the ultimate objective of the module is the theatre performance and that the means at our disposal are limited, we regret that no more than 30 students can enrol; each module is open to a maximum of 15 students.

Bibliography :
Bernardy M. : Traité de diction française à l'usage de l'honnête homme. Editions de l'aube, 1994. Boal A. : Jeux pour l'acteur et le non acteur. Editions La Découverte, 1997.

Requirements :

Organisation :

Evaluation :
Validation of first semester (no mark awarded)

Target :

Light & sound engineering for theatre with studies	HUMT1-TEK
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
Teach students how to deal with the technical aspects of theatre plays, concerts, public-address systems for conferences, recordings...

Content :
Microphones, sound recording, sound software,stage/light mixing techniques, lighting desks and sound control systems : theoretical and practical experience.

Bibliography :

Requirements :
None

Organisation :
Workshops on Thurday afternoon in local venues or at INSA

Evaluation :
Validation of first semester (no mark awarded)

Target :
Any year

Semestre 4

Parcours Formation Initiale STPI

1	**STP04-TCS-1**		**Fundamental Science MODULE**	**7.00**
	STP04-ALG3	O	Algebra 3 (matrix calculus)	2.50
	STP04-GEOM	O	Differential Geometry	3.00
	STP04-CALM	O	Mathematics computations	1.50
2	**STP04-TCS-2**		**Experimental Science MODULE**	**11.00**
	STP04-ELMG	O	Electromagnetism 2	2.00
	STP04-CHIM	O	Chemistry 4	3.00
	STP04-ACSA	O	Automated Systems	3.00
	STP04-ONDE	O	Waves	3.00
3	**STP04-PRESP**		**Specialisation MODULE**	**6.00**
	STP04-ELEC	C	Electronics 2	1.50
	STP04-ALGO	C	Algorithm and complexity	1.50
	STP04-IPROG	C	Object Oriented Programming	1.50
	STP04-LOGC	C	Combinatorial Logic	1.50
	STP04-MFLU	C	Introduction to Fluid Mechanics	1.50
	STP04-MMCS	C	Introduction to Continuum Mechanics	1.50
	STP04-MECM	C	Microstructural Classification of Materials	1.50
	STP04-COMP	C	Electronic components	1.50
	STP04-ANA	C	Outils d'analyse pour l'ingénieur	1.50
	STP04-STAT	C	Statistique pour l'ingénieur	1.50
4	**STP04-HUM**		**Humanities MODULE**	**6.00**
	STP04-ANGL	O	English 4	1.50
	STP04-PPI	O	Professional Project	1.00
	STP04-COMM	O	Culture and communication 4	1.50
	STP04-EPS	O	Sport and physical education	1.00
	STP04-SHESx	O	Sciences Humaines Economiques et Sociales	1.00
5	**HUMT2-LANG2STP4**		**2nd Foreign Language MODULE**	**1.50**
	STP04-ALLDEB	C	Allemand Débutant	1.50
	STP04-ALL	C	German (second language)	1.50
	STP04-ALL+	C	German (First language)	1.50
	STP04-ESPDEB	C	Espagnol Débutant	1.50
	STP04-ESP	C	Espagnol 4 - 2STPI	1.50
	STP04-ESP+	C	Espagnol 4 confirmé - 2STPI	1.50
	STP04-FLE	C	French as a foreign language	1.50
	HUMT2-ITA	C	Italian	1.50
	HUMT2-JAP	C	Japanese	1.50
	HUMT2-CHI	C	Chinese	1.50
	HUMT2-ARA	C	Arabic	1.50
	HUMT2-POR	C	Portuguese	1.50
	HUMT2-RUS	C	Russian	1.50
6	**HUMT2-LANG3STP4**		**3rd Foreign Language MODULE**	**1.50**
	STP04-ALLDEB	C	Allemand Débutant	1.50
	STP04-ALL	C	German (second language)	1.50
	STP04-ALL+	C	German (First language)	1.50

	STP04-ESPDEB	C	Espagnol Débutant	1.50
	STP04-ESP	C	Espagnol 4 - 2STPI	1.50
	STP04-ESP+	C	Espagnol 4 confirmé - 2STPI	1.50
	STP04-FLE	C	French as a foreign language	1.50
	HUMT2-ITA	C	Italian	1.50
	HUMT2-JAP	C	Japanese	1.50
	HUMT2-CHI	C	Chinese	1.50
	HUMT2-ARA	C	Arabic	1.50
	HUMT2-POR	C	Portuguese	1.50
	HUMT2-RUS	C	Russian	1.50
7	**HUMT2-ELSA Tek**		**Light & sound engineering for theatre with studies**	**1.00**
	HUMT2-TEK	F	Light & sound engineering for theatre with studies	1.00
8	**HUMT2-ELSA Thea**		**Theatre with Studies**	**1.00**
	HUMT2-THEA	C	Theatre With Studies	1.00
9	**HUMT2-ELSA Mus**		**Music with Studies**	**1.00**
	HUMT2-MUS	C	Music With Studies	1.00
10	**HUMT2-ELSA ES**		**High Level Sport with Studies / Sports Management MODULE**	**1.00**
	HUMT2-ES	F	High-Level sport with studies	1.00
11	**HUMT2-SAM(1)**		**"SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility)**	**1.00**
	HUMT2-APES	F	APES	1.00

O = compulsary, C= in choice , F= optional

Algebra 3 (matrix calculus)	STP04-ALG3
Number of hours : 28.00 h	2.50 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : CAMAR-EDDINE MOHAMED	

Objectives :
Matrix reduction method and application to linear differential systems solving

Content :
MATRIX REDUCTION
Matrix polynomials.
Eigenspaces and generalised eigenspaces.
Diagonalisation of a matrix.
Triangulation of a matrix.
Reduction of real symmetric matrices.
LINEAR DIFFERENTIAL EQUATIONS
Cauchy problem.
Solutions structure and wronskian.
Method of variation of constants
Matrix exponential.
Solving linear differential systems.
Solving linear differential equations of order n.

Bibliography :

Requirements :
Algebraic calculation and first year linear algebra.

Organisation :
30h

Evaluation :
2 written examinations

Target :

Differential Geometry	STP04-GEOM
Number of hours : 42.00 h	3.00 ECTS credit
CM : 18.00 h, TD : 24.00 h	
Reference Teacher(s) : CAMAR-EDDINE MOHAMED	

Objectives :
Geometric study of curves (in the plane, in space) and surfaces. Tools for calculating line and surface integrals. Stokes' theorems and their applications.

Content :
I - STUDY OF CURVES
Plane parameterised curves : local study, infinite branches, tracing of an arc, etc.
Construction of curves in polar coordinates.
Space curves.
Metric study of curves: curvilinear abscissa, length of an arc, curvature and radius of curvature, torsion.

II - STUDY OF SURFACES
Parametrised surfaces : local study, tangent plane, position of a parameterised surface with respect to its tangent plane
Particular surfaces: cylinders, cones, surfaces of revolution, ruled surfaces.

III - COMPUTING INTEGRALS AND APPLICATIONS
lINE INTEGRALS
Green-Riemann's theorem.
Surface integral and flux.
Stokes and Ostrogradski's theorems.
Applications.

Bibliography :

Requirements :
Vectorial, affine and Euclidian structures of R2 and R3.
Analysis 2 (First year undergraduate), Analysis 4 (second year undergraduate)

Organisation :

Evaluation :
Two written examinations

Target :

Mathematics computations	STP04-CALM
Number of hours : 0.50 h	1.50 ECTS credit
TD : 0.50 h	
Reference Teacher(s) : MONIER LAURENT	

Objectives :
Improve technics of computation for analysis and algebra

Content :
polynomial, matrix, vector calculus, linear algebra, vector space
Asymptotic expansion, integral, differential equation, multivariable calculus, improper integral etc

Bibliography :

Requirements :
Mathematics program of semester S1 to S3

Organisation :
Prepare one hundred exercises

Evaluation :
Oral examination (30 min)

Target :

Electromagnetism 2	STP04-ELMG
Number of hours : 29.50 h	2.00 ECTS credit
CM : 10.50 h, TD : 10.00 h, TP : 9.00 h	
Reference Teacher(s) : LEMOINE CHRISTOPHE	

Objectives :
- to understand the electromagnetic induction phenomenon
- to be able to apply the main physical tools related to electromagnetic induction on simple and real-life examples (for instance Eddy currents)
- to learn the basics on electromagnetism in linear materials (dielectric and magnetic materials)

Content :
I. ELECTROMAGNETIC INDUCTION:
Induction phenomenon. Lenz's law. Moving circuit in a permanent magnetic field.
Faraday's law. Fixed circuit in a variable magnetic field. General case: Induced electromotive force in a moving circuit. Mutual
and self-inductance coefficients: Magnetic energy in a two-circuit system. Applications: Foucault currents. Kelvin effect.
II. ELECTROMAGNETISM AND MATTER:
Dipole moment. Action of a field on a dipole. Dielectric environments:
polarisation. Polarisation charges. Magnetic properties of matter: Introduction to magnetisation. Magnetisation current;
Diamagnetics, Paramagnetics and Ferromagnetics. Electromagnetism in material environments: Introduction of D and H.
Maxwell's equations in material environments. Crossing conditions at the separation of two environments. Homogeneous and
isotropic linear environments (dielectric permittivity, magnetic permeability).

Bibliography :
- Polycopiés de cours INSA
- Polycopiés de TP INSA
- J.M. Brébec, P. Denève, Electromagnétisme 2ème Année (Hachette Supérieur)
- J.P. Faroux, J. Renault, Electromagnétisme 2 (Dunod)
- F. Masset, Electromagnétisme 2 (Ellipse)
- J.P. Pérez, R. Carles, R. Fl

Requirements :
Electromagnetism 1.

Organisation :
2 hours per week.

Evaluation :
Two-hour written examination.
Practical Work examination.

Target :

Chemistry 4	STP04-CHIM
Number of hours : 42.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 14.00 h, TP : 14.00 h	
Reference Teacher(s) : DAIGUEBONNE CAROLE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Automated Systems	STP04-ACSA
Number of hours : 42.00 h	3.00 ECTS credit
TD : 26.00 h, TP : 16.00 h	
Reference Teacher(s) : GOURDON JEAN-GUILLAUME	

Objectives :
The industrial environment continuously integrates processes and products based on automation ; therefore, it is essential that
every engineer, whatever his field of specialisation, be trained in the essential basics of this domain. This module is an
initiation to automated systems, associated technology and behavioural modelling via a descriptive approach.

Content :
I - Summary of the programme
I.1 - Lectures and tutorial classes.
1 - Presentation of automated systems and industrials sensors.
2 - Study of the energy chain : technology of the elements and choice of the actuatorss for different energy sources and their command system.
3 - Study of the information chain : logical and control systems.
I.2 - Practical work
Energy and information chains problem-solving in group of three students (educational and industrial models)
1 - Study of electric motorisation.
2 - Study of pneumatic and hydraulic components.
3 - Programming of an industrial automaton process.
4 - Study of an automated process : sensors.
5 - Servo-control: educational model.
II - Detailed programme
II.1 - Lectures and tutorials
1 - Presentation of automated systems
. Introduction
. definition of the energy chain
. definition of the information chain
. main industrial sensors
2 - Study of the energy chain
Technology of the elements of the energy chain and choice of the actuators and their command system for different energy
sources :
. pneumatic energy
. hydraulic energy
. electric energy
. selection criterion
3 - Study of the information chain
. combinatory systems
. sequential systems : GRAFCET model
. introduction of control systems : modelling and behaviour of continuous and invariant linear systems, controlled invariant
continuous linear systems, PID controllers
II.2 - Practical Work
1 - Stepper motorisation, continuous current.
2 - Study of the behaviour of hydraulic components and output.
3 - Study of pneumatic components. Characterisation of pneumatic motorisation.
4 - Programming of a programmable logical controller with GRAFCET language.
5 - Programming of a programmable logical controller with LADDER language.
6 - Analysis of an automation process and sensors.
7 - Analysis of a linear feedback system (position and speed of a DC motors).

Bibliography :
Logique combinatoire et séquentielle - Brie - ELLIPSE
Automatismes et automatique - Fabert - ELLIPSE
Langage de spécification GRAFCET pour diagramme fonctionnel en séquence - Normes Européennes EN 60848 (CEI 60848 : 2002)
Traitement de l'information, symboles de documentation et conventions applicables aux données, aux

organigrammes de programmation et d'analyse, aux schémas des réseaux de programmes et des ressources de systèmes - ISO 5807 : 1985
Automates programmables - Partie 3 : langages de programmation - CEI 1131-3
Automatismes et automatique - Fabert - ELLIPSE
Régulation automatique - Maret - PRESSES POLYTECHNIQUES ROMANDES
Théorie et calcul des asservissements linéaires - Gille, Decaulne, Pelegrin - DUNOD
Signaux et systèmes linéaires - Thomas - MASSON
Cours d'automatique - Tome 1 : signaux et systèmes - Rivoire, Ferrier - EYROLLES
Cours d'automatique - Tome 2 : asservissement, régulation et commande analogique - Rivoire, Ferrier - EYROLLES
Les capteurs en instrumentation - Asch - 6e ÉDITION
Capteurs - Toux - TECHNIQUES DE L'INGÉNIEUR

Requirements :
Mathematics :
- Linear differential equations ;
- Real and imaginary numbers ;
- Laplace transform (possibly).
Other disciplines :
- Introduction to fluid mechanics (Mechanics modules II - STP03-MECA2) ;
- Statics and dynamics (Mechanics modules I - STP02-MECA1).

Organisation :
about 12 hours

Evaluation :
- three-hour written examination
- practical work

Target :

Waves	STP04-ONDE
Number of hours : 38.50 h	3.00 ECTS credit
CM : 14.00 h, TD : 14.00 h, TP : 10.50 h	
Reference Teacher(s) : LOUALICHE SLIMANE	

Objectives :
This module takes a first look at waves in a vibrating string and in a fluid, and electromagnetic waves. Solutions to harmonic
wave problems are found and analyzed. Electromagnetic waves are described and used in applications involving interference
and/or diffraction properties.

Content :
Equation of vibrating strings. Revelation of spatial and temporal dependence. Wave in a fluid. Notion of the transverse and
longitudinal wave, speed of sound. Harmonic waves and plane waves. Notion of frequency, period, wavelength. Vibration
modes and forced oscillations. Notion of stationary waves. Doppler effect. Application to speed measurements and acoustic
imagery techniques.
Energy carried by a wave: Definition of intensity, Notion of acoustic decibel.
Interference and diffraction: Notion of cavities and of spectral and spatial filters.
Composition of waves: Monochromatic waves. Use of the complex expression of the field, factorisation of the temporal part of
the field, revelation of the importance of the spatial part of the phase and apparition of the phase and optical path length
difference. Importance of the initial phase, coherent and incoherent source. Waves of different frequencies Interference
between two waves Interference in multiple-wave. Diffraction phenomena.

Bibliography :
Polycopié du cours INSA : S. Loualiche,
Polycopié de TD et de TP J.M. Brebec, ,
J.N. Parisot, P. Deneve, Ondes 2ème année (Hachette, Hachette supérieur)
J.P. Perez, Fondements et applications, (Masson)

Requirements :
Optics and image formation.
Mathematics of Complex numbers and functions.

Organisation :
Two-hours per week

Evaluation :
Three-hour written examination.
Written examination based on Practical Work.
Practical work examination.

Target :

Electronics 2	STP04-ELEC
Number of hours : 28.00 h	1.50 ECTS credit
CM : 8.00 h, TD : 8.00 h, TP : 12.00 h	
Reference Teacher(s) : PROVOST JEAN-NOEL	

Objectives :
- Study of electronic circuits composed of an assembly of elementary functions.
- Practical application of the circuits studied in the electronics 1 module (networks, AOP, filters).
- Introduction of simple functions based on semiconductors (diodes, transistors).

Content :
- Introduction to the use of electronic circuits by studying the simple treatment of an analog signal (a concrete example is chosen to illustrate this module). The chosen system is composed of an amplification function, filtering functions, and other functions realised with transistors.
- The diode: Behaviour, modelling and example of use. Rectifier circuits.
- The bipolar transistor: Behaviour, functioning zones, use in commutation, linearisation principle, polarisation circuits,
elementary amplifying circuits.

Bibliography :

Requirements :
Validation of the following modules: Electrokinetics 1 and 2 and Electronics 1.

Organisation :

Evaluation :
Written examination covering the Practical Work aspect of the module. (2 hours)

Target :

Algorithm and complexity	STP04-ALGO
Number of hours : 28.00 h	1.50 ECTS credit
TD : 18.00 h, TP : 10.00 h	
Reference Teacher(s) : GARCIA PASCAL	

Objectives :
The construction of algorithms and an understanding of the notion of complexity.

Content :
1. Introduction to complexity.
2. Sorting algorithms, route algorithms of sorted structures, complexity calculation.
3. Resolution of recurrent equations in order to calculate the complexity of recursive algorithms.
4. Introduction to dynamic programming.
5. Research algorithms, heuristic pruning.

Bibliography :
1. Art of Computer Programming, Vol. 1-3, Knuth, Addison-Wesley, 1973.
2. Structures de données et algorithmes, Aho, Hopcroft, Ullman, Addison-Wesley, 1987.
3. Types de données et algorithmes, Froidevaux, Gaudel et Soria, Mc Graw-Hill, 1990.
4. Concrete Mathematics, Graham, Knuth, Patashnik, Addison-Wesley, 1990.
5. Introduction à l'algorithmique, Cormen et Leiserson, Dunod, 1992.
6. Mathématiques pour l'informatique"", Arnold et Guessarian, Masson, 1994.
7. Introduction à l'analyse des algorithmes"", Sedgewick et Flajolet, 1996.

Requirements :
Algorithmics; validation of modules 1 and 2. Java and Scheme programming.

Organisation :

Evaluation :
Two-hour written examination.

Target :

Object Oriented Programming	STP04-IPROG
Number of hours : 28.00 h	1.50 ECTS credit
TD : 14.00 h, TP : 14.00 h	
Reference Teacher(s) : ANQUETIL ERIC	

Objectives :
Fundamental understanding of object programming: abstraction, encapsulation, inheritance and polymorphism.

Content :
1. Notion of objects and classes in Java.
2. Compilation unit and Package.
3. Inheritance and Polymorphism.
4. Abstract classes and Interface.
5. Exceptions.
6. Java collection.
7. Graphic interface: AWT and Applet.

Bibliography :
1. Thinking in Java - Bruce Eckel - Upper Saddle River, NJ : Prentice.
2. Practical Object-Oriented Development in C++ and JAVA - C.S. Horstmann - wiley computer publishing.
3. Just Java2 (fourth edition) - Peter van der LINDEN - Sun MicroSystems Press.

Requirements :
Understanding of Java programming.
Validation of Algorithmics 1 and 2 modules.

Organisation :
Preparation of Practical Work.

Evaluation :
Two-hour written examination.

Target :

Combinatorial Logic	STP04-LOGC
Number of hours : 28.00 h	1.50 ECTS credit
CM : 12.00 h, TD : 8.00 h, TP : 8.00 h	
Reference Teacher(s) : COAT VERONIQUE	

Objectives :
The necessary methods and tools to design combinatorial logic systems.

Content :
1. Numeration systems: representation of signed and unsigned numbers, base change or conversion, representation with codes
(DCB codes, continuous codes).
2. Elementary logical functions: logical variables and functions (inclusive OR, AND, NOR, NAND, exclusive OR, Identity).
3. Representation of logical functions: truth tables, Karnaugh's tables, logical equations, decimal equivalents, complete and
incomplete logical equations.
4. Simplification of logical functions: Boole's algebra, Karnaugh's tables.
5. Combinatory circuits: multiplexers, decoders, priority encoders, parity generators and verifiers, comparators, arithmetic
circuits.

Bibliography :
1. MANGE D., ""Analyse et synthèse des systèmes logiques"", Traité d'électricité, Volume V, Presses Polytechniques Romandes, 1992.
2.LETOCHA J., ""Introduction aux circuits logiques"", McGraw-Hill, 1985.
3. TOCCI R. J., ""Circuits numériques - Théorie et applications"", Dunod, 1992.
4. BRIE C., ""Logique combinatoire et séquentielle : Méthodes, outils et réalisations"", Editions Ellipses, collection Technosup, 2002.

Requirements :
None.

Organisation :
Revision of the lecture notes. Preparation of the exercises and of the Practical Work.

Evaluation :
Two-hour written examination.

Target :

Introduction to Fluid Mechanics	STP04-MFLU
Number of hours : 28.00 h	1.50 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : HELLOU MUSTAPHA	

Objectives :
The fundamental basics of fluid dynamics. Preparation for the resolution of problems encountered in third year (first year of
specialisation). Classic applications of fluid mechanics. This module introduces the fundamentals of fluid dynamics needed to
address issues specific to each specialty. It also allows to study some typical applications in fluid mechanics.

Content :
I Representation of the fluid motion. Lagrange and Euler variables. Velocity field, circulation, acceleration, Streamlines.
Irrotational plane flow. Revolution flow. Rotational flow. Potential flow with circulation.
II Viscous fluid dynamics. Newtonian fluid. Dynamic viscosity. Stress tensor. General viscous flow equations.
III Exact solutions and applications. Couette flow. Poiseuille plane flow. Poiseuille flow. Permanent circular flow.

Bibliography :
1. JOULIE R., « Mécanique des fluides appliquée », éditions Ellipses, 1998. 2. GRAF W. et ALTINAKAR M. S., « Hydrodynamique », PPUR, 1995.
3. CHASSAING P., « Mécanique des fluides », Polytech, 1997.
4. COMOLET R., « Mécanique expérimentale des fluides», 3 tomes, Masson, 1994.
5. OUZIAUX R. et PERRIER J., « Mécanique des fluides appliquée », éditions Dunod, 1989.
6. SPURK J. H., «Fluid mechanics, problems and solutions», Springer, 1997.

Requirements :
Mathematics: integrals, differential equations, partial derivatives, tensor analysis.
Other disciplines: mechanics I and II, physics.

Organisation :

Evaluation :
Two-hour written examination.

Target :

Introduction to Continuum Mechanics	STP04-MMCS
Number of hours : 28.00 h	1.50 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : RAGNEAU ERIC	

Objectives :
Introduction to continuum mechanics through the study of a plane entity in order to clearly explain the different steps
necessary for the study of a part under construction (mechanical or civil engineering). In the interest of clarity, plane entities
are also the subject of new concepts developed in this module. This is an introduction to general theory in preparation for the
problems studied when the student enters one of the departments of specialisation.

Content :
1. Presentation of the objectives to be achieved through a typical problem
2. Plane stress state.
3. Small plane distortions.
4. Law of Linear Elastic behaviour and criteria of elastic limit L.
5. A look at stress fields and deformation.
6. Resolution methods adapted to the plane problems of elasticity.

Bibliography :
1. Analyse des structures et milieux continus - F. FREY, Presses Polytechniques et Universitaires Romandes.
2. Exercices d'élasticité - G.CAIGNERT et J.P. HENRY, Dunod, 1976.
3. Exercices et problèmes résolus de mécanique des milieux continus - J.OBALA, Masson, 1988.

Requirements :
Mathematics: Linear applications and matrices, Integrals and differential equations, Partial derivatives.
Mechanics: Mechanics I and II modules.

Organisation :
1 hour per week.

Evaluation :
A two-hour written examination.

Target :

Microstructural Classification of Materials	STP04-MECM
Number of hours : 28.00 h	1.50 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : GUILLOU ANNIE	

Objectives :
The relationships between microstructures of materials (rock, metallic alloys, ceramics) and their properties. Understanding
microstructure by studying phase diagrams of common alloys using micrography and characterisation methods. Methods for
the development or improvement of alloys. Basics of thermal treatment. (Why quench steel?).

Content :
Presentation of methods of characterisation (microscopy, thermal analysis, mechanical properties) Relationship between
microstructures and equilibrium diagrams. Applications. Influence of phase transformations and thermal treatment. TTT and
TRC diagrams. Application to steel.
Detailed program:
Introduction: Classification of Materials, usage properties, phases, microstructure. Use of characterisation methods: optical
microscopy, simple and differential thermal analysis, resistivity, dilatometry, phase analysis by MEB or microprobe, hardness
and microhardness, tensile strength test.
Development of materials: relationship between phase diagrams and solidification microstructures. Homogenisation roblems
(solidification with segregation). Identification of the presence of a eutectic or a peritectic reaction during solidification. Study
of transformations of solid phase precipitations, eutectoid transformation, martensitic transformation. Use of diagrams for the
classification and the improvement of metallic materials. Classification of the big families of metallic alloys in phase diagrams
(ferrous, cuprous, aluminium or titan alloys). Galvanisation, superficial treatments.
Thermal and thermochemical treatment: modification of microstructure and mechanical properties by annealing, quenching,
tempering, cementation.
Establishment and use of TTT and TRC diagrams: application to steel.

Bibliography :
Des Matériaux J. P. BAILON, J.M. DORLOT, Presses Internationales Polytechnique (2000).
Introduction à la science des matériaux J.P. MERCIER, G. ZAMBELLI, W. KURZ, Presses Polytechniques Romandes, (1999).
Du microscopique au macroscopique : Propriétés et comportement des matériaux, (2003)
Métallurgie Mécanique (2006), A. CORNET, F HLAWKA, Ellipses

Requirements :
Thermochemistry S3 module of the first two preparatory years at the INSA.

Organisation :

Evaluation :
Two-hour written examination.

Target :

Electronic components	STP04-COMP
Number of hours : 28.00 h	1.50 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : BERTRU NICOLAS	

Objectives :
An overview of the properties and applications of electronic semiconductor components. Components studied: the diode,
bipolar MOS field-effect transistors.

Content :
1. Presentation of semiconductor solids: Physical aspects, primitive cells, periodicity, reciprocal network.
2. Presentation of band structure and Electronic properties: Definition of gap and origin of gap. Valency band, conduction
band, effective mass, carrier speed, state density, filling of the bands, number of carriers, doping. Mobility of the carriers,
definition of conductivity and of resistivity.
3. Presentation of the P.N junction and of its electronic properties: P.N junction in statics. Natural potential barrier and its
relationship with gap and with doping. Current tension characteristic of the ideal diode. Schottky diode.
4. Bipolar transistor: Presentation of the transistor and fabrication technology. Electronic properties. Static characteristic.
Current tension characteristic. Ebers-Moll diagram. Small signal circuit. Gain. Application to commutation, saturated and
blocked functioning.
5. Field effect transistor: Presentation and working schematic. Static and dynamic study. Transconductance. Small signal
circuit. Examples of uses.
6. Metal oxide semiconductor transistor (MOS): Presentation and working schematic. Important material parameters. Static
and dynamic study. Small signal circuit. Examples of uses. Use in integrated circuits. Application to CCD and to MOS
memories.
7. Optoelectronic components: light emitting semi-conductors. Use in solar cell. Light detector. Light-emitting diode (LED).
Semiconductor laser.

Bibliography :
1. Propriétés optiques des solides et composants: Mathieu.
2. Semiconductor devices: S.M. Sze.
3. Semiconductor Physics and devices : D.A. Neaman.
4. Semiconductor devices: Streetman.

Requirements :
Mathematics: Differential equations, Complex numbers, periodic complex functions, Series, Fourier series.
Other disciplines: Atom structure, Plane waves, electrostatics, electronics.

Organisation :

Evaluation :
Two-hour written examination covering both the lectures and the tutorial classes.

Target :

Outils d'analyse pour l'ingénieur	STP04-ANA
Number of hours : 28.00 h	1.50 ECTS credit
CM : 14.00 h, TD : 8.00 h, TP : 6.00 h	
Reference Teacher(s) : BRIANE MARC	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Statistique pour l'ingénieur	STP04-STAT
Number of hours : 28.00 h	1.50 ECTS credit
CM : 14.00 h, TD : 8.00 h, TP : 6.00 h	
Reference Teacher(s) : DUPUY JEAN-FRANCOIS	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

English 4	STP04-ANGL
Number of hours : 26.00 h	1.50 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : MORAN GARRETT	

Objectives :
General Objectives
Improving communication skills in everyday life situations, both at work and in informal environments. The module aims to consolidate skills developed during the first three semesters.

Language-oriented objectives
Obtaining or reinforcing B2 level, required for graduation and defined by CECRL.

Content :
Speaking and listening skills are focused upon first and foremost.

The ability to write and develop arguments using the appropriate grammar, syntax and vocabulary is also an area of skill that must be improved.

A level of oral expression that is as accurate and fluent as possible is the ultimate aim. Group activities that require spontaneity must be carried out, usually involving role-plays and discussions.

Being able to relay information to an audience in a coheherent and interesting way must be mastered. Group oral presentations are organised.

Bibliography :
A good dictionary (Oxford, Chambers, etc), preferably a paper version.

Requirements :
A reasonable level of English

Organisation :
Class duration is two hours. Video can be used to add variety to learning.

Teaching resources include written documents, grammar and vocabulary exercises, and other accessories as the need arises.

Passive behaviour among students can only reinforce a sentiment of failure.

Without at least 5 hours of personal work per week, students cannot expect to progress.

Evaluation :
A two-hour written test involving some written expression.
A 15-minute individual oral presentation in the presence of the module teacher.

Target :
FIRE et filière classique

Professional Project	STP04-PPI
Number of hours : 16.00 h	1.00 ECTS credit
PR : 4.00 h, TD : 4.00 h	
Reference Teacher(s) : LE BAIL SYLVIE	

Objectives :
Students are asked to reflect upon their career project and in particular, on their choice of department of specialisation.

Content :
Understanding one's capabilities: Transactional analysis. Restitution action. Career guidance with the help of the "CEIP"
service.

Bibliography :

Requirements :

Organisation :
Creation of a slide show of the students career-discovery project.

Evaluation :
Interview: students are asked to defend their choice of department of specialisation.

Target :

Culture and communication 4	STP04-COMM
Number of hours : 24.00 h	1.50 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
Context : Radio is the most widely availed of media for people on the move; the mean listening time per person is 2h 55 min, with more than 43 million tuning in on an average weekday.

Statistics show that 74 % of internauts in France over the age of twelve listen to the radio daily, and more than one in 3 (35 %) users of the Internet via a mobile phone consulted a news site or news application in June 2012. (Source: Médiamétrie)

Partners: The following are collaborators in this module "La cantine numérique rennaise" - a digital-age workshop, and a meeting place which is a hub for initiative. "CLEMI (Centre de Liaison de l'Enseignement et des Médias d'Information)", whose objective is to create a link between the national education system in France and the media.

Events: Two main events have been selected to accompany this module; The "Festival de l'Ecoute et de la Radio - Longueurs d'ondes", which takes place in Brest, and the "UNESCO World Radio Day".

Objectives:
Media education.

Familiarisation with Internet and traditional media best practices.

Finding your voice: media communication.

Introduction to law and economics concerning digital and traditional media.

Half of all tutorials are given by professionals from the relative fields.

Content :
Preparation for and recording of a programme for the web radio stations at INSA "Le Mégaphone" and the European University of Brittany (Université Européenne de Bretagne).
Production of podcasts.
Setting up of an RSS feed with the addition of complementary texts, links, graphics, photos and videos; all from sites which permit sharing.

Two tutorials dedicated to the study of law:
Rights and ethical code / Copyright
Online radio broadcasting is subject to the 1881 press act, which defines three breaches of press law: defamation, insult and disturbance of the peace. They are also subject to the confidence in the digital economy act.
Reminder of the laws concerning the right to privacy, intellectual property and image rights.
There will be a meeting with representatives of SACEM (a French copyright association for authors and composers).

Learning outcomes:

Documentation
Finding the right approach (the issue)
Writing - How to be listened to and understood:
* The 20% rule (When a radio journalist presents a message, listeners only capture 80%, understand 50%, and retain 20%).
The geographical, sociological, etc, proximity rules.
How to manage a project and have it ready in time / learning tools: mind mapping.
How to display one's creativity and inventiveness (listening techniques, rhythm in speech, audio context of the radio programme).
Adapting one's voice : intonation, flow, rhythm, etc.
Familiarisation with a digital editing system (Audacity or Samplitude Pro)

Media sociology : the concept of infomobility. Media best practices in the 21st century and analysis of changes.

Explore the history of the press using Gallica; the digital section of the National Library of France (Bibliothèque nationale de France).

Bibliography :
BALLE Francis, Médias et Sociétés, 15 ème édition, Montchrestien, 2011.
CARDON Dominique, La Démocratie internet, Seuil, 2010.
GLEVAREC Hervé, PINET Michel, La Radio et ses publics, Editions Mélanie Séteun/IRMA éditions, 2009.
JEANNENEY Jean-Nöel, Une histoire des médias, des origines à nos jours, Seuil, coll. Points histoire, 2011.
RAMONET Ignacio, L'Explosion du journalisme Des médias de masse à la masse des médias, Galilée 2011.

Requirements :
Completion of the "Culture and Communication / Creative Writing" module of Semester 1.

Organisation :
Each lesson lasts two hours. Recording is carried out in the Humanities Department Radio Studio. Some class-time may be spent in the "Cantine Numérique", or at the "Festival Longueurs d'Ondes", etc. Consistent personal input is required.

Evaluation :
Continuous Assessment (one mark)

Target :
Common-core syllabus

Sport and physical education	STP04-EPS
Number of hours : 22.00 h	1.00 ECTS credit
TD : 22.00 h	
Reference Teacher(s) : HINAULT YVAN	

Objectives :
Team work, discovery of one's capabilities, management responsibilities, communication, invention, creation, delegating.

Content :
Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Climbing (1 for entrants and 2 for non-entrants) or coaching of a
badminton team. The relationship between coach and individual athlete.
Outdoor activity: orienteering or kayak canoeing or golf.
Organisation of Physical and Sports Education: two 14-hour sports or physical activity programmes in groups of twenty-four.

Bibliography :
Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Sciences Humaines Economiques et Sociales	STP04-SHESx
Number of hours : 10.00 h	1.00 ECTS credit
TD : 10.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Allemand Débutant	STP04-ALLDEB
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

German (second language)	STP04-ALL
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
Dealing with everyday situations in the German language with the further goal of reaching the A1 competency level
(minimum) by the end of the first cycle. Development of listening and reading skills. Development of spoken German either in
small groups or through class discussions. The aim of the method is to prepare the student for autonomous progression in
language learning.

Content :
1. Students learn German through the Berliner Platz 1 method.
Themes: Presenting oneself, going shopping, health, etc.
2. Pronunciation and the basics of German grammar.
3. Common vocabulary.
4. Group work, role playing.

Bibliography :
1. Christiane Lemcke et al., Berliner Platz 1, Berlin/Munich : Langenscheidt, 2002.
2. Dictionnaire bilingue français-allemand / allemand-français Harraps Universal
3. Waltraud Legros, Ach so ! Les bases de la grammaire allemande : tout reprendre à zéro, Paris : Ellipses, 1999.

Requirements :
The corresponding module in the first year at INSA or equivalent.

Organisation :
Work done in class should be reinforced through revision and preparation should be done with the next class in mind.

Evaluation :
Two-hour written examination. Oral examination.

Target :

German (First language)	STP04-ALL+
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol Débutant	STP04-ESPDEB
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol 4 - 2STPI	STP04-ESP
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol 4 confirmé - 2STPI	STP04-ESP+
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

French as a foreign language	STP04-FLE
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : FOURE DOMINIQUE	

Objectives :
To achieve level B1-B2 of the European Common Language Reference by the end of the semester.

Content :
- Understanding an informative text.
- Presenting and expressing one's opinion about the contents of a document.
- Understanding the methods of composing and the actual writing of an argumentative text.
- Presenting and defending your opinion orally.
- The development of listening skills when confronted with a long speech (lectures, presentations, etc.).
- Reading articles and reports on contemporary subjects.

Bibliography :
CAMPUS 2 CLE International.

Requirements :

Organisation :

Evaluation :
Continuous examination 50%.
Final evaluation 50%.

Target :

Italian	HUMT2-ITA
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : KERSUSAN SYLVIA	

Objectives :
Beginners : discover the Italian language and culture, learn how to communicate and express simple ideas.
Intermediate :
improve oral and written skills in order to reach a good level of communication. Advanced : Cultural and everyday life themes.
Cinema, literature and civilization.

Content :
Oral expression and comprehension
Reading and writing
Phonetics
Films and book extracts
Articles from the local news.

Bibliography :
La lingua italiana per Stranieri 1, 2, 3 P K.Katerinov
La prova orale 1, 2, 3 T. Marin
Rete 1 and Rete 2, Marco Mezzadri and Paolo Balboni, Guerra Edizioni
Newspaper clips and articles, films, book extracts.

Requirements :
Beginners : none.
Intermediate : at least one year of Italian.
Advanced : good level of written and spoken Italian.

Organisation :
Reading and written exercizes.

Evaluation :
Oral examination

Target :

Japanese	HUMT2-JAP
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) :	

Objectives :
Basic user : breakthrough or beginner (A1) :
- Discovering the linguistic specificities of the language (phonetics, syntax)
- Discovering Japanese culture, traditions and customs
- Learning about two writing systems (Hiragana and Katakana)
- Good command of basic conversational skills in everyday life context.

Basic user : waystage or elementary (A2) :
- Introduction to ideograms (60 kanji)
- Reading simple texts (Manga etc.)
- Writing simple texts.
- Good command of oral skills in everyday life context.

Independent User (B1, B2) :
- Learning Kanji (60-200)
- Good command of reading, writing skills as well s oral comprehension and expression skills to study in Japan or visit the country.

Content :
Basic user : breakthrough or beginner (A1) :
- Improving / reinforcing Hiragana and Katakana
- Manga reading
    - Lesson 5 : hobbies
    - Lesson 6 : using public transport
    - Lesson 7 : shopping
    - Lesson 8 : expressing how I feel.

Basic user : waystage or elementary (A2) :
- Good command of 30 kanji
- Manga reading
- Basic grammar skills
- Reading and writing simple texts
- How to communicate in everyday life context.

Independent user (B1, B2) :
- Good command of over 30 kanji
- Manga reading
- Command of reading, writing skills as well as oral comprehension and expression skills.

Bibliography :
- Beginner level (A1) : Marugoto, 3A Network, to be published soon, Japan
- Basic user (A2) : Daichi, 1, 3A Network, 2008, Japan
- Independent user (B1, B2) : Minna no Nihongo, I and II, 3A Network, 1998, Japan & Satoru Koyama, J. Bridge, Bonjinsha, 2007, Japan

Requirements :
Beginner (A1) : None

Organisation :
The course is a tutorial. Each time, notions will be explained and then illustrated by a series of relevant examples, tasks and oral activities involving the students.

Evaluation :
- Writing test at the end of each semester
- Face-to-face individual oral (15 mn)

- Attendance, student's involvment.

Target :

Chinese	HUMT2-CHI
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) :	

Objectives :
To acquire the basics of Chinese, Essential structures and vocabulary, Comprehension, expression ans pronunciation, Use of
everyday Chinese.

Content :
Oral skills : corrective phonetics (pinyin system), listening to and analysis of complex sentences and simple texts, oral
exercizes (student-student / student-teacher), introduction of new characters (pronunciation and tone accentuation).
Written skills : prose/translation, written production of complex sentences and simple texts, learning and reinforcement of
grammatical ans vocabulary mechanisms, oral and written Chinese, learning of new characters (order of lines, basic
ideograms), reading and analysis of texts, text commentary.

Bibliography :
1. Interactive chinese, Sinolingua, 2004
2. Le chinois contemporain, WU Zhongwei, Sinolingua, 2010
3. Faire l'expérience du chinois, ZHANG Rumei, AI Xin, Higher Education Press, 2006
Other documents will be added to these basic books to provide the students with a wide panel of practical exercises.

Requirements :

Organisation :
Students are required to read the texts from the lessons (in character form), to rewrite the new characters, to work on the
application exercices on grammar, lexical and morphological points, to ask questions on the texts from the lessons, to do prose
and translation exercices.

Evaluation :
Oral test

Target :

Arabic	HUMT2-ARA
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
According to level : Beginners (A1), Intermediate (A2/B1), Advanced (B1-B2). Help the students to progress autonomously.

Content :
Written and oral communication. Firstly, in everyday life situations, and secondly in other fields such as professional topics.
- Films and book extracts are used as a learning aid.
- Individual exercices and group work, oral presentations for intermediates
- Grammar
- Cinema, literature and civilization.

Bibliography :

Requirements :

Organisation :
Classes take place at SUPELEC (campus de Beaulieu)

Evaluation :
Final grade (overseen by SUPELEC)

Target :

Portuguese	HUMT2-POR
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
Portuguese language is taught at Rennes 2 University

Content :

Bibliography :

Requirements :

Organisation :
Classes take place at Rennes 2 University.

Evaluation :

Target :

Russian	HUMT2-RUS
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
According to level: Beginners (A1), Intermediate (A2/B1), Advanced (B1-B2). Help the students to progress autonomously.

Content :
Written and oral communication. Firstly in everyday life situations, and secondly in other fields such as professional topics.
-Films and book extracts are used as a learning aid
-Individual exercices and group work, oral presentations for intermediates
-Grammar
-Cinema, literature and civilization.

Bibliography :

Requirements :

Organisation :
Classes take place at SUPELEC (Campus de Beaulieu)

Evaluation :
Final grade (overseen by SUPELEC).

Target :

Allemand Débutant	STP04-ALLDEB
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

German (second language)	STP04-ALL
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
Dealing with everyday situations in the German language with the further goal of reaching the A1 competency level
(minimum) by the end of the first cycle. Development of listening and reading skills. Development of spoken German either in
small groups or through class discussions. The aim of the method is to prepare the student for autonomous progression in
language learning.

Content :
1. Students learn German through the Berliner Platz 1 method.
Themes: Presenting oneself, going shopping, health, etc.
2. Pronunciation and the basics of German grammar.
3. Common vocabulary.
4. Group work, role playing.

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1. Christiane Lemcke et al., Berliner Platz 1, Berlin/Munich : Langenscheidt, 2002.
2. Dictionnaire bilingue français-allemand / allemand-français Harraps Universal
3. Waltraud Legros, Ach so ! Les bases de la grammaire allemande : tout reprendre à zéro, Paris : Ellipses, 1999.

Requirements :
The corresponding module in the first year at INSA or equivalent.

Organisation :
Work done in class should be reinforced through revision and preparation should be done with the next class in mind.

Evaluation :
Two-hour written examination. Oral examination.

Target :

German (First language)	STP04-ALL+
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol Débutant	STP04-ESPDEB
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol 4 - 2STPI	STP04-ESP
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Espagnol 4 confirmé - 2STPI	STP04-ESP+
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : AMARGOS BOSCH MARINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

French as a foreign language	STP04-FLE
Number of hours : 19.00 h	1.50 ECTS credit
TD : 19.00 h	
Reference Teacher(s) : FOURE DOMINIQUE	

Objectives :
To achieve level B1-B2 of the European Common Language Reference by the end of the semester.

Content :
- Understanding an informative text.
- Presenting and expressing one's opinion about the contents of a document.
- Understanding the methods of composing and the actual writing of an argumentative text.
- Presenting and defending your opinion orally.
- The development of listening skills when confronted with a long speech (lectures, presentations, etc.).
- Reading articles and reports on contemporary subjects.

Bibliography :
CAMPUS 2 CLE International.

Requirements :

Organisation :

Evaluation :
Continuous examination 50%.
Final evaluation 50%.

Target :

Italian	HUMT2-ITA
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : KERSUSAN SYLVIA	

Objectives :
Beginners : discover the Italian language and culture, learn how to communicate and express simple ideas.
Intermediate :
improve oral and written skills in order to reach a good level of communication. Advanced : Cultural and everyday life themes.
Cinema, literature and civilization.

Content :
Oral expression and comprehension
Reading and writing
Phonetics
Films and book extracts
Articles from the local news.

Bibliography :
La lingua italiana per Stranieri 1, 2, 3 P K.Katerinov
La prova orale 1, 2, 3 T. Marin
Rete 1 and Rete 2, Marco Mezzadri and Paolo Balboni, Guerra Edizioni
Newspaper clips and articles, films, book extracts.

Requirements :
Beginners : none.
Intermediate : at least one year of Italian.
Advanced : good level of written and spoken Italian.

Organisation :
Reading and written exercizes.

Evaluation :
Oral examination

Target :

Japanese	HUMT2-JAP
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) :	

Objectives :
Basic user : breakthrough or beginner (A1) :
- Discovering the linguistic specificities of the language (phonetics, syntax)
- Discovering Japanese culture, traditions and customs
- Learning about two writing systems (Hiragana and Katakana)
- Good command of basic conversational skills in everyday life context.

Basic user : waystage or elementary (A2) :
- Introduction to ideograms (60 kanji)
- Reading simple texts (Manga etc.)
- Writing simple texts.
- Good command of oral skills in everyday life context.

Independent User (B1, B2) :
- Learning Kanji (60-200)
- Good command of reading, writing skills as well s oral comprehension and expression skills to study in Japan or visit the country.

Content :
Basic user : breakthrough or beginner (A1) :
- Improving / reinforcing Hiragana and Katakana
- Manga reading
    - Lesson 5 : hobbies
    - Lesson 6 : using public transport
    - Lesson 7 : shopping
    - Lesson 8 : expressing how I feel.

Basic user : waystage or elementary (A2) :
- Good command of 30 kanji
- Manga reading
- Basic grammar skills
- Reading and writing simple texts
- How to communicate in everyday life context.

Independent user (B1, B2) :
- Good command of over 30 kanji
- Manga reading
- Command of reading, writing skills as well as oral comprehension and expression skills.

Bibliography :
- Beginner level (A1) : Marugoto, 3A Network, to be published soon, Japan
- Basic user (A2) : Daichi, 1, 3A Network, 2008, Japan
- Independent user (B1, B2) : Minna no Nihongo, I and II, 3A Network, 1998, Japan & Satoru Koyama, J. Bridge, Bonjinsha, 2007, Japan

Requirements :
Beginner (A1) : None

Organisation :
The course is a tutorial. Each time, notions will be explained and then illustrated by a series of relevant examples, tasks and oral activities involving the students.

Evaluation :
- Writing test at the end of each semester
- Face-to-face individual oral (15 mn)

- Attendance, student's involvment.

Target :

Chinese	HUMT2-CHI
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) :	

Objectives :
To acquire the basics of Chinese, Essential structures and vocabulary, Comprehension, expression ans pronunciation, Use of
everyday Chinese.

Content :
Oral skills : corrective phonetics (pinyin system), listening to and analysis of complex sentences and simple texts, oral
exercizes (student-student / student-teacher), introduction of new characters (pronunciation and tone accentuation).
Written skills : prose/translation, written production of complex sentences and simple texts, learning and reinforcement of
grammatical ans vocabulary mechanisms, oral and written Chinese, learning of new characters (order of lines, basic
ideograms), reading and analysis of texts, text commentary.

Bibliography :
1. Interactive chinese, Sinolingua, 2004
2. Le chinois contemporain, WU Zhongwei, Sinolingua, 2010
3. Faire l'expérience du chinois, ZHANG Rumei, AI Xin, Higher Education Press, 2006
Other documents will be added to these basic books to provide the students with a wide panel of practical exercises.

Requirements :

Organisation :
Students are required to read the texts from the lessons (in character form), to rewrite the new characters, to work on the
application exercices on grammar, lexical and morphological points, to ask questions on the texts from the lessons, to do prose
and translation exercices.

Evaluation :
Oral test

Target :

Arabic	HUMT2-ARA
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
According to level : Beginners (A1), Intermediate (A2/B1), Advanced (B1-B2). Help the students to progress autonomously.

Content :
Written and oral communication. Firstly, in everyday life situations, and secondly in other fields such as professional topics.
- Films and book extracts are used as a learning aid.
- Individual exercices and group work, oral presentations for intermediates
- Grammar
- Cinema, literature and civilization.

Bibliography :

Requirements :

Organisation :
Classes take place at SUPELEC (campus de Beaulieu)

Evaluation :
Final grade (overseen by SUPELEC)

Target :

Portuguese	HUMT2-POR
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
Portuguese language is taught at Rennes 2 University

Content :

Bibliography :

Requirements :

Organisation :
Classes take place at Rennes 2 University.

Evaluation :

Target :

Russian	HUMT2-RUS
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : HOLZNER-JACQUES CECILE	

Objectives :
According to level: Beginners (A1), Intermediate (A2/B1), Advanced (B1-B2). Help the students to progress autonomously.

Content :
Written and oral communication. Firstly in everyday life situations, and secondly in other fields such as professional topics.
-Films and book extracts are used as a learning aid
-Individual exercices and group work, oral presentations for intermediates
-Grammar
-Cinema, literature and civilization.

Bibliography :

Requirements :

Organisation :
Classes take place at SUPELEC (Campus de Beaulieu)

Evaluation :
Final grade (overseen by SUPELEC).

Target :

Light & sound engineering for theatre with studies	HUMT2-TEK
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
Teach students how to deal with the technical aspects of theatre plays, concerts, public-address systems for conferences, recordings...
Put into practise knowledge and know-how acquired during the first semester through participation in "Art-with-studies" theatre plays, concerts and other events organised by the department of Modern Humanities.

Content :
Microphones, sound recording, sound software, stage/light mixing techniques, lighting desks and sound control systems : theoretical and practical experience.

Bibliography :

Requirements :
Students must have followed first semester classes

Organisation :
Workshops on Thursday afternoon in local venues or at INSA.

Evaluation :
Final mark

Target :
Any year

Music With Studies	HUMT2-MUS
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
- This module aims to enable students who have already reached a good level in music to continue practicing. - Group rehearsals. - Music as a means of developing the collaborative and adaptive abilities that are essential to any teamwork situation.

Content :
- Weekly group rehearsals
- Classical, jazz or folk music taught by music teachers
- Use of facilities at INSA-Rennes.
- At least 2 concerts per year.

Bibliography :

Requirements :
At least 5 years of practice.
The ability to read sheet music.
Admission to the "Music with Studies" section is decided upon through an audition conducted by the music teachers.

Organisation :
2 hours per week

Evaluation :
Continuous assessment: musical ability.

Target :

High-Level sport with studies	HUMT2-ES
Number of hours : 6.00 h	1.00 ECTS credit
CM : 6.00 h	
Reference Teacher(s) : VAILLANT GERARD	

Objectives :
Students must set out and structure a personal project to establish the best possible coherence between engineering studies at
INSA and a career as a high-level athlete. Acquisition of specific knowledge and know-how.

Content :
- Lessons and conferences on the tools of project management.
- Guided work on project building (personal career).
- Stress management. Relaxation therapy. Action type profiling. Mental preparation. Athletic traumatology. Motivation.
Dietetics. Physical preparation.
Organisation : Lessons, and evening conferences.

Bibliography :
Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education website.

Requirements :

Organisation :

Evaluation :
Production of a personal-career dossier. Oral presentation (30 minutes).
The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :
Maximum 4 semestrial registrations throughout the whole cursus.

APES	HUMT2-APES
Number of hours : 30.00 h	1.00 ECTS credit
DIV : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Academic year 2013/2014

Courses offered by the programme

Electronique et Informatique Industrielle (EII)
Electronics and Computer Engineering

Semester(s) : 1-2-3-4-5-6-7-8-9

Commonly used abbreviations
CM : Lectures
TD : Tutorials
TP : Laboratory Work
CONF : Conferences
TA : Personal Work
PR : Project
ST : Internship
DIV : Miscellaneous

Semestre 5

Parcours Formation Initiale EII

1	**TCM05**		**Science and technology of engineer S5**	**9.00**
	TCM05-ANAL	O	Mathematical Analysis for the Engineer	2.00
	TCM05-PROBA	O	Probability Tools for Engineers	2.00
	TCM05-INFOC	C	C language	3.00
	TCM05-PROG	C	C and Matlab programming	3.00
	TCM05-RISQ	O	Risk Management	2.00
2	**EII05-E**		**Electronics S5**	**10.00**
	EII05-E1	O	Electronics IA	3.50
	EII05-E2	O	Electronics IB	2.50
	EII05-LCS	O	Combinational Logic - Level 2	4.00
3	**EII05-II**		**Computer Engineering S5**	**3.00**
	EII05-ARC	O	Computer Architecture I	3.00
4	**EII05-MSA**		**Signal, Automatic, Mathematics S5**	**3.00**
	EII05-A1	O	Signals and Systems	3.00
5	**EII-HUM05**		**Non - scientific syllabus S5**	**5.00**
	EII05-ANGL	O	English 3	2.00
	EII05-PSH	O	Monographs	2.00
	EII05-EPS	O	Sport and physical Education	1.00

O = compulsary, C= in choice , F= optional

Mathematical Analysis for the Engineer	TCM05-ANAL
Number of hours : 28.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : BRIANE MARC	

Objectives :
Integration, Fourier transform, complex variables

Content :
1. Integration
Convergence theorems
Integrals with a parameter
Integrable functions
Fubini's theorems and convolution
Change of variables
2. Fourier transform
Fourier transform of a integrable function
Inversion theorem
Fourier transform of a square-integrable function
Plancherel theorem
Fourier transform and convolution
3. Complex variables
Holomorphic functions
Entire functions
Exponential and logarithmic functions
Cauchy's formula
Residues method

Bibliography :
G. GASQUET, P. WITOMSKI : « Analyse de Fourier et applications ». Masson, 1990.

Requirements :
Mathematical analysis of first and second year

Organisation :
30h

Evaluation :
1 written examination

Target :

Probability Tools for Engineers	TCM05-PROBA
Number of hours : 28.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : HERVE LOIC	

Objectives :
Probability calculus
- Large-samples
- Elements of statistics

Content :
1. Probability distributions. Examples.
2. Gaussian models.
3. Characteristic functions.
4. Limit theorems for Large-samples. Statistical applications.

Bibliography :
Modélisation probabiliste et statistique- Bernard Garel - Collection POLYTECH des éditions CEPADUES

Requirements :
Bases of analysis and linear algebra. Elements of probability theory of STP03-PROBA « Introduction aux probabilités »

Organisation :
30h

Evaluation :
One two hours written examination.

Target :

C language	TCM05-INFOC
Number of hours : 42.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 8.00 h, TP : 20.00 h	
Reference Teacher(s) : LEPLUMEY IVAN	

Objectives :
Basic understanding of the C programming language.
Ability to resolve all common problems.
Find the minimal intersection of needs / C. language.
Writing and comprehension of the code. Syntax and associated semantic.

Content :
1. Introduction to C programming language:
   Introduction.
   Chain of production, from the code source to the executable.

2. Basic C:
   Lexical entities.
   Language syntax.
   Variable declaration.
   Predefined types.
   Operators and expressions.
   General structure of a program.
   Basic input/output.
   Control structures and instructions.
   Fields: 1st form.
   Functions and pass-by-value parameter passing.

3. Advanced C:
   Pointers.
   Functions and pass-by-address parameter passing.
   Standard library functions.
   Memory models for functions and pointers.
   Fields : 2nd form.
   New types and types constructor.
   Explicit type conversion.
   File input/output.
   Allocation class.
   Dynamic Allocation.
   Pointers to functions.

Bibliography :
J.P. BRAQUELAIRE. Méthodologie de la programmation en langage C - Principes et applications. Manuels Informatiques Masson. Masson, 1993.
J.P. BRAQUELAIRE. Méthodologie de la programmation en langage C - Norme C99 - API POSIX. Sciences Sup. Dunod, 2005.
C. DELANOY. Programmer en langage C, avec exercices corrigés. Eyrolles, 1997.
B.W. KERNIGHAN and D.M. RITCHIE. Le langage C. Manuels Informatiques Masson. Masson, 1990.
J.L NEBUT. Le langage C - définition de la norme ANSI. Technical Report Cours C81, IFSIC -Université de Rennes 1, juillet 1989.

Requirements :
Understanding of Algorithms Foundations

Organisation :
Revision of the lecture notes.
Preparation for the practical work.
14hours of course, 8 hours of directed work and 20 hours of practical work

Evaluation :

2-hour written examination at the end of the semester (documents allowed).

Target :

C and Matlab programming	TCM05-PROG
Number of hours : 35.00 h	3.00 ECTS credit
CM : 9.00 h, TD : 8.00 h, TP : 18.00 h	
Reference Teacher(s) : MORIN LUCE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Risk Management	TCM05-RISQ
Number of hours : 21.00 h	2.00 ECTS credit
CM : 21.00 h	
Reference Teacher(s) : GALL PHILIPPE	

Objectives :
The engineer must always remain master of his choices and his actions within the limits defined by acceptable risk.

Content :
I- THE PRINCIPAL CONCEPTS OF RISK ANALYSIS: Dangerous situations. The five dimensions: facts, models, objectives, norms, values. The dissonances between players in a network. The deficits that affect dimensions. Options for
preventative action.
II. DANGER: AN INTRINSIC REALITY. WHEN AND WHERE TO EXPECT DANGER. Danger inherent to the natural
environment. Climate-related uncertainties. Terrestrial uncertainties. Fire as a man-made danger: facilities, production,
creation, etc. Sources of danger in the workplace: electrical, mechanical, chemical, toxicological, radiation, etc.
III - RISK: A LIKELY EVENT WHICH INDUCES DANGER: Characterisation of risk or estimation of danger: probability
and gravity. Natural or man-made danger. Error or approximation. Economic and financial risk. Complexity of the models.
Sport-related risk. Information-related risk. Alarm-related risk. Numerical treatment of problems. Risk; chemical-related risk.
IV. SECURITY: Development of a secure environment. Regulations: logic, criticism and use; technical regulations.
V. PREVENTION AND ASSUMING RESPONSIBILITY: JURIDICAL ASPECTS.

Bibliography :
Risque et Génie Civil - AFGC - 8 -10 nov 2000, Presse des Ponts et Chaussées Konstantin PROTASSOV, 1999,
""Probabilités et Incertitudes"", PUG Michèle NEUILLY - CETAMA
""Modélisation e estimation des erreurs de mesure"" GIS - MR-GenCi J.A. CALGARO, 1996,
- Introduction aux Eurocodes, Presse de l'ENPC Peter G. NEUMANN, 1995,
Computer-Related Risks, Addison-Wesley/ACM Press, ISBN 0-201-55805-X, 384pp

Requirements :

Organisation :

Evaluation :
Two-hour written examination in French.

Target :

Electronics IA	EII05-E1
Number of hours : 42.50 h	3.50 ECTS credit
CM : 22.50 h, TD : 20.00 h	
Reference Teacher(s) : HAESE SYLVAIN	

Objectives :
Familiarisation with the methods required to analyse the behaviour of basic electronic circuits such as bipolar and field effect transistors. Use of these methods to comprehend integrated structures including static characterisation of operational amplifiers.

Content :
1. Review of bipolar transistors. Analysis of the Ebers-Moll model, harmonic distortion rate. Study of a differential stage using (a) the small-signal model, (b) the Ebers-Moll model.
Other technology: the field effect transistor. Analysis of the MOSFET transistor and the JFET (Junction gate Field-Effect Transistor).
2. Study of integrated structures based on the transistors seen during the first part of the module. Description of manufacturing methods and technologies. Analysis of current mirrors, transistor combinations and output stages (A, B and AB class power amplifiers).
3. Application of calculation methods (based on integrated structures) in order to comprehend the static functioning of operational amplifiers. Explanation of the origin of input offset voltage and input bias current. Common mode input voltage and output voltage limitations.

Bibliography :
1. BLOT J., ""Electronique linéaire - Cours avec exercices et travaux pratiques"", Chapitres 1 et 3, Dunod, 1993.
2. BLOT J., ""Electronique linéaire - exercices résolus"", Dunod, 1994.
3. BLOT J., ""Les transistors - éléments d'intégration des circuits analogiques"", Chapitres 1 à 3, Dunod, 1995.
4. SEDRA ADEL S. et SMITH KENNETH C.,"Microelectronic circuits", Holt, Rinehart, and Winston, 1998.
5. GREBENE A. B., ""Bipolar and MOS analog integrated circuit design"", n° ISBN 0471085294, 1984.

Requirements :
Analogue Electronics 2 (STP04-ELEC).

Organisation :
Revision of lecture notes. Preparation of exercises.

Evaluation :
1h written examination (without documents).
2h written examination (with documents) at the end of the semester.

Target :
3EII

Electronics IB	EII05-E2
Number of hours : 36.00 h	2.50 ECTS credit
PR : 15.00 h, TP : 21.00 h	
Reference Teacher(s) : HAESE SYLVAIN	

Objectives :
Practical application of the theory studied in the Analogue Electronics I-A module. Manipulation and further study of the components using simulation software. Analysis of basic electronic circuits based on bipolar and field effect transistors. Study of integrated structures including static characterisation of operational amplifiers.

Content :
1. Manipulation of equipment and measurement tools.
2. Manipulation of the simulator including a working example on linear and non-linear circuits.
3. Simulation and wiring of schematics based on the following notions: Bipolar transistors, Differential amplifiers, Field effect transistors and Operational amplifiers.

Bibliography :
1. BLOT J., ""Electronique linéaire - Cours avec exercices et travaux pratiques"", Chapitres 1 et 3, Dunod, 1993.
2. BLOT J., ""Electronique linéaire - exercices résolus"", Dunod, 1994.
3. BLOT J., ""Les transistors - éléments d'intégration des circuits analogiques"", Chapitres 1 à 3, Dunod, 1995.
4. SEDRA ADEL S. et SMITH KENNETH C.,"Microelectronic circuits", Holt, Rinehart, and Winston, 1998.
5. GREBENE A. B., ""Bipolar and MOS analog integrated circuit design"", n° ISBN 0471085294, 1984.

Requirements :
Analog Electronics IA (EII05-E1).

Organisation :
Preparation of exercises. Practical application of the notions seen during lectures.

Evaluation :
Project and written report.
The project takes place during the five last sessions of this module.

Target :
3EII

Combinational Logic - Level 2	EII05-LCS
Number of hours : 41.00 h	4.00 ECTS credit
CM : 12.00 h, TA : 3.00 h, TD : 14.00 h, TP : 12.00 h	
Reference Teacher(s) : NEZAN JEAN-FRANCOIS	

Objectives :
Teach the student the concepts on combinational and sequential logic for the design of digital electronic systems.

Targeted competences are:
- To know basic elements of combinational and sequential logic
- To control efficiently standard functions of digital systems
- To design hierarchically a digital system with interconnected functions
- To use efficiently available resources to solve digital system design problems (documentation, internet, supervisors)

Content :
1. Introduction and reminder: numbers representation and coding, Boolean Algebra, Numeral systems
2. main logic functions : multiplexer, decoders, adder/subtractor
3. simplification of logic functions and timing parameters
4. main sequential logic functions : SR/D/JK/T bistable
5. registers and memories
6. counters
7. design of digital systems : finite-state machine, state diagram

Bibliography :
1. MANGE D., "Analyse et synthèse des systèmes logiques", Traité d'électricité, Volume V, Presses Polytechniques Romandes, 1992.
2. LETOCHA J., "Introduction aux circuits logiques", McGraw-Hill, 1985.
3. TOCCI R. J., "Circuits numériques - Théorie et applications", Dunod, 1992.
4. BRIE C., "Logique combinatoire et séquentielle : Méthodes, outils et réalisations", Editions Ellipses, collection Technosup, 2002.

Requirements :

Organisation :
Active pedagogy, Preparation of exercises and practical work.

Evaluation :
2 Written examinations with documents.

Target :
3EII

Computer Architecture I	EII05-ARC
Number of hours : 31.00 h	3.00 ECTS credit
CM : 9.00 h, TA : 4.00 h, TD : 10.00 h, TP : 8.00 h	
Reference Teacher(s) :	

Objectives :
- Understanding computer organization at the microarchitecture level: the datapath, the program control unit, the microprogrammed design
- Linking fundamental concepts introduced by the hardware lecture "Sequential Logic" (EII05-II2) and the software lecture "C Language" (TCM05-infoC)

Targeted main competences are:
- To design hierarchically a digital system with interconnected units/functions
- To program in C code and take into account hardware mechanisms of a computer
- To use efficiently available resources to solve digital system design problems (documentation, internet, supervisors)
- To explain some hardware mechanisms, by a team to other teams

Content :
- Case studies of hardwired computers: datapath, memory and address space, hardwired control unit
- Case study of a microprocessor: microprogram control unit, micro-instruction set and instruction set
- Case study of the Am2900 bit-slice microprocessor (microprogramming on simulator in practicals)
- Design and timing, Von-Neumann architecture, CISC and RISC architectures (Complex/Reduced Instruction-Set Computer)

Bibliography :
- TANENBAUM S., "Structured Computer Organization", Prentice Hall, 1999
- HENNESSY J. & PATTERSON D., "Computer Architecture: a Quantitativ Approach", McGraw-Hill, 1992
- MICK J. & BRICK J., "Bit-slice Microprocessor Design", McGraw-Hill, 1980
- STAUFFER A., "Systèmes numériques câblés et microprogrammés", Collection informatique, Presses Polytechniques Romandes, 1989
- FLOYD T.L., "Systèmes numériques", Editions Goulet, 2004

Requirements :
- Sequential Logic (EII05-LCS)
- C Language (TCM05-INFOC)

Organisation :
- Active pedagogy
- Revision of lecture notes
- Preparation for tutorials and practicals

Evaluation :
- Attendance at lectures and practicals
- Presentation of parts of lectures
- Written examination

Target :
3EII

Signals and Systems	EII05-A1
Number of hours : 28.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : KPALMA KIDIYO	

Objectives :
Introduction and application of all the necessary mathematical tools to better understand electronics, control and signal processing. The applications are illustrated with simple examples taken from those disciplines.

Targeted competences are:
-> Understand the concept of a signal and know how to modelize it,
-> Understand what is a system and predict its behaviour face to an input signal,
-> Understand mathematical tools needed to electronics, control and signal processing

Content :
1. Overview of signals: signals described by functions and signals described by distributions. Deterministic and random signals. Classification of deterministic signals depending on their time variation (discrete or continuous), test signals (pulse, step, sinusoid, etc.)
2. Overview of systems: definition, system response and convolution. Linear system response to a sinusoidal input or to a non-sinusoidal periodic input (Fourier series).
3. Fourier series, Fourier and Laplace transforms - Definitions, spectral representation of a signal, properties of transformations, transform of some usual signals.
4. Response of a linear system to any input. Application of the Laplace transform to the study of the response of a linear system subject to any input; isomorphic transfer function, frequency representation and stability analysis (definition of stability, stability of a transfer function and its poles location; stability of systems with a feedback loop).
.

Bibliography :
1. BLOT J., "Electronique linéaire - cours", Chapitre 2, Dunod Université, 1993.
2. BOITE R., NEIRYNCK J., "Traité d'électricité, Théorie des réseaux de Kirchhoff", Georgi.
3. BORNE P., DAUPHIN-TANGUY G., RICHARD J. P., ROTELLA F., ZAMBETTAKIS I., "Automatique, Analyse et régulation des processus industriels", Tome 1, Tecnip.
4. COULON F., "Traité d'électricité, Théorie et traitement des signaux", Georgi.

Requirements :
None.

Organisation :
Revision of lecture notes. Review of basic mathematics. Preparation of exercises. Active learning: participation in problem solving on the board.

Evaluation :
One-hour written examination in the middle of the semester (without documents) and a two-hour written examination (with documents) at the end of the semester.

Target :
3EII

English 3	EII05-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : DARGAY EVELYNE	

Objectives :
Improve expression, comprehension and interaction skills within everyday contexts, with special emphasis on professional and social life.
Language Objectives
Obtain or reinforce B2 level (as required for graduation and defined by CECRL).

Content :
-Action-oriented approach - learning by doing :
students have to listen and speak, write documents while using their problem-solving, reasoning, arguing, and demonstrating capabilities, in an articulate manner.
-Expressing oneself accurately by a rigorous use of syntax and phonology :
Activities requiring creative and reactive skills, ranging from debating, role-playing, individual oral presentations (PowerPoint), projects ... are based on scientific topics and current events.
-Building up specific skills in connection with the working world :
- writing e-mails
- conducting telephone conversations
- technical English
- intercultural contexts

In addition to the English course, a 90-minute remedial course takes place every week (over 10 weeks), in which students can update their various skills (listening and reading, writing, speaking and interacting) in small groups. Remedial classes are compulsory for all students that did poorly in their start-of-term placement test - and optional for those who feel they need to attend. There is no specific assessment for this course.

Bibliography :
- Dictionnaire Robert et Collins bilingue, or Collins Cobuild unilingue
- English Grammar in Use (Cambridge University Press)

Requirements :
Good command of STPI curriculum is essential : B1/B2

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for students to work in a stimulating environment.
-Teaching resources include press articles, audio and video documents (TV reports, film and series extracts) as well as the Internet.
-Regular personal work is required. Students must be curious and practise their English outside the classroom.

Evaluation :
Two-hour written test.
Oral presentation in class.

Target :

Monographs	EII05-PSH
Number of hours : 28.00 h	2.00 ECTS credit
CM : 2.00 h, TD : 26.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
Overview : Students choose and plan an appropriate project in accordance with the objectives. They carry out rigorous research
on the theme and interview specialists (emphasis is placed on the use of project management tools and teamwork).
A presentation is made in front of an invited audience. An inter-departmental competition to finish.

Content :
The aim of this module is to broaden the students' knowledge of their chosen professional field and of the prevailing social and
managerial environment. Students must structure their thinking to argue their point and make sense of the various sources of
information studied. Particular emphasis is placed on the importance of the use and quotation of trustworthy sources. The
monographs, which are archived in the library, will then represent a reliable, recent source of information.
The methodological tools required for project management (aims, organisational chart, task-delegation, work schedule) are
applied, resulting in well-written documents and improved public-speaking skills. Teamwork is particularly encouraged.
The teacher ensures that teams never lose sight of their stated objectives.
The advantages and pitfalls of research via the internet are discussed. Interviews are organised with people from within INSA
(Mr. Aubel of CEIP and various teacher-researchers), and with various engineers and managers from elsewhere. Their thoughts
are added systematically to the monograph to support the analysis. The library and the multimedia centre also prove to be
reliable sources of information.
Proper writing style and editing technique are essential; The main rules of editing a document of quality are studied, including
structure of a report, style, bibliography, etc.
At least one rehearsal precedes the final oral presentation in order to give the students confidence and highlight the importance
of a well-delivered speech. Students learn how to create a PowerPoint presentation.
The last classes focus on the voice, gestures, and carefully communicating information in a clear and rigorous way. The oral
presentation event is open to students, teachers and those interviewed in the course of research. The formal nature of this event
is of significant importance as it underlines INSA's policy for the training of generalist engineers.
An inter-departmental competition is held to reward the three best monographs of the year.
The objective is threefold:
- to promote the importance of the students' work
- to bring together those interviewed and explain to them our approach
- to promote exchange between departments.

Bibliography :
Timbal-Duclaux L.: L'Expression écriteEcrire pour communiquer. Editions ESF 1994.
Claret J. :Organiser la pensée. Editions ESF, 1989.
Quivy R. et Van Campenhoudt L. : Manuel de recherche en sciences sociales. Editions Dunod 1995.
Licette C. : La prise de parole en public. Editions Studyrama 2002.

Requirements :

Organisation :
Research, writing of progress reports and press reviews.

Evaluation :
Monograph.
Oral Presentation.

Target :

Sport and physical Education	EII05-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : LE LAGADEC PIERRE	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O or
Kayak or golf

Bibliography :
Several specialized books are available to the students at the library. Links to internet sites are given on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Semestre 6

Parcours Formation Initiale EII

1	**TCM06**		**Science and technology of engineer S6**	**4.00**
	TCM06-CAPT	C	Introduction to SENSORS	1.00
	TCM06-ENRG	C	Energy	1.00
	TCM06-IMO	O	Introduction to Production and quality Management	1.00
	TCM06-SHES1	O	Science Humaine Economique et Sociale 1	1.00
	TCM06-SHES2	O	Science Humaine Economique et Sociale 2	1.00
2	**EII06-E**		**Electronics S6**	**6.00**
	EII06-E1	O	Electronics IIA	4.00
	EII06-E2	O	Electronics IIB	2.00
3	**EII06-II**		**Computer Engineering S6**	**9.50**
	EII06-II1	O	Advanced C language tools	1.50
	EII06-II3	O	C language Project	1.50
	EII06-II4	O	Microprocessor-Based Systems A	3.00
	EII06-II5	O	Microprocessor -Based Systems B	1.50
	EII06-SE	O	Operating Systems	2.00
4	**EII06-MSA**		**Signal, Automatic, Mathematics S6**	**4.50**
	EII06-A1	O	Signal processing IA	3.00
	EII06-A2	O	Signal processing IB	1.50
5	**EII-HUM06**		**Non - scientific syllabus S6**	**6.00**
	EII06-ANGL	O	English 4	2.00
	EII06-EPS	O	Sport and physical Education	1.00
	EII06-PPI	O	Professional Project	1.00
	EII06-PSH	O	Monographs	2.00

O = compulsary, C= in choice , F= optional

Introduction to SENSORS	TCM06-CAPT
Number of hours : 35.00 h	1.00 ECTS credit
CM : 21.00 h, TD : 14.00 h	
Reference Teacher(s) : DURAND OLIVIER	

Objectives :
In Europe, the sensors market has been estimated to 10 billions Euros in 2007, corresponding to 28% of the glogal world
market, with an estimated growth more than 6% per year and sustained by the security systems, the automotive, aeronautics
and defence. Nowadays, the sensors market swipes to the electronic instrument mass market. Such a market generates a large
amount of employment in a wide range of industries. The aim of this course is a general overview of the properties and the
applications of sensors, with a global understanding, as general knowledge, of the different phenomena used for the sensors
elaboration.

Content :
General introduction to sensors. Active and passive sensor conditioners. Basics of semiconductor physics. Optical sensors.
Notions on the photovoltaic cells. Temperature sensors. Position and displacement sensors. Magnetic sensors. Mechanical
sensors. Introduction to microsensors.

Bibliography :
Les capteurs en instrumentation industrielle (G. Asch et collaborateurs), Dunod Handbook of Modern Sensors 2nd edition (J. Fraden), AIP Presss, Woodbury, New York Principe généraux des capteurs, cours CNAM (F. Lepoutre)
Cours capteurs (M. Hubin) : http://perso.orange.fr/michel.hubin/capteurs/instrum.htm

Requirements :
No prerequisite.

Organisation :
Homework.

Evaluation :
Written examination on work covered during lectures and tutorials.

Target :

Energy	TCM06-ENRG
Number of hours : 42.00 h	1.00 ECTS credit
TD : 12.00 h	
Reference Teacher(s) : CORNET CHARLES	

Objectives :
Impact of the choice energy sources of the 21st century. Photovoltaic cells and the thermal efficiency of buildings in terms of
cost, efficiency and environmental impact. Inventory of the energy sources currently in use. Thermodynamic tools. Overview
of the different methods of energy production including combustion engines, boilers, nuclear energy, renewable energies, etc.
Presentation of the different means of transport and energy transfer; thermal isolation or conduction, convection, material
transfer, inverted cycle machines, etc.

Content :
24 hours of lectures, 12 hours of tutorials and 6 hours of practical training.
Introduction to energy management and analysis of the current energy situation. The tools of energy engineering: Fick's laws
of diffusion, black body, thermal machines and basic reminders of thermodynamics. Production of energy: nuclear, thermal
combustion, boiler. Renewable energies: wind power, solar, geothermic energy, etc. Delivery of energy: insulation, conduction, convection, electricity and gas transport, etc.
Chapter I: Introduction to energy engineering.
(I) The energy context
1/ Definitions
2/ Overview of the current energy situation
(II) Energy prospects
1/ Supply and demand
2/ Technological orientation
3/ Conclusions
(III) Energy
1/ The different forms of energy
2/ Energy conversion
3/ Stocking and transport of energy.
Chapter II: Engineering tools for Energy
(I) - Transport phenomena
1/ Particle diffusion
2/ Thermal diffusion
3/ Fourier/Ohm/Fick Analogy
4/ Convection
(II) Energy transfer by radiation: black body model
1/ classic description
2/ quantum description - Planck's law
3/ Spectral characteristics of radiation
4/ Interest of the model
(III) Thermodynamics (Reminder)
1/ Thermal machines and cycles
2/ Energetic and entropic outcomes
3/ Diathermy machines
4/ Performance and efficiency.
Chapter III: The production of energy
(I) Nuclear energy
1/ Principle
2/ Fission and nuclear power
3/ Perspectives : toward thermonuclear fusion
(II) Combustion and combustion engines
1/ Combustion and fuels
2/ Ovens and boilers
3/ Combustion engines
(III) Renewable energies : solar, wind power, etc.
1/ Renewable energies

2/ Geothermic and ocean energy
3/ The thermal conversion of solar energy
4/ Photovoltaic solar energy
5/ Wind power
6/ Other energies.
Chapter IV: Transport and transfer of energy
(I) Heat transfer
1/ Heat transfer by thermal conduction: Applications to insulation
2/ Heat transfer by convection: heat exchangers
(II) Material transfers
1/ Pressure or load losses
2/ Turbo machines
(III) Transport of electricity: three-phase current.

Bibliography :
Energétique : concept et applications : Michel Feidt Systèmes énergétiques : (2004) (bibliothèque insa rennes)
Energies renouvelables : (2006) (bibliothèque insa rennes)

Requirements :
Mathematics: differential equations, complex numbers.
Other: Thermodynamics of diffusion and thermodynamic potentials , entropy, efficiency. Fluid mechanism (Bernoulli's
principle), understanding of semiconductors.

Organisation :
Preparation for tutorials, conferences. Internet research.

Evaluation :
2-hour examination based on the lectures and tutorials.

Target :

Introduction to Production and quality Management	TCM06-IMO
Number of hours : 28.00 h	1.00 ECTS credit
CM : 14.00 h, TD : 10.00 h, TP : 4.00 h	
Reference Teacher(s) : SORRE FREDERIC	

Objectives :
Introduction to production management and quality issues: Nowadays, companies must adopt methods associated with tools,
which will allow them to manage production effectively. Overview of the organisation of a factory.

Content :
PART ONE: Production management
(I) Introduction: definition of production management, classification of production systems.
(II) Scheduling in specialised workshops: scheduling on a machine, scheduling with two or three production centres.
(III) Stock management: stock management policies, associated costs, fixed interval order system for stock with a turnover of
zero, re-order point-management.
(IV) Production planning: Planning of the number of components required, basic principles of MRP2, load adjustment, capacity.
(V) "Just-in-time" techniques: origin and principle of JIT, key factors, the Kanban method.
PART TWO: Quality:
(I) Quality of industrial products: the concepts, Quality function, and the international norms for quality control management.
(II) Quality tools: 5S, SMED, TPM, control system and reception control system.
PART THREE: Case study - A presentation by representatives of manufacturers.

Bibliography :
Gestion de la production - Blondel - DUNOD\ n
La gestion de production - Bénassy - HERMES
Contrôle de la qualité - Jaupi - DUNOD
Industrialisation des produits mécanique (Tome 1) - Linarès-Marty - HERMES

Requirements :

Organisation :

Evaluation :
Two-hour written examination. Continuous assessment of Practical work.

Target :

Science Humaine Economique et Sociale 1	TCM06-SHES1
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Science Humaine Economique et Sociale 2	TCM06-SHES2
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Electronics IIA	EII06-E1
Number of hours : 42.50 h	4.00 ECTS credit
CM : 22.50 h, TD : 20.00 h	
Reference Teacher(s) : HAESE SYLVAIN	

Objectives :
Introduction to closed-loop electronic systems and study of the feedback theory. Application to stability problems and frequency compensation. Study of the behaviour of specific operational amplifiers. Further study of "filtering".

Content :
1. Study of the principles of feedback theory for the study of closed-loop systems.
2. Calculation methods and criteria for the study of stability. Amplifier compensation, with the study of the influence of poles on the closed-loop transfer function.
3. Analysis of limitations of operational amplifiers in dynamic use (frequency response, slew-rate). Cascade amplifiers.
4. Study of modern operational amplifiers: current feedback, rail-to-rail input and output.
5. Filtering: approximation functions, design using passive components, active filters, switched capacitor filters.

Bibliography :
1. BLOT J., ""Electronique linéaire - Cours avec exercices et travaux pratiques"", Chapitres 1 et 3, Dunod, 1993.
2. BLOT J., ""Electronique linéaire - exercices résolus"", Dunod, 1994.
3. BLOT J., ""Les transistors - éléments d'intégration des circuits analogiques"", Chapitres 1 à 3, Dunod, 1995.
4. SEDRA ADEL S. et SMITH KENNETH C.,"Microelectronic circuits", Holt, Rinehart, and Winston, 1998.
5. GREBENE A. B., ""Bipolar and MOS analog integrated circuit design"", n° ISBN 0471085294, 1984.

Requirements :
Electronics IA and IB (EII05-E1, EII05-E2).

Organisation :
Revision of lecture notes. Preparation of exercises.

Evaluation :
Three-hour written examination at the end of the semester (Documents authorised).

Target :
3EII

Electronics IIB	EII06-E2
Number of hours : 36.00 h	2.00 ECTS credit
PR : 15.00 h, TP : 21.00 h	
Reference Teacher(s) : HAESE SYLVAIN	

Objectives :
Practical applications of the theoretical concepts studied in the Electronics IIB module. Practical handling and simulation of the structures and components studied. Closed-loop electronic systems and study of feedback theory. Stability problems and frequency compensation. Behaviour of specific operational amplifiers. Advanced filtering.

Content :
1. Feedback theory.
2. Study of stability. Amplifier compensation.
3. Limitations of operational amplifiers in dynamic use.
4. Specific operational amplifiers: current feedback, rail-to-rail, differential input and output stages.
5. Filtering.

Bibliography :
1. BLOT J., ""Electronique linéaire - Cours avec exercices et travaux pratiques"", Chapitres 1 et 3, Dunod, 1993.
2. BLOT J., ""Electronique linéaire - exercices résolus"", Dunod, 1994.
3. BLOT J., ""Les transistors - éléments d'intégration des circuits analogiques"", Chapitres 1 à 3, Dunod, 1995.
4. SEDRA ADEL S. et SMITH KENNETH C.,"Microelectronic circuits", Holt, Rinehart, and Winston, 1998.
5. GREBENE A. B., ""Bipolar and MOS analog integrated circuit design"", n° ISBN 0471085294, 1984.

Requirements :
Electronics IA, IB, IIA (EII05-E1, EII05-E2, EII06-E1).

Organisation :
Preparation of practical work.
Practical application of the notions studied in lectures and exercise sessions. Writing of the project report.

Evaluation :
Project and written report.
The project takes place during the last sessions of this module.

Target :
3EII

Advanced C language tools	EII06-II1
Number of hours : 23.00 h	1.50 ECTS credit
CM : 8.00 h, TP : 15.00 h	
Reference Teacher(s) : COAT VERONIQUE	

Objectives :
Master advanced C language tools
Increase experience and confidence in C programing
Master another IDE (MS-Visual)

Content :
1. File access through low-level functions: file opening/closing/modification, read and write, current position.
2. Additional information about pointers: arrays of pointers, pointers and functions arguments, function pointers.
3. Functions with a variable number of arguments.
4. Recursive structures: lists, trees and graphs.

Bibliography :
1. PERSON R., "Aspects avancés du langage C", InterEditions (Paris), 1987.
2. HOROWITZ E., SAHNI S., ANDERSON-FREED S., "L'essentiel des structures de données en C", Dunod, 1993.
3. KOENIG A., "Pièges du langage C", Addison-Wesley, 1991.

Requirements :
C Language (TCM05-INFOC).

Organisation :
Revision of lecture notes. Preparation of practical work in pairs.

Evaluation :
A two-hour written examination (with documents) at the end of the module.

Target :
3EII students

C language Project	EII06-II3
Number of hours : 24.00 h	1.50 ECTS credit
PR : 24.00 h	
Reference Teacher(s) : COAT VERONIQUE, PRESSIGOUT MURIEL	

Objectives :
-Develop a complete software application within a team
-Write precise specification and user requirements
-Conceive a software architecture according to functional specifications
-Master professional tools for collaborative software development (SVN, forge,..)
-Self-training on some technical points in software development (graphic interfaces...)
-Work with greater autonomy in a collaborative team
-Experiment necessity of project management methodology
-Develop skills for written and oral presentation of technical work
-Establish a critical assessment of project results with respect to initial project goal

Content :
1. Produce written specifications
2. Task repartition
3. Regular meetings with supervising teacher
4. Project development
5. Report writing, oral presentation preparation
6. Oral defense of the project

Examples of project topics:
1. Design and administration of a school-grades database.
2. Translation of Boolean equations into a ladder diagram.
3. Backgammon simulation program.
4. Graphical representation of Backgammon.
5. Conversion of a data file into a HPGL file (file for HP plotters).
6. "Mastermind" simulation program.
7. Pattern recognition applied to marine animals.
8. Design of a graphical environment for an automation control system.
9. Generation of line segments, and filling of patterns on a digital grid.
10. Domino Game Simulation.
11. Design of a music software program for bagpipes.

Bibliography :

Requirements :
C language C level 2 (EII06-II1)

Organisation :
-Teams of 4 to 5 students, including a project leader
-Topics proposed by students and/or teachers
-Regular meetings between the students and the project supervisor (a professor) are planned in the timetable.
-Autonomous work over several months: no specific hours fixed in the time-table

Evaluation :
Each team of 4 students must write a report of no more than 5 pages, accompanied by the listing of the program. Their work, along with a demonstration of the program (if possible) is then presented to a jury of two teachers. A final mark out of 10 (written report 5, presentation 5) is awarded based on the quality of the work, choice of algorithms, readability, etc.

Target :
3EII Students

Microprocessor-Based Systems A	EII06-II4
Number of hours : 28.50 h	3.00 ECTS credit
CM : 4.50 h, TD : 9.00 h, TP : 15.00 h	
Reference Teacher(s) : PELCAT MAXIME	

Objectives :
Apply the varied fundamental concepts introduced by the course: "Architecture des calculateurs I" (EII06-II2). The studied microprocessor-based system is a board with a TI MSP430 microcontroller and several peripherals. The 16-bit MSP430 microcontroller and its different versions are studied thoroughly, including its internal architecture and instruction set. The students discover the low-level (assembly) and high-level (C code) programming of the microcontroller.

Targeted competences are:
- To program microcontroller-based systems while understanding their internal mechanisms
- To program in assembly language if necessary and to program efficiently in C code, using assembly code understanding
- To use efficiently available resources to solve digital system design problems (documentation, internet and supervisors)

Content :
1. General presentation of microcontrollers, internal MSP430 architecture
3. Assembly code and memory adressing
2. Programmation and introduction to compilation

Bibliography :
MSP430x2xx Family User¿s Guide (SLAU144E), Texas Instruments Manual, 2008

Requirements :
Computer Architecture I (EII06-II2), C Language (TCM05-INFOC)

Organisation :
Active pedagogy, preparing exercises during TD and validating the results in practicals

Evaluation :
Written examination of 1.5 hours, with documents.

Target :
3EII

Microprocessor -Based Systems B	EII06-II5
Number of hours : 28.50 h	1.50 ECTS credit
CM : 4.50 h, TD : 9.00 h, TP : 15.00 h	
Reference Teacher(s) : PELCAT MAXIME	

Objectives :
Explore the different peripherals and input/output units of a microcontroller (digital I/Os, ADC, timers and PWM). The studied microcontroller is a low-power TI MSP430. During practical works, the students command different peripherals connected to a MSP430 mother board.

Targeted competences are:
- To use a microcontroller to control peripherals in order to create a complete functional system.
- To generate an efficient system by using the different low-power options of the microcontroller
- To program efficiently in C code, using assembly code and internal register understanding

Content :
1. Timers and PWM
3. Power modes and interruptions
2. Analog to Digital Converter

Bibliography :
MSP430x2xx Family User¿s Guide (SLAU144E), Texas Instruments Manual, 2008

Requirements :
Computer Architecture I (EII06-II2), C Language (TCM05-INFOC), Microprocessor-Based Systems A (EII06-II4)

Organisation :
Active pedagogy, preparing exercises during TD and validating the results in practicals

Evaluation :
Written and practical examination.

Target :
3EII

Operating Systems	EII06-SE
Number of hours : 27.00 h	2.00 ECTS credit
CM : 12.00 h, TP : 15.00 h	
Reference Teacher(s) : PRESSIGOUT MURIEL	

Objectives :
To present the principles, the structure and the functions of operating systems available on a PC by defining the basic ideas and their evolution.
To illustrate the main mechanisms of Windows, Unix and Linux systems.

The targeted skills are :
-> To control a material architecture by means of an operating system by exploiting the differents elements of this system and using some shell scripts with regular expressions.
-> To use a filesystem by having a good command of the principle of pseudo files, the browsing and configuration methods.
-> To manage projects configured by a MAkefile by using static and dynamic linking.

Content :
1. Introduction to the principles of operating systems.
2. Processus.
3. Threads.
4. Scheduling.
5. Memory management.
6. Virtual memory.
7. Management of input/output devices.

Bibliography :
1. SILBERSCHATZ A., GALVIN P. and GAGNE G., Operating Systems Concepts (6th Ed), John Wiley et Sons,).
2. MIDDOT, TANENBAUM A., Modern Operating Systems (2nd Ed), Prentice-Hal

Requirements :
Langage C (TCM05-INFOC), Microprocessor-Based Systems A and B (EII06-II4 et EII06-II5), Langage C (EII06-II1).

Organisation :
revision and in-depth study of lectures, preparing practicals exercises.

Evaluation :
A 3 hours practical exercise with documents at the end of the current semester.

Target :
3EII

Signal processing IA	EII06-A1
Number of hours : 36.00 h	3.00 ECTS credit
CM : 18.00 h, TD : 18.00 h	
Reference Teacher(s) : KPALMA KIDIYO	

Objectives :
The fundamental elements of signal theory and signal processing. Raise the problems inherent to signal processing and propose some solutions. Provide methods for choosing an appropiate solution.

Targeted competences are:
-> Consolidate and apply the concepts learned in EII05-A1.
-> Understanding signal theory and its mathematical modeling
-> Assimilate various signal processing techniques

Content :
1. Signals: definition, temporal, energy, morphological, etc. classifications, representation by Fourier series, Fourier transform, and Laplace transform.
2. Deterministic signals: definition, a reminder of the basic notions of the Fourier transform, analytic signals and Hilbert transform, convolution integrals, correlation, matched filters, deterministic signals of finite energy and finite mean power, periodic signals.
3. Random signals: definition, a reminder of the basic notions of probability theory, temporal moments, statistical moments, stationarity, ergodicity, noise.
4. Linear filtering: definition, filter impulse response, filter transfer function, construction of a linear filter, properties of linear filters, filtering of a random signal, the matched filter.
5. Modulation, demodulation: introduction, the different types of modulation, modulations of a sinusoidal carrier wave (linear modulations, angle modulations), pulse modulations.

Bibliography :
1. DE COULON F., "Théorie et traitement des signaux", Traité d'électricité, Volume VI, Presses Polytechniques Romandes, Lausanne, 1980.
2. FONTOLLIET P. G., "Systèmes de télécommunications, bases de transmission", Dunod, 1983.
3. CHARBIT M., "Eléments de théorie du signal : les signaux aléatoires", Ellipses, Collection Pédagogique des Télécommunications, 1990.

Requirements :
Signals and systems (EII05-A1), Mathematics (TCM05-MATHS), Mathematics for signal theory (EII05-A2), Introduction to
probability theories (STP04-PROBA).

Organisation :
Revision of lecture notes. Preparation of exercises. Active learning: participation in problem solving on the board and work in sub-groups.

Evaluation :
Two-hour written examination (with documents) at the end of the semester.

Target :
3EII

Signal processing IB	EII06-A2
Number of hours : 18.00 h	1.50 ECTS credit
TP : 18.00 h	
Reference Teacher(s) : KPALMA KIDIYO	

Objectives :
Practical implementation of the notions addressed during previous lectures and exercises.

Targeted competences are:
-> Practical illustration of concepts learned EII06-A1.
-> Understanding the limits of the theory when manipulating real-world signals

Content :
1. Fourier series and Fourier transform.
2. Convolution and intercorrelation.
3. Linear filtering.
4. Linear filtering and Linear modulations.
5. Linear modulations (continued), angular modulations.
6. Synthesis practical work: study of a DTMF coder-decoder.

Bibliography :
1. DE COULON F., "Théorie et traitement des signaux", Traité d'électricité, Volume VI, Presses Polytechniques Romandes, Lausanne, 1980.
2. FONTOLLIET P. G., "Systèmes de télécommunications, bases de transmission", Dunod, 1983.
3. CHARBIT M., "Eléments de théorie du signal : les signaux aléatoires", Ellipses, Collection Pédagogique des Télécommunications, 1990.

Requirements :
Signal Processing IA (EII06-A1).

Organisation :
Preparation of practical work. Work in two-students groups

Evaluation :
One-hour examination, with documents, based on practical work at the end of the semester.

Target :
3EII

English 4	EII06-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : DARGAY EVELYNE	

Objectives :
Improve expression, comprehension and interaction skills within everyday contexts, with special emphasis on professional and social life.
Language Objectives
Obtain or reinforce B2 level (as required for graduation and defined by CECRL)

Content :
-Action-oriented approach - learning by doing :
students have to listen and speak, write documents while using their problem-solving, reasoning, arguing, and demonstrating capabilities, in an articulate manner.
-Expressing oneself accurately by a rigorous use of syntax and phonology :
Activities requiring creative and reactive skills, ranging from debating, role-playing, individual oral presentations (PowerPoint), projects ... are based on scientific topics and current events.
-Building up specific skills in connection with the working world :
- writing e-mails
- conducting telephone conversations
- technical English
- intercultural contexts

In addition to the English course, a 90-minute remedial course takes place every week (over 10 weeks), in which students can update their various skills (listening and reading, writing, speaking and interacting) in small groups. Remedial classes are compulsory for all students that did poorly in their start-of-term placement test - and optional for those who feel they need to attend. There is no specific assessment for this course.

Bibliography :
- Dictionnaire Robert et Collins bilingue, or Collins Cobuild unilingue
- English Grammar in Use (Cambridge University Press)

Requirements :
Good command of STPI curriculum is essential : B1/B2

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for students to work in a stimulating environment.
-Teaching resources include press articles, audio and video documents (TV reports, film and series extracts) as well as the Internet.
-Regular personal work is required. Students must be curious and practise their English outside the classroom.

Evaluation :
Two-hour written test.
Individual oral presentation.

Target :

Sport and physical Education	EII06-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : LE LAGADEC PIERRE	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O or
Kayak or golf.

Bibliography :
Several specialized books are available to the students at the library. Links to internet sites are given on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Professional Project	EII06-PPI
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) : LE BAIL SYLVIE	

Objectives :
Students are encouraged to reflect upon their future careers.

Content :
1. Discovering enterprises: working for an enterprise, the relationship between "technicians" and other teams (marketing, direction, sales, finance....)
2. Analysis of professional ambition with the aid of human resource specialists and company directors.
3. Meetings: each department sets up meetings to illustrate the situations particular to their sector.

Detailed programme:
Stage 1: In groups of twelve, working alongside consultants and company directors on "how to establish and develop a
professional project".
Stage 2: Discovery of the different professions. Meeting professionals. The student is to set up meetings with two professionals
with the objective of understanding the relationship between the engineering department and the other departments of the
enterprise (marketing, sales, finance, human resources, etc...)
Stage 3: Debriefing (with the human resources consultants).
The objective is to have the student to refine his professional project with respect to the enterprise. Students must prepare a
document in advance of the interview containing the following; How did you relate to your interviewee? How did you obtain a
meeting? Did you come across difficulties? How did you prepare for your interview? What were your main objectives? What
can you say about the course of your interview? Have you achieved your objectives (Give details)? And finally, what will you
do differently in future interviews?
Networking: how to use first contacts in an enterprise to achieve further goals.
In the framework of their professional project, fifth year students will attend a conference on job opportunities in their chosen
domain. Examples: High quality car production and the requirements of this sector (GMA). Images and networks (ESC-EII-Info). Setting up business in the information technology sector (EII-ESC-Info). Purchasing: the opportunities for the
engineer (GMA). The different professions open to civil engineering students (GCU). Microelectronics and nanotechnology:
job opportunities (MNT).
Write and present a synthesis report on a topic related to economic or social news, or linked to a career project.
An inter-departmental competition takes place to find the "monograph of the year".

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Monographs	EII06-PSH
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
Overview: Students choose and plan an appropriate project in accordance with the objectives. They carry out rigorous research
on the theme and interview specialists (Emphasis is placed on the use of project management tools and teamwork). A
Presentation is given in front of an invited audience. An inter-departmental competition to finish.

Content :
The aim of this module is to broaden the students' knowledge of their chosen professional field and of the prevailing social and
managerial environment. Students must structure their thinking to argue their point and make sense of the various sources of
information studied. Particular emphasis is placed on the importance of the use and quotation of trustworthy sources. The
monographs, which are archived in the library, will then represent a reliable, recent source of information.
The methodological tools required for project management (aims, organisational chart, task-delegation, work schedule) are
applied, resulting in well-written documents and improved public-speaking skills. Teamwork is particularly encouraged.
The teacher ensures that teams never lose sight of their stated objectives.
The advantages and pitfalls of research via the internet are discussed. Interviews are organised with people from within INSA
(Mr. Aubel of CEIP and various teacher-researchers), and with various engineers and managers from elsewhere. Their thoughts
are added systematically to the monograph to support the analysis. The library and the multimedia centre also prove to be
reliable sources of information.
Proper writing style and editing technique are essential; The main rules of editing a quality document are studied, including
structure of a report, style, bibliography, etc.
At least one rehearsal precedes the final oral presentation in order to give the students confidence and highlight the importance
of a well-delivered speech. Students learn how to create a Power Point presentation.
The last classes focus on the voice, gestures, and carefully communicating information in a clear and rigorous way. The oral
presentation event is open to students, teachers and those interviewed in the course of research. The formal nature of this event
is of significant importance as it underlines INSA's policy for the training of generalist engineers.
An inter-departmental competition is held to reward the three best monographs of the year. The objective is threefold: - to
promote the importance of the students' work - to bring together those interviewed and explain to them our approach - to
promote exchange between departments.

Bibliography :
Timbal-Duclaux L.: L'Expression écriteEcrire pour communiquer. Editions ESF 1994.
Claret J. :Organiser la pensée. Editions ESF, 1989.
Quivy R. et Van Campenhoudt L. : Manuel de recherche en sciences sociales. Editions Dunod 1995.
Licette C. : La prise de parole en public. Editions Studyrama 2002.

Requirements :

Organisation :
Research, writing of progress reports and press reviews.

Evaluation :
Monograph.
Oral Presentation.

Target :

Semestre 7

Innovation par la Recherche

1	**EII07-E-R**		**ELECTRONIQUE S7**	**2.50**
	EII07-E3	O	Programmable Logic devices	2.50
2	**EII07-II**		**Computer Engineering S7**	**4.50**
	EII07-II1	O	Computer Organization II	2.50
	EII07-II3	O	Operating Systems	2.00
3	**EII07-MSA**		**Signal, Automation, Mathematics S7**	**9.50**
	EII07-A1	O	Numerical Methods	3.00
	EII07-A2	O	Signal processing II	2.00
	EII07-A3	O	Automation IA	3.00
	EII07-A4	O	Automation IB	1.50
4	**EII07-PJ- R**		**PROJETS S7**	**8.50**
	EII07-PROJ2	O	Methodology and Project Management	2.00
	EII07-INVR-EB	O	Innov-R- étude bibliographique	6.50
5	**EII-HUM07**		**Non - scientific syllabus S7**	**5.00**
	EII07-ANGL	O	English	2.00
	EII07-ECOG	O	Economy and Business Management	2.00
	EII07-EPS	O	Sport and physical education	1.00

O = compulsary, C= in choice , F= optional

Programmable Logic devices	EII07-E3
Number of hours : 30.00 h	2.50 ECTS credit
CM : 10.00 h, PR : 12.00 h, TD : 8.00 h	
Reference Teacher(s) : DEFORGES OLIVIER	

Objectives :
The integration of systems in programmable logic devices. Presentation of the different existing component families and their respective capabilities. Illustrations of the embedding of digital functions and systems.

Targeted competences are:
-> To be able to choose an adapted componant family, and use the corresponding design frameworks,
-> To be able to design a dedicated architecture, and perform optimized implementations.

Content :
1. Simple PLD and CPLD.
2. FPGA : main concepts architectures, technonogies, functionnalities, ...
3. Present FPGA : STRATIX and VIRTEX families.
4. Design techniques: current methods and advanced ones based on SOC and IP.
5. Exercises : implementation of basic functions (convolution, FIR, ..) into CPLD and FPGA

Bibliography :
1. TAVERNIER, "Circuits logiques programmables", Dunod.
2. BROWN D., FRANCIS R. J., "Field-Programmable Gate-Arrays", Kluwer Academic Publishers.
3. Sites Web constructeurs.

Requirements :
Combinational Logic Level 2 (EII05-II1), Sequential Logic (EII05-II2), Methodology for Project Design and Management (EII07-PROJ2).

Organisation :
Active pedagogy, preparing exercises during TD and validating the results in practicals

Evaluation :
Note based on the project performances

Target :
4EII

Computer Organization II	EII07-II1
Number of hours : 17.00 h	2.50 ECTS credit
CM : 9.00 h, TD : 8.00 h	
Reference Teacher(s) : COUSIN JEAN-GABRIEL	

Objectives :
Study of hardware methods that impact the performance of modern computers and have a feedback into the C/assembler code

Targeted main competences are:
- To design hierarchically a digital system with interconnected units/functions
- To program in C code and take into account hardware mechanisms of a modern computer
- To use efficiently available resources to solve digital system design problems (documentation, internet, supervisors)

Content :
- Pipelined design and dynamic execution: principles, case study of a basic pipelined design, branch prediction techniques
- Memory hierarchy and cache memory: structures and main characteristics
- Parallel computing: superscalar and VLIW architectures, data packing, from SIMD to MIMD architecture, introduction of multiprocessor/multicore designs

Bibliography :
- TANENBAUM S., "Structured Computer Organization", Prentice Hall, 1999
- HENNESSY J. & PATTERSON D., "Computer Architecture: a Quantitativ Approach", McGraw-Hill, 1992
- STALLINGS W., "Computer Organization and Architecture", Prentice hall, 1999
- NOEERGAARD T., "Embedded Systems Architecture", Elsevier Newnes, 2005

Requirements :
- Microprocessor Systems (EII06-II4)
- C Language (EII06-II1)

Organisation :
- Active pedagogy
- Revision of lecture notes
- Preparation for tutorials

Evaluation :
- Attendance at lectures and tutorials
- Written examination

Target :
4EII

Operating Systems	EII07-II3
Number of hours : 27.00 h	2.00 ECTS credit
CM : 12.00 h, TP : 15.00 h	
Reference Teacher(s) : PRESSIGOUT MURIEL	

Objectives :
To present the principles, the structure and the functions of operating systems available on a PC by defining the basic ideas and their evolution.
To illustrate the main mechanisms of Windows, Unix and Linux systems.

The targeted skills are :
-> To control a material architecture by means of an operating system by exploiting the differents elements of this system and using some shell scripts with regular expressions.
-> To use a filesystem by having a good command of the principle of pseudo files, the browsing and configuration methods.
-> To manage projects configured by a MAkefile by using static and dynamic linking.

Content :
1. Introduction to the principles of operating systems.
2. Processus.
3. Threads.
4. Scheduling.
5. Memory management.
6. Virtual memory.
7. Management of input/output devices.

Bibliography :
1. SILBERSCHATZ A., GALVIN P. and GAGNE G., Operating Systems Concepts (6th Ed), John Wiley et Sons,).
2. MIDDOT, TANENBAUM A., Modern Operating Systems (2nd Ed), Prentice-Hal

Requirements :
Langage C (TCM05-INFOC), Microprocessor-Based Systems A and B (EII06-II4 et EII06-II5), Langage C Level 2 (EII06-II1).

Organisation :
revision and in-depth study of lectures, preparing practicals exercises.

Evaluation :
A 3 hours practical exercise with documents at the end of the current semester.

Target :
4EII

Numerical Methods	EII07-A1
Number of hours : 45.00 h	3.00 ECTS credit
CM : 22.50 h, TD : 22.50 h	
Reference Teacher(s) : MERRIEN JEAN-LOUIS	

Objectives :
Classic numerical resolution for applied mathematical problems through efficient algorithms.

Content :
Linear algebra tools.
Direct and iterative solution of systems of linear equations, conditioning, Gauss, Choleski and Householder methods.
Least squares problems.
Polynomial and cubic spline interpolation.
Cauchy problem applied to differential equations: one step method (Runge-Kutta) and multi-step method (Adams).
Discrete Fourier transform and FFT.
Introduction to Wavelet analysis.

Bibliography :

Requirements :
Two years of mathematics at university level. (e.g. completion of STPI at INSA or L2 level Sciences).

Organisation :
Preparation of exercises. Preparation for supervised computer work.

Evaluation :
Three-hour written examination and two-hour examination (on computer at the end of the semester).

Target :

Signal processing II	EII07-A2
Number of hours : 34.50 h	2.00 ECTS credit
CM : 13.50 h, TD : 12.00 h, TP : 9.00 h	
Reference Teacher(s) : KPALMA KIDIYO	

Objectives :
Basics of digital signal processing. To provide students with digital processing methods in order to complete and extend the knowledge of signal theory and (analog) signal processing acquired in EII06-A1 and EII06-A2.

Targeted competences are:
-> Understand the techniques of signal discretization,
-> Understand digital signal processing,
-> Apprehend the limits of those processings

Content :
1. Sampling and quantisation: discrete signals, different samplings, sampling theorem, signal reconstruction; quantisation: definition and principle, quantisation noise, quantisation efficiency, uniform quantisation, quantised signal encoding.
2. Discrete Fourier Transform (DFT): direct and inverse Fourier transform of a digital signal, digital signal frequency spectrums, digital signal Fourier transform properties, convolution, digital signal correlation: frequency sampling, sampling quality, periodic signal DFT, DFT properties, practical DFT for time-limited signals (windowing); Z-transform: direct and inverse transform, properties.
3. Digital filtering: representation methods, IIR/FIR classification, realisation structures, digital filters stability, IIR and FIR synthesis methods.
4. Unitary transforms: review of signals and vector spaces, signal transforms, transformation matrices generation by Kronecker product; Karhunen-Loève Transform (KLT), Hadamard transform (Walsh), Fast Fourier Transform (FFT), Discrete Cosine Transform (DCT); unitary transforms applications.
5. Digital communications introduction: digital transmission link description, modulations classification, emitters/receivers
structure, digital signals description, baseband modelling and complex envelope; baseband digital modulations (PCM, DPCM, PCM delta) and digital modulation on carrier frequency (ASK,FSK,PSK,QAM); modulations efficiency, transmission on real channel.

Bibliography :
1. KUNT M., "Traitement numérique des signaux", Traité d'électricité, Volume XX, Presses Polytechniques Romandes, Lausanne, 1980.
2. FONTOLLIET P. G., "Systèmes de télécommunications, bases de transmission", Dunod, 1983.
3. MARVEN C., EWERS G., "A simple approach to digital signal processing", Texas Instruments, 1993.
4. OPPENHEIM A.V., SHAFER R. W., "Digital Signal Processing", Prentice Hall, Englewood Cliffs, 1975.

Requirements :
Signal processing 1A and 1B (EII06-A1 and EII06-A2).

Organisation :
Lesson review. Preparation of exercises and practical work. Active learning: participation in problem solving on the board or work in sub-groups.

Evaluation :
One-hour written examination in the middle of the semester (without documents). Two-hour written examination (with documents) at the end of the module.

Target :
4EII

Automation IA	EII07-A3
Number of hours : 42.00 h	3.00 ECTS credit
CM : 22.00 h, TD : 20.00 h	
Reference Teacher(s) : GUEGAN SYLVAIN	

Objectives :
Give students an understanding of conventional methods:
- To control analog dynamic systems with one input and one output. Synthesis of control in Laplace transform space.
- To control digital dynamic systems with one input and one output. Synthesis of control in Z transform space.

Content :
1. Analog control in Laplace transform space:
- Simple models and graphical identification methods: first degree model, second degree model, first degree-delay model (Broïda), Ziegler-Nichols model, Strejc model;
- Closed-loop control systems, structure and representation: concept of feedback loop, advantages and basic diagram, graphical representation of open loop and closed- loop transfer functions, Bode diagrams, Black-Nichols plot;
- Stability and precision of closed-loop systems: Routh-Hurwitz and Nyquist stability criteria, stability margins, static and dynamic precision, performance criteria;
- Time and frequential specifications;
- Effects of the addition of poles and zeros to a transfer function, study of main poles;
- Proportional, derivative and integral actions;
- Design methods for correctors: semi-empirical, Naslin, Bode, Nyquist, Black-Nichols, root locus (Evans), internal model control, Smith predictor;
- Introduction to nonlinear systems: phase plane and first harmonic methods, influence of threshold, saturation, ¿
2. Digital control in Z transform space:
- first degree model, second degree model;
- Steady-states precision ;
- Study of stability : location of poles, Jury criterion.
- Time and frequential specifications;
- Effects of the addition of poles and zeros to a transfer function, study of main poles;
- Proportional, derivative and integral actions;
- Synthesis of digital correctors: choice of sampling period, transposition of analog control methods, corrector by bilinear transformation, corrector by impulsional or step invariance, corrector using main poles, minimal time response corrector, accurate response corrector.

Bibliography :
- RIVOIRE M., FERRIER J.-L., 1992, " Cours d'automatique - tome 2 : asservissement, régulation et commande analogique ", Eyrolles.
- RIVOIRE M., FERRIER J.-L., 1993, " Cours d'automatique - tome 3 : commande par calculateur, identification ", Eyrolles.
- KUO Benjamin C., 1995, " Automatic control systems ", Prentice Hall International Editions.
- DE LARMINAT Ph., 1993, " Automatique, commande des systèmes linéaires ", Hermès.
- BORNE P. et al., "Analyse et régulation des processus industriels", Tome 1, Régulation continue, Technip (Paris),

Requirements :
Signals and Systems (EII05-A1).

Organisation :
Revision of lecture notes. Preparation of exercises.

Evaluation :
A written examination of 1 hour without documents during the semester and a written examination of 2 hours with documents at the end of the semester.

Target :
4EII

Automation IB	EII07-A4
Number of hours : 18.00 h	1.50 ECTS credit
TP : 18.00 h	
Reference Teacher(s) : KPALMA KIDIYO	

Objectives :
Practical implementation of the notions addressed during previous lectures and exercises.

Content :
1. Introduction to Matlab/Simulink software.
2. Thermal systems (identification).
3. Regulation of course settings for a helicopter.
4. Flow regulation.
5. On-off regulation of a thermal system.
6. Feedback position control.

Bibliography :
1. DE LARMINAT P., "Automatique", Hermès (Paris), 1993.
2. BORNE P., ..., "Analyse et régulation des processus industriels", Tome 1, Régulation continue, Technip (Paris), 1993.

Requirements :
Signals and Systems (EII05-A1). Control Theory IA (EII07-A3).

Organisation :
Preparation of practical work.

Evaluation :
Mark for practical work.

Target :

Methodology and Project Management	EII07-PROJ2
Number of hours : 32.00 h	2.00 ECTS credit
CM : 6.00 h, CONF : 6.00 h, TD : 20.00 h	
Reference Teacher(s) : DEFORGES OLIVIER	

Objectives :
Presentation and learning of a design methodology for electronic systems: MCSE. Design approach consists of five essential stages (specification, functional design, definition, realisation and test). Each stage uses a specific description model for both structural (present entities, functions of the system, type of relation,etc.) and behavioural aspects. Otherwise, the module emphasises the necessity for a perfectly structured approach for the development of every digital system.
Methodology used later for lectures on real-time systems, programmable logic and VHDL. Introduction to project management through lectures and conferences (given by representatives of various firms).

Content :
MCSE lectures:
1. Purpose of a methodology and general presentation of MCSE.
2. Specification: definition of the environment, descriptions of the entities, inputs/outputs bounding, functional specifications,
operating and technological specifications.
3. Functional design: functional analysis, behaviour (description).
4. Realisation: layout constraints, hardware/software implementation.
5. Examples studied - control-command systems or digital circuits. Project management lectures:
1. Project life cycle.
2. The contract.
3. Cost Estimations.
4. Project design stages.
5. Scheduling.
6. Oral communication. The meeting.

Bibliography :
CALVEZ J. P., "Spécification et conception des systèmes : une méthodologie", Masson.

Requirements :
Combinational Logic - Level 2 (EII05-II1), Sequential logic (EII05-II2).

Organisation :
Active pedagogy, preparing exercises during TD and validating the results in practicals.

Evaluation :
Written examination 3 hours, with documents.

Target :
4EII

Innov-R- étude bibliographique	EII07-INVR-EB
Number of hours : 74.00 h	6.50 ECTS credit
CM : 10.00 h, PR : 64.00 h	
Reference Teacher(s) : MENARD DANIEL	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

English	EII07-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : WEST ANN	

Objectives :
Acquiring the required skills for working in a firm as an engineer. Reaching the required level (B2) is compulsory in order to graduate.

Content :
-Learning by doing:
The student will have to be able to talk and listen, write documents while showing he/she can solve problems, reason, convince and demonstrate in an articulate manner.
-Expressing oneself accurately and fluently.
The student will engage in activities requiring creative and reactive skills (such as debates, role-plays, individual oral presentations using PowerPoint, projects), which will be based on scientific topics and current events.
-Writing CVs and cover letters
-Scientific English
-Discovering the professional world in an international context
-Preparing for the TOEIC (during the second semester, a specific ¿Toeic Booster¿ course will be available)

Bibliography :
- Oxford Advanced learners¿ Dictionary
- English Grammar in Use (Cambridge University Press)

Requirements :
1st, 2nd and 3rd year English courses (or equivalent)

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia language lab and computer rooms are also available and make it possible for the students to work in a stimulating environment. Our teaching resources include press articles, audio and video documents (TV reports, extracts from films and series). We also use the Internet.
Regular personal work is obviously required. The student must be curious and practise English outside the classroom as well.

Evaluation :
One two-hour written exam.

Target :

Economy and Business Management	EII07-ECOG
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course focuses on the complexity of the decision-making process in a company.
Main learning outcomes:
- Understanding information relative to marketing and finance
- The ability to use specific tools and vocabulary in the field of management
- Understanding the importance of teamwork: making collective decisions and producing the expected work in time

Content :
The course is mainly focused around a Business simulation game called Simbrand, which empowers participants to run their own virtual businesses. Just like in real life, the teams compete against each other in order to gain market shares. The right decisions lead to success while the wrong ones engender invaluable problem solving experiences. The learning process becomes efficient and fun, and allows "learning by doing" as well as "learning from mistakes".
As an outcome of the simulation exercise, participants will fully comprehend the different aspects of the marketing decision making process, their relationship with each other, and their impact on the company's overall results. In addition, participants will gain invaluable experience in teamwork and problem solving.
The simulation is based on an online platform that allows students to play in their own language (many languages available: English, Spanish, Portuguese, Chinese ...).

Bibliography :
Provided during the course

Requirements :
None.

Organisation :
2 hours per week

Evaluation :
Each team produces a written report in French and makes an oral presentation in English

Target :
4EII

Sport and physical education	EII07-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : VAILLANT GERARD	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O or
Kayak or golf

Bibliography :
Several specialized books are available to the students at the library. Links to internet sites are given on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Semestre 7

Parcours Formation Initiale EII

1	**EII07-E**		**Electronics S7**	**8.00**
	EII07-E1	O	Electronics IIIA	3.50
	EII07-E2	O	Electronics IIIB	2.00
	EII07-E3	O	Programmable Logic devices	2.50
2	**EII07-II**		**Computer Engineering S7**	**4.50**
	EII07-II1	O	Computer Organization II	2.50
	EII07-II3	O	Operating Systems	2.00
3	**EII07-MSA**		**Signal, Automation, Mathematics S7**	**9.50**
	EII07-A1	O	Numerical Methods	3.00
	EII07-A2	O	Signal processing II	2.00
	EII07-A3	O	Automation IA	3.00
	EII07-A4	O	Automation IB	1.50
4	**EII07-PJ**		**Project S7**	**3.00**
	EII07-PROJ1	O	Presentations in English	1.00
	EII07-PROJ2	O	Methodology and Project Management	2.00
5	**EII-HUM07**		**Non - scientific syllabus S7**	**5.00**
	EII07-ANGL	O	English	2.00
	EII07-ECOG	O	Economy and Business Management	2.00
	EII07-EPS	O	Sport and physical education	1.00
10	**HUMT1-ELSA Mus**		**Music with studies**	**1.00**
	HUMT1-MUS	F	Music with studies	1.00

O = compulsary, C= in choice , F= optional

Electronics IIIA	EII07-E1
Number of hours : 44.50 h	3.50 ECTS credit
CM : 22.50 h, TD : 22.00 h	
Reference Teacher(s) : HAESE SYLVAIN	

Objectives :
Identification of the various functions of a complex electronic system, defining specifications, suggesting satisfactory applications and distinguishing between theoretical design constraints and current technological limitations.

Content :
1. Harmonic oscillator (timebase clocks, local oscillators): Linear study of oscillation conditions; Nonlinear study of steady state; Frequency stability; Amplitude stability; Different kinds of harmonic oscillators: RC network oscillator, resonant LC and quartz oscillators.
2. Comparator, flip-flops: Ideal comparator, Real comparator circuits, Schmitt trigger, Monostable and astable flip-flops and relaxation oscillators, Voltage to frequency conversion, VCO.
3. Linear power supply. Voltage references with low temperature coefficient. Voltage regulation circuit schematics.
4. Switched-mode power supply: Step-down, step-up and inverter circuits. Switched-mode regulators.
5. Amplitude modulation: Definition; Spectrum of an amplitude modulated signal; Frequency transposition, heterodyne receiver, filtering; Amplitude modulation and demodulation circuits.
6. Angle modulation: Definition, phase and frequency modulation, spectrum, Phase-shift keying, Frequency and phase modulation and demodulation circuits.
7. Phase Lock Loop (PLL): Working principle; Loop gain; Lock-in range; Capture range; Dynamic functioning of a first and second order loop; Applications: synchronisation, frequency modulation and demodulation, frequency synthesiser.

Bibliography :
1. CHATELAIN J.D., DESSOULAVY R., ""Electronique"", Tome 2, Dunod.
2. GIRARD M., ""Alimentations à découpage"", Ediscience, 1993.

Requirements :
Analogue electronics IA, IB (EII05-E1 and EII05-E2) and IIA, IIB (EII06-E1 and EII06-E2), Signals and systems (EII05-A1).

Organisation :
Revision of lecture notes. Preparation of exercises.

Evaluation :
Three-hour written examination (with documents) at the end of the semester.

Target :
4EII

Electronics IIIB	EII07-E2
Number of hours : 24.00 h	2.00 ECTS credit
TP : 24.00 h	
Reference Teacher(s) : HAESE SYLVAIN	

Objectives :
Practical application of the concepts studied in the Analogue Electronics IIIA lectures and classes. The aim is to improve students' knowledge on the capabilities and limitations of simulation tools (ORCAD-PSPICE software). Practical work serves to illustrate the concepts studied in lectures and completes the theoretical aspects studied by taking account of technological constraints.

Content :
1. Harmonic oscillators (test generator for audio equipment): Practical study of a sine wave oscillator using RC Type components and operational amplifiers with large operating frequency variation. Open and close loop study. Simulation of behaviour of various models of amplifiers. Building an amplifier and use of measurement instruments. Enhancement of waveform and THD measurement.
2. Harmonic oscillators (high frequency structure): design of a LC oscillator using bipolar transistors. Use of simulation to define the characteristics of the functional blocks of the oscillator. Analysis of sensitivity in relation to component tolerance and the internal impedance of the oscillator. Design of an output stage. Simulations and building of an oscillator.
3. Switched-mode power supply: Study of a step-down circuit. Analysis of the influence of switching frequency on running mode (continuous and discontinuous). Study of a commercial integrated regulator circuit. Implementation of this circuit in order to design a switched-mode regulator 5V/1A. Wiring and measurement of the power supply performances (operating limits, efficiency).

Bibliography :
1. CHATELAIN J.D., DESSOULAVY R., ""Electronique"", Tome 2, Dunod.
2. GIRARD M., ""Alimentations à découpage"", Ediscience, 1993.

Requirements :
Analogue Electronics IIIA (EII07-E1).

Organisation :
Revision of lecture notes. Preparation of exercises and practical work.

Evaluation :
Practical work report.

Target :
4EII

Programmable Logic devices	EII07-E3
Number of hours : 30.00 h	2.50 ECTS credit
CM : 10.00 h, PR : 12.00 h, TD : 8.00 h	
Reference Teacher(s) : DEFORGES OLIVIER	

Objectives :
The integration of systems in programmable logic devices. Presentation of the different existing component families and their respective capabilities. Illustrations of the embedding of digital functions and systems.

Targeted competences are:
-> To be able to choose an adapted componant family, and use the corresponding design frameworks,
-> To be able to design a dedicated architecture, and perform optimized implementations.

Content :
1. Simple PLD and CPLD.
2. FPGA : main concepts architectures, technonogies, functionnalities, ...
3. Present FPGA : STRATIX and VIRTEX families.
4. Design techniques: current methods and advanced ones based on SOC and IP.
5. Exercises : implementation of basic functions (convolution, FIR, ..) into CPLD and FPGA

Bibliography :
1. TAVERNIER, "Circuits logiques programmables", Dunod.
2. BROWN D., FRANCIS R. J., "Field-Programmable Gate-Arrays", Kluwer Academic Publishers.
3. Sites Web constructeurs.

Requirements :
Combinational Logic Level 2 (EII05-II1), Sequential Logic (EII05-II2), Methodology for Project Design and Management (EII07-PROJ2).

Organisation :
Active pedagogy, preparing exercises during TD and validating the results in practicals

Evaluation :
Note based on the project performances

Target :
4EII

Computer Organization II	EII07-II1
Number of hours : 17.00 h	2.50 ECTS credit
CM : 9.00 h, TD : 8.00 h	
Reference Teacher(s) : COUSIN JEAN-GABRIEL	

Objectives :
Study of hardware methods that impact the performance of modern computers and have a feedback into the C/assembler code

Targeted main competences are:
- To design hierarchically a digital system with interconnected units/functions
- To program in C code and take into account hardware mechanisms of a modern computer
- To use efficiently available resources to solve digital system design problems (documentation, internet, supervisors)

Content :
- Pipelined design and dynamic execution: principles, case study of a basic pipelined design, branch prediction techniques
- Memory hierarchy and cache memory: structures and main characteristics
- Parallel computing: superscalar and VLIW architectures, data packing, from SIMD to MIMD architecture, introduction of multiprocessor/multicore designs

Bibliography :
- TANENBAUM S., "Structured Computer Organization", Prentice Hall, 1999
- HENNESSY J. & PATTERSON D., "Computer Architecture: a Quantitativ Approach", McGraw-Hill, 1992
- STALLINGS W., "Computer Organization and Architecture", Prentice hall, 1999
- NOEERGAARD T., "Embedded Systems Architecture", Elsevier Newnes, 2005

Requirements :
- Microprocessor Systems (EII06-II4)
- C Language (EII06-II1)

Organisation :
- Active pedagogy
- Revision of lecture notes
- Preparation for tutorials

Evaluation :
- Attendance at lectures and tutorials
- Written examination

Target :
4EII

Operating Systems	EII07-II3
Number of hours : 27.00 h	2.00 ECTS credit
CM : 12.00 h, TP : 15.00 h	
Reference Teacher(s) : PRESSIGOUT MURIEL	

Objectives :
To present the principles, the structure and the functions of operating systems available on a PC by defining the basic ideas and their evolution.
To illustrate the main mechanisms of Windows, Unix and Linux systems.

The targeted skills are :
-> To control a material architecture by means of an operating system by exploiting the differents elements of this system and using some shell scripts with regular expressions.
-> To use a filesystem by having a good command of the principle of pseudo files, the browsing and configuration methods.
-> To manage projects configured by a MAkefile by using static and dynamic linking.

Content :
1. Introduction to the principles of operating systems.
2. Processus.
3. Threads.
4. Scheduling.
5. Memory management.
6. Virtual memory.
7. Management of input/output devices.

Bibliography :
1. SILBERSCHATZ A., GALVIN P. and GAGNE G., Operating Systems Concepts (6th Ed), John Wiley et Sons,).
2. MIDDOT, TANENBAUM A., Modern Operating Systems (2nd Ed), Prentice-Hal

Requirements :
Langage C (TCM05-INFOC), Microprocessor-Based Systems A and B (EII06-II4 et EII06-II5), Langage C Level 2 (EII06-II1).

Organisation :
revision and in-depth study of lectures, preparing practicals exercises.

Evaluation :
A 3 hours practical exercise with documents at the end of the current semester.

Target :
4EII

Numerical Methods	EII07-A1
Number of hours : 45.00 h	3.00 ECTS credit
CM : 22.50 h, TD : 22.50 h	
Reference Teacher(s) : MERRIEN JEAN-LOUIS	

Objectives :
Classic numerical resolution for applied mathematical problems through efficient algorithms.

Content :
Linear algebra tools.
Direct and iterative solution of systems of linear equations, conditioning, Gauss, Choleski and Householder methods.
Least squares problems.
Polynomial and cubic spline interpolation.
Cauchy problem applied to differential equations: one step method (Runge-Kutta) and multi-step method (Adams).
Discrete Fourier transform and FFT.
Introduction to Wavelet analysis.

Bibliography :

Requirements :
Two years of mathematics at university level. (e.g. completion of STPI at INSA or L2 level Sciences).

Organisation :
Preparation of exercises. Preparation for supervised computer work.

Evaluation :
Three-hour written examination and two-hour examination (on computer at the end of the semester).

Target :

Signal processing II	EII07-A2
Number of hours : 34.50 h	2.00 ECTS credit
CM : 13.50 h, TD : 12.00 h, TP : 9.00 h	
Reference Teacher(s) : KPALMA KIDIYO	

Objectives :
Basics of digital signal processing. To provide students with digital processing methods in order to complete and extend the knowledge of signal theory and (analog) signal processing acquired in EII06-A1 and EII06-A2.

Targeted competences are:
-> Understand the techniques of signal discretization,
-> Understand digital signal processing,
-> Apprehend the limits of those processings

Content :
1. Sampling and quantisation: discrete signals, different samplings, sampling theorem, signal reconstruction; quantisation: definition and principle, quantisation noise, quantisation efficiency, uniform quantisation, quantised signal encoding.
2. Discrete Fourier Transform (DFT): direct and inverse Fourier transform of a digital signal, digital signal frequency spectrums, digital signal Fourier transform properties, convolution, digital signal correlation: frequency sampling, sampling quality, periodic signal DFT, DFT properties, practical DFT for time-limited signals (windowing); Z-transform: direct and inverse transform, properties.
3. Digital filtering: representation methods, IIR/FIR classification, realisation structures, digital filters stability, IIR and FIR synthesis methods.
4. Unitary transforms: review of signals and vector spaces, signal transforms, transformation matrices generation by Kronecker product; Karhunen-Loève Transform (KLT), Hadamard transform (Walsh), Fast Fourier Transform (FFT), Discrete Cosine Transform (DCT); unitary transforms applications.
5. Digital communications introduction: digital transmission link description, modulations classification, emitters/receivers
structure, digital signals description, baseband modelling and complex envelope; baseband digital modulations (PCM, DPCM, PCM delta) and digital modulation on carrier frequency (ASK,FSK,PSK,QAM); modulations efficiency, transmission on real channel.

Bibliography :
1. KUNT M., "Traitement numérique des signaux", Traité d'électricité, Volume XX, Presses Polytechniques Romandes, Lausanne, 1980.
2. FONTOLLIET P. G., "Systèmes de télécommunications, bases de transmission", Dunod, 1983.
3. MARVEN C., EWERS G., "A simple approach to digital signal processing", Texas Instruments, 1993.
4. OPPENHEIM A.V., SHAFER R. W., "Digital Signal Processing", Prentice Hall, Englewood Cliffs, 1975.

Requirements :
Signal processing 1A and 1B (EII06-A1 and EII06-A2).

Organisation :
Lesson review. Preparation of exercises and practical work. Active learning: participation in problem solving on the board or work in sub-groups.

Evaluation :
One-hour written examination in the middle of the semester (without documents). Two-hour written examination (with documents) at the end of the module.

Target :
4EII

Automation IA	EII07-A3
Number of hours : 42.00 h	3.00 ECTS credit
CM : 22.00 h, TD : 20.00 h	
Reference Teacher(s) : GUEGAN SYLVAIN	

Objectives :
Give students an understanding of conventional methods:
- To control analog dynamic systems with one input and one output. Synthesis of control in Laplace transform space.
- To control digital dynamic systems with one input and one output. Synthesis of control in Z transform space.

Content :
1. Analog control in Laplace transform space:
- Simple models and graphical identification methods: first degree model, second degree model, first degree-delay model (Broïda), Ziegler-Nichols model, Strejc model;
- Closed-loop control systems, structure and representation: concept of feedback loop, advantages and basic diagram, graphical representation of open loop and closed- loop transfer functions, Bode diagrams, Black-Nichols plot;
- Stability and precision of closed-loop systems: Routh-Hurwitz and Nyquist stability criteria, stability margins, static and dynamic precision, performance criteria;
- Time and frequential specifications;
- Effects of the addition of poles and zeros to a transfer function, study of main poles;
- Proportional, derivative and integral actions;
- Design methods for correctors: semi-empirical, Naslin, Bode, Nyquist, Black-Nichols, root locus (Evans), internal model control, Smith predictor;
- Introduction to nonlinear systems: phase plane and first harmonic methods, influence of threshold, saturation, ¿
2. Digital control in Z transform space:
- first degree model, second degree model;
- Steady-states precision ;
- Study of stability : location of poles, Jury criterion.
- Time and frequential specifications;
- Effects of the addition of poles and zeros to a transfer function, study of main poles;
- Proportional, derivative and integral actions;
- Synthesis of digital correctors: choice of sampling period, transposition of analog control methods, corrector by bilinear transformation, corrector by impulsional or step invariance, corrector using main poles, minimal time response corrector, accurate response corrector.

Bibliography :
- RIVOIRE M., FERRIER J.-L., 1992, " Cours d'automatique - tome 2 : asservissement, régulation et commande analogique ", Eyrolles.
- RIVOIRE M., FERRIER J.-L., 1993, " Cours d'automatique - tome 3 : commande par calculateur, identification ", Eyrolles.
- KUO Benjamin C., 1995, " Automatic control systems ", Prentice Hall International Editions.
- DE LARMINAT Ph., 1993, " Automatique, commande des systèmes linéaires ", Hermès.
- BORNE P. et al., "Analyse et régulation des processus industriels", Tome 1, Régulation continue, Technip (Paris),

Requirements :
Signals and Systems (EII05-A1).

Organisation :
Revision of lecture notes. Preparation of exercises.

Evaluation :
A written examination of 1 hour without documents during the semester and a written examination of 2 hours with documents at the end of the semester.

Target :
4EII

Automation IB	EII07-A4
Number of hours : 18.00 h	1.50 ECTS credit
TP : 18.00 h	
Reference Teacher(s) : KPALMA KIDIYO	

Objectives :
Practical implementation of the notions addressed during previous lectures and exercises.

Content :
1. Introduction to Matlab/Simulink software.
2. Thermal systems (identification).
3. Regulation of course settings for a helicopter.
4. Flow regulation.
5. On-off regulation of a thermal system.
6. Feedback position control.

Bibliography :
1. DE LARMINAT P., "Automatique", Hermès (Paris), 1993.
2. BORNE P., ..., "Analyse et régulation des processus industriels", Tome 1, Régulation continue, Technip (Paris), 1993.

Requirements :
Signals and Systems (EII05-A1). Control Theory IA (EII07-A3).

Organisation :
Preparation of practical work.

Evaluation :
Mark for practical work.

Target :

Presentations in English	EII07-PROJ1
Number of hours : 13.00 h	1.00 ECTS credit
DIV : 12.00 h, TD : 1.00 h	
Reference Teacher(s) : COUSIN JEAN-GABRIEL	

Objectives :
Given the speed at which technology has been evolving and the fact that it is becoming more interdisciplinary in nature, this
exercise aims at: alerting students to the importance of keeping up to date with technology and modes of communication;
developing the ability to find appropriate information from a variety of different sources (libraries, science journals, computerised databases, etc.); Improving the ability to communicate efficiently through various means (written report,
audio-visual presentation, use of other languages, etc.).

Content :
Each student carries out bibliographical research, produces a brief report in English and prepares a presentation (also in
English, supported by a PowerPoint slideshow). Examples: Aided GPS, Extreme programming, MPEG compression standards:
examples of products, Spread Spectrum: principle and applications, Surgical navigation, Teleportation: what physical realities?
Wireless USB, OLED Technology (Organic Light Emitting Diode) against LCD technology, Batteryless torches (magnetic
induction, dynamo, etc.), Drones, profile of the ideal home automation system, stereograms and 3-D vision: How does it work?
Gas sensor technologies for the measurement of the quality of air (COx, Nox, etc.).

Bibliography :
Provided during the course

Requirements :
None.

Organisation :
About 12 hours per presentation.

Evaluation :
The final mark out of 20 is awarded as follows: scientific and technological content (6 marks); quality of English (6 marks:
writing 3, speaking 3); presentation (6 marks); participation during the presentations (2 marks).

Target :
4EII

Methodology and Project Management	EII07-PROJ2
Number of hours : 32.00 h	2.00 ECTS credit
CM : 6.00 h, CONF : 6.00 h, TD : 20.00 h	
Reference Teacher(s) : DEFORGES OLIVIER	

Objectives :
Presentation and learning of a design methodology for electronic systems: MCSE. Design approach consists of five essential stages (specification, functional design, definition, realisation and test). Each stage uses a specific description model for both structural (present entities, functions of the system, type of relation,etc.) and behavioural aspects. Otherwise, the module emphasises the necessity for a perfectly structured approach for the development of every digital system.
Methodology used later for lectures on real-time systems, programmable logic and VHDL. Introduction to project management through lectures and conferences (given by representatives of various firms).

Content :
MCSE lectures:
1. Purpose of a methodology and general presentation of MCSE.
2. Specification: definition of the environment, descriptions of the entities, inputs/outputs bounding, functional specifications,
operating and technological specifications.
3. Functional design: functional analysis, behaviour (description).
4. Realisation: layout constraints, hardware/software implementation.
5. Examples studied - control-command systems or digital circuits. Project management lectures:
1. Project life cycle.
2. The contract.
3. Cost Estimations.
4. Project design stages.
5. Scheduling.
6. Oral communication. The meeting.

Bibliography :
CALVEZ J. P., "Spécification et conception des systèmes : une méthodologie", Masson.

Requirements :
Combinational Logic - Level 2 (EII05-II1), Sequential logic (EII05-II2).

Organisation :
Active pedagogy, preparing exercises during TD and validating the results in practicals.

Evaluation :
Written examination 3 hours, with documents.

Target :
4EII

English	EII07-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : WEST ANN	

Objectives :
Acquiring the required skills for working in a firm as an engineer. Reaching the required level (B2) is compulsory in order to graduate.

Content :
-Learning by doing:
The student will have to be able to talk and listen, write documents while showing he/she can solve problems, reason, convince and demonstrate in an articulate manner.
-Expressing oneself accurately and fluently.
The student will engage in activities requiring creative and reactive skills (such as debates, role-plays, individual oral presentations using PowerPoint, projects), which will be based on scientific topics and current events.
-Writing CVs and cover letters
-Scientific English
-Discovering the professional world in an international context
-Preparing for the TOEIC (during the second semester, a specific ¿Toeic Booster¿ course will be available)

Bibliography :
- Oxford Advanced learners¿ Dictionary
- English Grammar in Use (Cambridge University Press)

Requirements :
1st, 2nd and 3rd year English courses (or equivalent)

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia language lab and computer rooms are also available and make it possible for the students to work in a stimulating environment. Our teaching resources include press articles, audio and video documents (TV reports, extracts from films and series). We also use the Internet.
Regular personal work is obviously required. The student must be curious and practise English outside the classroom as well.

Evaluation :
One two-hour written exam.

Target :

Economy and Business Management	EII07-ECOG
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course focuses on the complexity of the decision-making process in a company.
Main learning outcomes:
- Understanding information relative to marketing and finance
- The ability to use specific tools and vocabulary in the field of management
- Understanding the importance of teamwork: making collective decisions and producing the expected work in time

Content :
The course is mainly focused around a Business simulation game called Simbrand, which empowers participants to run their own virtual businesses. Just like in real life, the teams compete against each other in order to gain market shares. The right decisions lead to success while the wrong ones engender invaluable problem solving experiences. The learning process becomes efficient and fun, and allows "learning by doing" as well as "learning from mistakes".
As an outcome of the simulation exercise, participants will fully comprehend the different aspects of the marketing decision making process, their relationship with each other, and their impact on the company's overall results. In addition, participants will gain invaluable experience in teamwork and problem solving.
The simulation is based on an online platform that allows students to play in their own language (many languages available: English, Spanish, Portuguese, Chinese ...).

Bibliography :
Provided during the course

Requirements :
None.

Organisation :
2 hours per week

Evaluation :
Each team produces a written report in French and makes an oral presentation in English

Target :
4EII

Sport and physical education	EII07-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : VAILLANT GERARD	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O or
Kayak or golf

Bibliography :
Several specialized books are available to the students at the library. Links to internet sites are given on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Music with studies	HUMT1-MUS
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
- This module aims to enable students who have already reached a good level in music to continue practicing. - Group rehearsals. - Music as a means of developing the collaborative and adaptive abilities that are essential to any teamwork situation.

Content :
- Weekly group rehearsals.
- Classical, jazz or folk music taught by music teachers.
- Use of facilities at INSA-Rennes.
- At least 2 concerts per year.

Bibliography :

Requirements :
At least 5 years of practice.
The ability to read sheet music.
Admission to the "Music with Studies" section is decided upon through an audition conducted by the music teachers.

Organisation :
2 hours per week

Evaluation :
Validation of first semester : no mark awarded

Target :

Semestre 8

Innovation par la Recherche

1	**EII08-PJ-R**		**PROJETS S8**	**5.50**
	EII08-INVR-CR	O	Innov-R- conception et réalisation	5.50
2	**EII08-II-R**		**INFORMATIQUE INDUSTRIELLE S8**	**6.50**
	EII08-II1	O	Object Oriented Programming	2.50
	EII08-II2	O	Real -Time Systems	1.50
	EII08-II4	O	Embedded Operating Systems	1.50
	EII08-II5	O	Data transmission systems	1.00
3	**EII08-MSA**		**Signal, Automation, Mathematics S8**	**3.50**
	EII08-A2	O	Mathematical Programming	2.00
	EII08-A3	O	Image Processing	1.50
4	**EII-STAGE08**		**Industrial Placement**	**8.00**
	EII08-STAGE	O	4 EII Work Placement	8.00
5	**EII-HUM08**		**Non - scientific syllabus S8**	**5.00**
	EII08-ANGL	O	English	2.00
	EII08-ECOG	O	Economy and Business Management	2.00
	EII08-EPS	O	Sport and Physical Education	1.00

O = compulsary, C= in choice , F= optional

Innov-R- conception et réalisation	EII08-INVR-CR
Number of hours : 86.00 h	5.50 ECTS credit
CM : 6.00 h, PR : 80.00 h	
Reference Teacher(s) : MENARD DANIEL	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Object Oriented Programming	EII08-II1
Number of hours : 48.00 h	2.50 ECTS credit
CM : 28.00 h, TP : 20.00 h	
Reference Teacher(s) : ANQUETIL ERIC, PRESSIGOUT MURIEL	

Objectives :
Object Oriented programmation (OOP) is needed to build many software applications.
This course aims to familiarize the student with the object oriented programmation paradigm and to apply them using the C++ language.
The last hours are dedicated to graphical user interfaces where the OOP is widely used.

The targeted skills are :
-> To build a software solution to a simple problem by conceiving the relevant classes and by having a good command of the use of their instances.
-> To build a software solution to a more comple problem by using the inheritance mechanism and virtuals methods.
-> To build a grazphical user interface using MFC, Windows Forms or Qt.

Content :
1. Concepts de base en POO : objets, classes, instances et identité de classe, méthodes et envoi de messages, héritage, classes
clientes, règles d'accès aux membres, constructeurs et destructeurs, surdéfinition de méthodes, surdéfinition d'opérateurs,
variables de classes.
2. Concepts avancés en POO : objets polymorphes, polymorphisme, méthodes virtuelles et liaison dynamique, généricité.
3. Concepts nécessaires pour développer un formulaire de type "Simple Document Interface (SDI) ou de type "Multiple Document Interface (MDI)".
Les deux premières parties font l'objet de TP sous Visual 2010, la troisième se base sur les MFC et les Windows Form ainsi qu'un framework multi plateforme Qt.

Bibliography :
1. MEYER B., "Conception et programmation par objets", Interéditions.
2. BOOCH G., "Conception orientée objets et applications", Addison-Wesley.
3. DEWHURT S. C., STARK K. T., "Programmer en C++", Masson.
4. STROUSTRUP, "Le Langage C++", Addison-Wesley.
5. HILL, "Analyse orientée objet", Addison-Wesley.
6. RUMBAUGH et Al., "OMT - Modélisation et conception orientées objets", Masson.

Requirements :
Langage C (TCM05-INFOC), Langage C : Project (EII06-II3) et Langage C # level 2 (EII06-II1)

Organisation :
Lecture revision, preparing exercises and validating the results in practicals

Evaluation :
Written test of 2 hours with documents at the end of the current semester.

Target :
4EII

Real -Time Systems	EII08-II2
Number of hours : 28.00 h	1.50 ECTS credit
CM : 10.00 h, TD : 6.00 h, TP : 12.00 h	
Reference Teacher(s) : DEFORGES OLIVIER, NEZAN JEAN-FRANCOIS	

Objectives :
Présentation of real-time systems specificities, main features of real-time operation systems, programmation of real-time systems, concept of Multi-Task on monocore and multicore processors.

Targeted competences are:
-> To know main features proposed by real-time operating systems
-> To program an application using a real-time operating system
-> To know the organisation of a real-time operating system

Content :
1. Introduction to real-time : reactive systems, time constraints, position in the design process, need for a real-time operating system
2. multi-task approach : notion of parallelism, task model, monoprocessor and multiprocessor multi-task execution
3. Real-time operating system : goals and features, programming model, task management, sheduling algorithms
4. Examples of application : deadlocks, message passing ...
5. Most popular real-time operating systems
6. Scheduling analysis

Bibliography :
DORSEUIL A., PILLOT P., "Temps réel en milieu industriel : Concepts, environnements, multitâches", Dunod, 1991.

Requirements :
C language and C language level 2 (TCM05-INFOC, EII06-II1), Methodology and project management (EII07-PROJ2)
.

Organisation :
lectures, preparing exercises during TD and validating the results in practicals

Evaluation :
Written examination of 3 hours, with documents.

Target :
4EII

Embedded Operating Systems	EII08-II4
Number of hours : 38.00 h	1.50 ECTS credit
CM : 16.00 h, TP : 22.00 h	
Reference Teacher(s) : PELCAT MAXIME	

Objectives :
This course mainly aims at making the students comfortable with compiling and porting Linux to an embedded platform. Student compiles and prepares a Linux distribution and runs it on an autonomous system based on a TI OMAP3530 containing an ARM Cortex A8 core.

Targeted competences are:
- To configure, cross-compile and load a Linux kernel on an embedded platform
- To create executables and device drivers for embedded platforms
- To adapt rapidly to a new Linux-based target

Content :
1. Cross-compilation
3. Bootloading and board support package
2. Modules and device drivers

Bibliography :
Building Embedded Linux Systems Second Edition, Karim Yaghmour, Jon Masters, Gilad Ben-Yossef, Philippe Gerum, O'Reilly Media, 2008
Linux Device Drivers, 3rd Edition, Corbet Jonathan, Rubini Alessandro, Kroah-Hartman Greg, O'Reilly Media, 2005

Requirements :
C Language (TCM05-INFOC), Microprocessor-Based Systems A and B (EII06-II4 and EII06-II5), C Language Level 2 (EII06-II1), Operating Systems (EII07-II3).

Organisation :
Courses and practicals.

Evaluation :
Practical work.

Target :
4EII

Data transmission systems	EII08-II5
Number of hours : 16.00 h	1.00 ECTS credit
CM : 6.00 h, TP : 10.00 h	
Reference Teacher(s) : MENARD DANIEL, NEZAN JEAN-FRANCOIS	

Objectives :
The goal is to learn about the main data transmission systems for real-time and/or embedded systems. The first part of the lecture is about the main contraints and requirements of data transmissions (security, error detection and correction). Point-to-point connections and network protocols are illustrated on existing use cases (SPI, SCI, CAN)

Targeted competences are:
-> To know the main classes of data communication systems
-> To program microcontrollers using data transmission capabilities

Content :
1. Overview of communication systems : introduction, main problems
2. Point à point communications : parallel / serial links, synchronous / asynchronous links, SPI et SCI busses
3. networks and multipoint communications : network topology, OSI model, CAN protocol

Bibliography :
1. MSP430x2xx Family User¿s Guide (SLAU144E), Texas Instruments Manual, 2008
2. CAN Specification 2.0. BOSCH, 1997 (http://esd.cs.ucr.edu/webres/can20.pdf)

Requirements :
Microprocessor -Based Systems A and B (EII06-II4 et EII06-II5).

Organisation :
lectures, use of SPI and CAN communications protocols in practicals

Evaluation :
Report on experiments and written examination of 1 hour, with documents.

Target :
4EII

Mathematical Programming	EII08-A2
Number of hours : 40.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 12.00 h, TP : 16.00 h	
Reference Teacher(s) : HADDOU MOUNIR	

Objectives :
Linear programming and nonlinear optimisation with or without constraints; Finding an optimum through algorithmic
methods.

Content :
1. Linear programming: Definition, standard form, simplex algorithm, duality, geometrical interpretation.
2. Optimisation without constraints: Global/local minimums and maximums, and convex functions. Digital methods: Newton
method, gradient descent methods, conjugate gradient algorithm - Quasi-Newton methods.
3. Optimisation with constraints: Necessary conditions of optimality: Lagrange or Kuhn-Tucker conditions. Case of convex
programs. Presentation of some selected algorithms. Penalty methods.

Bibliography :
1. SAKAROVITCH M., "Optimisation combinatoire", Volume 1.
2. MINOUX M., "Programmation mathématique", tome 1, Dunod.
3. LUENBERGER D.G., "Introduction to linear and non linear programming", Addison-Wesley.

Requirements :
Mathematics INSA 1st cycle or Science DEUG level.

Organisation :
Revision of lecture notes. Preparation of exercises (2 hours per week). Programming. Writing of a project.

Evaluation :
Three-hour written examination (with documents).
Presentation of project at the end of the semester.

Target :

Image Processing	EII08-A3
Number of hours : 30.00 h	1.50 ECTS credit
CM : 14.00 h, TP : 16.00 h	
Reference Teacher(s) : MORIN LUCE, RONSIN JOSEPH	

Objectives :
This lecture aims at presenting basic image processing principles and tools together with basic methods dedicated to image
analysis and segmentation.

Content :
1. Human vision properties and modelling: perception of light, photometry and colorimetry, the visual system, visual
phenomena, monochrome vision model, colour vision model.
2. Introduction to information theory: source information, entropy and coding.
3. Sampling: Shannon theorem, error recovery, distortions caused by contour sampling
4. Quantization: scalar quantization definition, optimal quantifier (definition and properties), non-linear quantifier, quantifier
enhancement criteria, vector quantisation.
5. Binary image processing: discrete topology elements, topological skeleton, mathematical morphology.
6. Image quality enhancement: Enhancement (Contrast manipulation, histogram correction, false-color).
7. Segmentation: basic primitive extraction (pixel, outline, line/shape), sequential segmentation, iterative segmentation.

Bibliography :
1. KUNT M., GRANLUND R., KOCHER M., ""Traitement numérique des images, traitement de l'information"", Volume 2, Presses Polytechniques Romandes, 1993.
2. GONZALEZ R. C., WOODS R. E., ""Digital image processing"", Addison Wesley Publishing Company, 1992.
3. COSTER M., CHERMAN J. L., ""Précis d'analyse d'images"", Editions du CNRS, 1985.

Requirements :
Signal processing II (EII07-A2).

Organisation :
Revision of lecture notes. Personal'imput work.

Evaluation :
Two-hour written examination (with documents).

Target :

4 EII Work Placement	EII08-STAGE
Number of hours : 240.00 h	8.00 ECTS credit
ST : 240.00 h	
Reference Teacher(s) : NEZAN JEAN-FRANCOIS, PRESSIGOUT MURIEL	

Objectives :
In the interim between the fourth and fifth year of studies, each student from the Electronics and Computer Engineering
speciality must do a compulsory two-month (min) work placement; subject to an agreement.
Their placement allows students to:
- Acquire practical experience in an industrial environment by developing his communication and teamwork skills.
-Increase their capacities of observation, adaptation and integration in a professional context.
-Acquire concrete knowledge of a professional field by discovering how it functions and its operating methods.
- Practice collecting, analysing and summarising information about a project.
- Plan, propose and perform the tasks required to carry out a project.
- Learn the methods needed to take stock of the company's activities.

Content :
- Duration: Two to four months (minimum of eight weeks).
- Period: Mid-May to mid-September (depending on university timetable).
- Level: End of fourth year speciality Electronics and Computer Engineering (Bac + 4).
- Location: Private or public firm, preferably in a professional field related to Electronics and Computer Engineering. (Finding
the company and making contact with it is the student's responsibility).
- Administrative formalities: The placement is subject to an agreement between INSA and the company.
- Placement report: A ten-to-fifteen-page placement report (written in French). One copy to be delivered to the department
registrar's office and one to be delivered to the student's supervising teacher.

Bibliography :
Industrial placements in 2012-2013
- Locations: West of France (66%), Paris area (6%), other areas in France (19%), abroad (9%)
- Types of companies: SMB-SME, Large companies, universities and Research laboratories.
- Fields of activity: Electronics, Telecommunications, Computer science, Automation, Signal and picture processing.

Requirements :

Organisation :

Evaluation :
Final mark (maximum of 20) is awarded for:
(1) trainee assessment reports (placement supervisor + EII supervisor).
(2) placement report.
(3) poster ST4EII.
ECTS credits: The placement gives four ECTS credits in fourth year. The six remaining credits are awarded after the
assessment at the beginning of fifth year.

Target :

English	EII08-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : WEST ANN	

Objectives :
Acquiring the required skills for working in a firm as an engineer. Reaching the required level (B2) is compulsory in order to graduate.

Content :
-Learning by doing:
The student will have to be able to talk and listen, write documents while showing he/she can solve problems, reason, convince and demonstrate in an articulate manner.
-Expressing oneself accurately and fluently.
The student will engage in activities requiring creative and reactive skills (such as debates, role-plays, individual oral presentations using PowerPoint, projects), which will be based on scientific topics and current events.
-Writing CVs and cover letters
-Scientific English
-Discovering the professional world in an international context
-Preparing for the TOEIC. Furthermore, during the second semester, a specific ¿Toeic Booster¿ course is available for students wishing to attend.

Bibliography :
- Oxford Advanced learners¿ Dictionary
- English Grammar in Use (Cambridge University Press)

Requirements :
1st, 2nd and 3rd year English courses (or equivalent)

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia language lab and computer rooms are also available and make it possible for the students to work in a stimulating environment. Our teaching resources include press articles, audio and video documents (TV reports, extracts from films and series). We also use the Internet.
Regular personal work is obviously required. The student must be curious and practise English outside the classroom as well.

Evaluation :
TOEIC
15 minute oral exam

Target :

Economy and Business Management	EII08-ECOG
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course focuses on economic, legal and social matters. Students are encouraged to develop their curiosity and their ability to analyse topics related to the general environment of a company.
Main learning outcomes:
- Understanding key concepts related to a firm's environment and strategies
- The accumulation of high-quality information on these topics
- Establishing a strong, specific- vocabulary base
- Understanding how different stakeholders act

Content :
- Economics: How markets operate. Growth, financing and regulation of the economy
- Law: Corporate law. Industrial and intellectual property rights
- Management: Project management. Corporate social responsibility

Bibliography :
Provided during the course

Requirements :
None

Organisation :
2 hours per week Evaluation
Continuous assessment (collective work) + final examination (2 hours)

Evaluation :
Continuous assessment.

Target :
4EII

Sport and Physical Education	EII08-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : VAILLANT GERARD	

Objectives :
Team work, discovery of one's capabilities, communication, invention, autonomy, self-discovery and management responsibilities.

Content :
Whole class: "role of the coach, role of the referee, management" (knowledge of the rules, getting involved, leading, decision
making and communicating). Practice and knowledge of the sociomotive roles involved in the strategies of team attack and
team defence. Finding one's place in a group and awareness of your team-mates and their responsibilities.
Organisation of Physical and Sports Education: two 15-hour and one 30-hour sports or physical activity programmes in groups.

Bibliography :
Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Semestre 8

Parcours Formation Initiale EII

1	**EII08-E**		**Project S8**	**5.50**
	EII08-PROJA	O	Multidisciplinary project A	2.00
	EII08-PROJB	O	Multidisciplinary project B	2.00
	EII08-II3	O	VHDL Programming	1.50
2	**EII08-II**		**Computer Engineering S8**	**8.00**
	EII08-II1	O	Object Oriented Programming	2.50
	EII08-II2	O	Real -Time Systems	1.50
	EII08-II4	O	Embedded Operating Systems	1.50
	EII08-II5	O	Data transmission systems	1.00
	EII08-II6	O	Computer networks	1.50
3	**EII08-MSA**		**Signal, Automation, Mathematics S8**	**3.50**
	EII08-A2	O	Mathematical Programming	2.00
	EII08-A3	O	Image Processing	1.50
4	**EII-STAGE08**		**Industrial Placement**	**8.00**
	EII08-STAGE	O	4 EII Work Placement	8.00
5	**EII-HUM08**		**Non - scientific syllabus S8**	**5.00**
	EII08-ANGL	O	English	2.00
	EII08-ECOG	O	Economy and Business Management	2.00
	EII08-EPS	O	Sport and Physical Education	1.00
6	**HUMT2-SAM(1)**		**"SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility)**	**1.00**
	HUMT2-APES	F	APES	1.00
7	**HUMT2-SAM(2)**		**SAM : APES Responsabilités Associatives**	**2.00**
	HUMT2-APES ASSO	F	Association membership & responsabilities 2 credits	2.00
8	**HUMT2-SAM(3)**		**SAM : APES Responsabilités Associatives**	**3.00**
	HUMT2-APES RESP	F	Association membership & responsabilities 3 credits	3.00
9	**HUMT2-ELSA ES**		**High Level Sport with Studies / Sports Management MODULE**	**1.00**
	HUMT2-ES	F	High-Level sport with studies	1.00

O = compulsary, C= in choice , F= optional

Multidisciplinary project A	EII08-PROJA
Number of hours : 7.00 h	2.00 ECTS credit
CM : 1.00 h, PR : 6.00 h	
Reference Teacher(s) : PELCAT MAXIME	

Objectives :
-Emphasis on design, problem solving, teamwork and practical experience through the design of a new multidisciplinary
application.
-Put into practice the skills previously acquired in other modules (methodology and project leading, electronic systems, microprocessor systems, programming languages).
-Design and produce a complex electronic application which includes an analog part, and a digital part that uses a microcontroller and logic components.
-Write a technical report on thisproject.

Content :
Based on the supplied specifications, each team (4 to 5 students) must solve problems similar to those they may encounter in
an industrial environment. The multidisciplinary project, for practical reasons, is divided into two modules. For further details
on stages 4 and 5, please refer to MULTIDISCIPLINARY PROJECT B (EII08-PROJB).
-Stage 1: Preliminary design (1h presentation; 3x3h of supervised project work): Analysis of the specifications detailing the
different operating modes. Study of the problem using the MCSE approach : Each team decides on a solution. Production of
"methodological specifications". Production of a "preliminary draft report" detailing the diagrams, solutions and justifying the
choice of the microcontroller.
-Stage 2: Presentation of the different solutions. Critical study and elaboration of a joint solution (2h30): Each team presents its
hardware solution to the whole graduation class using PowerPoint (5 minutes per group). The teacher leads a discussion on the
different solutions and the class reaches agreement on the best solution (45 minutes). The practical problems associated with
the embedding of components and the manufacturing of printed circuit boards are presented and various items are introduced
to facilitate the tuning of the system (decoupling capacitors, loop resistors, additional wiring zones for eventual corrections,
etc.) (45 minutes).
-Stage 3: Production of the printed circuit board (1h30): The teacher presents the tools, techniques and files associated with the
drawing and routing of the circuit, demonstrating how to place some components and then presents the final result (1h30).
The files are then transmitted to a service firm which produces identical boards for each team. The boards are then wired at the
INSA.
-Stage 4: Study and realisation of the analogical electronic part (6x3h of supervised project work).
-Stage 5: Programming and tuning (4x3h of supervised project work).

Bibliography :

Requirements :

Organisation :
Approximately 30h per team of 4/5 students.

Evaluation :
Evaluation is based on a marking grid that takes into account the following items: methodological specifications, preliminary draft report, and presentation of the hardware solution.

Target :

Multidisciplinary project B	EII08-PROJB
Number of hours : 36.00 h	2.00 ECTS credit
PR : 36.00 h	
Reference Teacher(s) : PELCAT MAXIME	

Objectives :
-Emphasis on design, problem solving, teamwork and practical experience through the design of a new multidisciplinary
application.
-Put into practice the skills previously acquired in other modules (methodology and project leading, electronic systems, microprocessor systems, programming languages).
-Design and produce a complex electronic application which includes an analogic part and a digital part that uses a microcontroller and logical components.
-Write a technical report on this
project.

Content :
-Based on the supplied specifications, each team (4 to 5 students) must solve concrete problems similar to those they may
encounter in an industrial environment. The multidisciplinary project, for practical reasons, is divided into two modules. For
further details on stages 1 and 2, please refer to MULTIDISCIPLINARY PROJECT A (EII08-PROJA).
-Stage 1: Preliminary design (1h presentation; 3x3h of supervised project work).
-Stage 2: Presentation of the different solutions. Critical study and elaboration of a joint solution (2h30 lesson).
-Stage 3: Production of the printed circuit board (1h30 lesson).
-Stage 4: Study and production of the analog electronic part (6x3h of supervised project work): Breakdown of the application
into its elementary functions. Each team member is responsible for the execution of one function. Coordination is carried out
by a project leader to ensure that the planning and time limits are respected and that the complete system works well. A
complete board is wired and tested by each team. Writing of a report.
-Stage 5: Programming and tuning (4x3h of supervised project work): Each team receives a wired microcontroller board and
develops a programme. The development consists of checking that the hardware functions correctly and elaborating the
required functionalities by software programming. Writing of a thorough technical report.

Bibliography :

Requirements :
Multidisciplinary project A (EII08-PROJ1)

Organisation :
Approximately 30h per team of 4/5 students.

Evaluation :
Evaluation is based on a marking grid that takes into account the following items: Electronic part report, Technical report and
the results obtained.

Target :

VHDL Programming	EII08-II3
Number of hours : 38.00 h	1.50 ECTS credit
CM : 12.00 h, PR : 10.00 h, TP : 16.00 h	
Reference Teacher(s) : DEFORGES OLIVIER	

Objectives :
Familiarisation with VHDL, a standard high level Hardware Description Language (HDL). VHDL is widely used to model complex digital systems and to synthesise them on ASICs or programmable devices.

Content :
1. Description: behaviour, data flow, structure.
2. Temporal modelling.
3. Lexical and syntactic basics of the language.
4. Structural description.
5. High level behavioural description.
6. Synchronous/asynchronous logic description.
7. General planning of a design.
8. VHDL synthesis.
9. Link to design methodology: MCSE.

The first 8 hours of practical work are dedicated to the modelling and simulation of digital systems composed of simple components (multiplexers, comparators, sequencers, pipeline registers, etc.). The following 8 hours are dedicated to z more complex specification and description : a 8085 based processor. The last 8 hours are dedicated to a project.

Bibliography :
1. AUMIAUX M., "Initiation au langage VHDL", Masson.
2. DUTRIEUX L., DEMIGNY D., "Logique programmable", Eyrolles.
3. PERRY D. L., "VHDL", McGraw-Hill Series on Computer Engineering.
4. Principal site web : http://www.vhdl.org/

Requirements :
Combinational Logic: Level 2 (EII05-II1), Sequential Logic (EII05-II2), Architecture of Calculators I (EII06-II2), Design methodology (EII07-PROJ2), Programmable Logic (EII07-E3).

Organisation :
Revision of lecture notes. Preparation of practical work and project.

Evaluation :
Project evaluation

Target :
4EII

Object Oriented Programming	EII08-II1
Number of hours : 48.00 h	2.50 ECTS credit
CM : 28.00 h, TP : 20.00 h	
Reference Teacher(s) : ANQUETIL ERIC, PRESSIGOUT MURIEL	

Objectives :
Object Oriented programmation (OOP) is needed to build many software applications.
This course aims to familiarize the student with the object oriented programmation paradigm and to apply them using the C++ language.
The last hours are dedicated to graphical user interfaces where the OOP is widely used.

The targeted skills are :
-> To build a software solution to a simple problem by conceiving the relevant classes and by having a good command of the use of their instances.
-> To build a software solution to a more comple problem by using the inheritance mechanism and virtuals methods.
-> To build a grazphical user interface using MFC, Windows Forms or Qt.

Content :
1. Concepts de base en POO : objets, classes, instances et identité de classe, méthodes et envoi de messages, héritage, classes
clientes, règles d'accès aux membres, constructeurs et destructeurs, surdéfinition de méthodes, surdéfinition d'opérateurs,
variables de classes.
2. Concepts avancés en POO : objets polymorphes, polymorphisme, méthodes virtuelles et liaison dynamique, généricité.
3. Concepts nécessaires pour développer un formulaire de type "Simple Document Interface (SDI) ou de type "Multiple Document Interface (MDI)".
Les deux premières parties font l'objet de TP sous Visual 2010, la troisième se base sur les MFC et les Windows Form ainsi qu'un framework multi plateforme Qt.

Bibliography :
1. MEYER B., "Conception et programmation par objets", Interéditions.
2. BOOCH G., "Conception orientée objets et applications", Addison-Wesley.
3. DEWHURT S. C., STARK K. T., "Programmer en C++", Masson.
4. STROUSTRUP, "Le Langage C++", Addison-Wesley.
5. HILL, "Analyse orientée objet", Addison-Wesley.
6. RUMBAUGH et Al., "OMT - Modélisation et conception orientées objets", Masson.

Requirements :
Langage C (TCM05-INFOC), Langage C : Project (EII06-II3) et Langage C # level 2 (EII06-II1)

Organisation :
Lecture revision, preparing exercises and validating the results in practicals

Evaluation :
Written test of 2 hours with documents at the end of the current semester.

Target :
4EII

Real -Time Systems	EII08-II2
Number of hours : 28.00 h	1.50 ECTS credit
CM : 10.00 h, TD : 6.00 h, TP : 12.00 h	
Reference Teacher(s) : DEFORGES OLIVIER, NEZAN JEAN-FRANCOIS	

Objectives :
Présentation of real-time systems specificities, main features of real-time operation systems, programmation of real-time systems, concept of Multi-Task on monocore and multicore processors.

Targeted competences are:
-> To know main features proposed by real-time operating systems
-> To program an application using a real-time operating system
-> To know the organisation of a real-time operating system

Content :
1. Introduction to real-time : reactive systems, time constraints, position in the design process, need for a real-time operating system
2. multi-task approach : notion of parallelism, task model, monoprocessor and multiprocessor multi-task execution
3. Real-time operating system : goals and features, programming model, task management, sheduling algorithms
4. Examples of application : deadlocks, message passing ...
5. Most popular real-time operating systems
6. Scheduling analysis

Bibliography :
DORSEUIL A., PILLOT P., "Temps réel en milieu industriel : Concepts, environnements, multitâches", Dunod, 1991.

Requirements :
C language and C language level 2 (TCM05-INFOC, EII06-II1), Methodology and project management (EII07-PROJ2)
.

Organisation :
lectures, preparing exercises during TD and validating the results in practicals

Evaluation :
Written examination of 3 hours, with documents.

Target :
4EII

Embedded Operating Systems	EII08-II4
Number of hours : 38.00 h	1.50 ECTS credit
CM : 16.00 h, TP : 22.00 h	
Reference Teacher(s) : PELCAT MAXIME	

Objectives :
This course mainly aims at making the students comfortable with compiling and porting Linux to an embedded platform. Student compiles and prepares a Linux distribution and runs it on an autonomous system based on a TI OMAP3530 containing an ARM Cortex A8 core.

Targeted competences are:
- To configure, cross-compile and load a Linux kernel on an embedded platform
- To create executables and device drivers for embedded platforms
- To adapt rapidly to a new Linux-based target

Content :
1. Cross-compilation
3. Bootloading and board support package
2. Modules and device drivers

Bibliography :
Building Embedded Linux Systems Second Edition, Karim Yaghmour, Jon Masters, Gilad Ben-Yossef, Philippe Gerum, O'Reilly Media, 2008
Linux Device Drivers, 3rd Edition, Corbet Jonathan, Rubini Alessandro, Kroah-Hartman Greg, O'Reilly Media, 2005

Requirements :
C Language (TCM05-INFOC), Microprocessor-Based Systems A and B (EII06-II4 and EII06-II5), C Language Level 2 (EII06-II1), Operating Systems (EII07-II3).

Organisation :
Courses and practicals.

Evaluation :
Practical work.

Target :
4EII

Data transmission systems	EII08-II5
Number of hours : 16.00 h	1.00 ECTS credit
CM : 6.00 h, TP : 10.00 h	
Reference Teacher(s) : MENARD DANIEL, NEZAN JEAN-FRANCOIS	

Objectives :
The goal is to learn about the main data transmission systems for real-time and/or embedded systems. The first part of the lecture is about the main contraints and requirements of data transmissions (security, error detection and correction). Point-to-point connections and network protocols are illustrated on existing use cases (SPI, SCI, CAN)

Targeted competences are:
-> To know the main classes of data communication systems
-> To program microcontrollers using data transmission capabilities

Content :
1. Overview of communication systems : introduction, main problems
2. Point à point communications : parallel / serial links, synchronous / asynchronous links, SPI et SCI busses
3. networks and multipoint communications : network topology, OSI model, CAN protocol

Bibliography :
1. MSP430x2xx Family User¿s Guide (SLAU144E), Texas Instruments Manual, 2008
2. CAN Specification 2.0. BOSCH, 1997 (http://esd.cs.ucr.edu/webres/can20.pdf)

Requirements :
Microprocessor -Based Systems A and B (EII06-II4 et EII06-II5).

Organisation :
lectures, use of SPI and CAN communications protocols in practicals

Evaluation :
Report on experiments and written examination of 1 hour, with documents.

Target :
4EII

Computer networks	EII08-II6
Number of hours : 26.00 h	1.50 ECTS credit
CM : 14.00 h, TD : 4.00 h, TP : 8.00 h	
Reference Teacher(s) : BEDAT LAURENT, UZEL FABIENNE	

Objectives :
This module is aimed at students who have chosen not to specialise in networks. Explanation of the evolution of networks of
all sizes (LAN/MAN/WAN and Telecom) and demonstration of how current and future infrastructures may be suitable for new
applications. Focus on two main points: "quality of service" and "high-speed". Quality of service is defined by a set of
parameters (data integrity, real-time, security, hierarchical organisation of data) that are exchanged between the software and
the network. High-speed is analysed by making a comparison between classic protocols (Ethernet, Token Ring, RNIS, IP) and
emerging protocols (ATM, IPv6). The spread of new network architectures and carefully-chosen applied-examples demonstrates suitability.

Content :
1. Evolution of networks: Taxonomy of existing networks; PDH, SDH and cell based physical layers; optical and satellite
links; Concept of Quality of service.
2. Protocols: Local Area Networks (Ethernet), Mid and High-range networks (IP, ATM).
3. Quality of Service: Data integrity, Security, Real Time applications, Current and future applications, Multimedia applications (text, sound, image, vide, etc.); LAN infrastructures, MAN, high-speed WAN.
4. Internet architecture: IPv4, IPv6, UDP, TCP protocols, DNS servers, Web Servers, Proxy servers, Firewalls.

Bibliography :
1. TANENBAUM A., ""Réseaux"", Dunod 3ème édition, 1999.
2. ROLIN P., ""Réseaux haut débit"", Hermès, 1995.
3. PUJOLLE G., ""Les réseaux"", 1997.
4. STEVENS R., ""TCP/IP illustré"", volume 1, Thomson Publishing, 1996.

Requirements :
None

Organisation :
Revision of lecture notes. Preparation of practical work.

Evaluation :
Two-hour written examination (with documents) at the end of the semester. Remedial examination at the end of the year (if
required).

Target :
4EII

Mathematical Programming	EII08-A2
Number of hours : 40.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 12.00 h, TP : 16.00 h	
Reference Teacher(s) : HADDOU MOUNIR	

Objectives :
Linear programming and nonlinear optimisation with or without constraints; Finding an optimum through algorithmic
methods.

Content :
1. Linear programming: Definition, standard form, simplex algorithm, duality, geometrical interpretation.
2. Optimisation without constraints: Global/local minimums and maximums, and convex functions. Digital methods: Newton
method, gradient descent methods, conjugate gradient algorithm - Quasi-Newton methods.
3. Optimisation with constraints: Necessary conditions of optimality: Lagrange or Kuhn-Tucker conditions. Case of convex
programs. Presentation of some selected algorithms. Penalty methods.

Bibliography :
1. SAKAROVITCH M., "Optimisation combinatoire", Volume 1.
2. MINOUX M., "Programmation mathématique", tome 1, Dunod.
3. LUENBERGER D.G., "Introduction to linear and non linear programming", Addison-Wesley.

Requirements :
Mathematics INSA 1st cycle or Science DEUG level.

Organisation :
Revision of lecture notes. Preparation of exercises (2 hours per week). Programming. Writing of a project.

Evaluation :
Three-hour written examination (with documents).
Presentation of project at the end of the semester.

Target :

Image Processing	EII08-A3
Number of hours : 30.00 h	1.50 ECTS credit
CM : 14.00 h, TP : 16.00 h	
Reference Teacher(s) : MORIN LUCE, RONSIN JOSEPH	

Objectives :
This lecture aims at presenting basic image processing principles and tools together with basic methods dedicated to image
analysis and segmentation.

Content :
1. Human vision properties and modelling: perception of light, photometry and colorimetry, the visual system, visual
phenomena, monochrome vision model, colour vision model.
2. Introduction to information theory: source information, entropy and coding.
3. Sampling: Shannon theorem, error recovery, distortions caused by contour sampling
4. Quantization: scalar quantization definition, optimal quantifier (definition and properties), non-linear quantifier, quantifier
enhancement criteria, vector quantisation.
5. Binary image processing: discrete topology elements, topological skeleton, mathematical morphology.
6. Image quality enhancement: Enhancement (Contrast manipulation, histogram correction, false-color).
7. Segmentation: basic primitive extraction (pixel, outline, line/shape), sequential segmentation, iterative segmentation.

Bibliography :
1. KUNT M., GRANLUND R., KOCHER M., ""Traitement numérique des images, traitement de l'information"", Volume 2, Presses Polytechniques Romandes, 1993.
2. GONZALEZ R. C., WOODS R. E., ""Digital image processing"", Addison Wesley Publishing Company, 1992.
3. COSTER M., CHERMAN J. L., ""Précis d'analyse d'images"", Editions du CNRS, 1985.

Requirements :
Signal processing II (EII07-A2).

Organisation :
Revision of lecture notes. Personal'imput work.

Evaluation :
Two-hour written examination (with documents).

Target :

4 EII Work Placement	EII08-STAGE
Number of hours : 240.00 h	8.00 ECTS credit
ST : 240.00 h	
Reference Teacher(s) : NEZAN JEAN-FRANCOIS, PRESSIGOUT MURIEL	

Objectives :
In the interim between the fourth and fifth year of studies, each student from the Electronics and Computer Engineering
speciality must do a compulsory two-month (min) work placement; subject to an agreement.
Their placement allows students to:
- Acquire practical experience in an industrial environment by developing his communication and teamwork skills.
-Increase their capacities of observation, adaptation and integration in a professional context.
-Acquire concrete knowledge of a professional field by discovering how it functions and its operating methods.
- Practice collecting, analysing and summarising information about a project.
- Plan, propose and perform the tasks required to carry out a project.
- Learn the methods needed to take stock of the company's activities.

Content :
- Duration: Two to four months (minimum of eight weeks).
- Period: Mid-May to mid-September (depending on university timetable).
- Level: End of fourth year speciality Electronics and Computer Engineering (Bac + 4).
- Location: Private or public firm, preferably in a professional field related to Electronics and Computer Engineering. (Finding
the company and making contact with it is the student's responsibility).
- Administrative formalities: The placement is subject to an agreement between INSA and the company.
- Placement report: A ten-to-fifteen-page placement report (written in French). One copy to be delivered to the department
registrar's office and one to be delivered to the student's supervising teacher.

Bibliography :
Industrial placements in 2012-2013
- Locations: West of France (66%), Paris area (6%), other areas in France (19%), abroad (9%)
- Types of companies: SMB-SME, Large companies, universities and Research laboratories.
- Fields of activity: Electronics, Telecommunications, Computer science, Automation, Signal and picture processing.

Requirements :

Organisation :

Evaluation :
Final mark (maximum of 20) is awarded for:
(1) trainee assessment reports (placement supervisor + EII supervisor).
(2) placement report.
(3) poster ST4EII.
ECTS credits: The placement gives four ECTS credits in fourth year. The six remaining credits are awarded after the
assessment at the beginning of fifth year.

Target :

English	EII08-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : WEST ANN	

Objectives :
Acquiring the required skills for working in a firm as an engineer. Reaching the required level (B2) is compulsory in order to graduate.

Content :
-Learning by doing:
The student will have to be able to talk and listen, write documents while showing he/she can solve problems, reason, convince and demonstrate in an articulate manner.
-Expressing oneself accurately and fluently.
The student will engage in activities requiring creative and reactive skills (such as debates, role-plays, individual oral presentations using PowerPoint, projects), which will be based on scientific topics and current events.
-Writing CVs and cover letters
-Scientific English
-Discovering the professional world in an international context
-Preparing for the TOEIC. Furthermore, during the second semester, a specific ¿Toeic Booster¿ course is available for students wishing to attend.

Bibliography :
- Oxford Advanced learners¿ Dictionary
- English Grammar in Use (Cambridge University Press)

Requirements :
1st, 2nd and 3rd year English courses (or equivalent)

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia language lab and computer rooms are also available and make it possible for the students to work in a stimulating environment. Our teaching resources include press articles, audio and video documents (TV reports, extracts from films and series). We also use the Internet.
Regular personal work is obviously required. The student must be curious and practise English outside the classroom as well.

Evaluation :
TOEIC
15 minute oral exam

Target :

Economy and Business Management	EII08-ECOG
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course focuses on economic, legal and social matters. Students are encouraged to develop their curiosity and their ability to analyse topics related to the general environment of a company.
Main learning outcomes:
- Understanding key concepts related to a firm's environment and strategies
- The accumulation of high-quality information on these topics
- Establishing a strong, specific- vocabulary base
- Understanding how different stakeholders act

Content :
- Economics: How markets operate. Growth, financing and regulation of the economy
- Law: Corporate law. Industrial and intellectual property rights
- Management: Project management. Corporate social responsibility

Bibliography :
Provided during the course

Requirements :
None

Organisation :
2 hours per week Evaluation
Continuous assessment (collective work) + final examination (2 hours)

Evaluation :
Continuous assessment.

Target :
4EII

Sport and Physical Education	EII08-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : VAILLANT GERARD	

Objectives :
Team work, discovery of one's capabilities, communication, invention, autonomy, self-discovery and management responsibilities.

Content :
Whole class: "role of the coach, role of the referee, management" (knowledge of the rules, getting involved, leading, decision
making and communicating). Practice and knowledge of the sociomotive roles involved in the strategies of team attack and
team defence. Finding one's place in a group and awareness of your team-mates and their responsibilities.
Organisation of Physical and Sports Education: two 15-hour and one 30-hour sports or physical activity programmes in groups.

Bibliography :
Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

APES	HUMT2-APES
Number of hours : 30.00 h	1.00 ECTS credit
DIV : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Association membership & responsabilities 2 credits	HUMT2-APES ASSO
Number of hours : 14.00 h	2.00 ECTS credit
DIV : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Association membership & responsabilities 3 credits	HUMT2-APES RESP
Number of hours : 20.00 h	3.00 ECTS credit
DIV : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

High-Level sport with studies	HUMT2-ES
Number of hours : 6.00 h	1.00 ECTS credit
CM : 6.00 h	
Reference Teacher(s) : VAILLANT GERARD	

Objectives :
Students must set out and structure a personal project to establish the best possible coherence between engineering studies at
INSA and a career as a high-level athlete. Acquisition of specific knowledge and know-how.

Content :
- Lessons and conferences on the tools of project management.
- Guided work on project building (personal career).
- Stress management. Relaxation therapy. Action type profiling. Mental preparation. Athletic traumatology. Motivation.
Dietetics. Physical preparation.
Organisation : Lessons, and evening conferences.

Bibliography :
Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education website.

Requirements :

Organisation :

Evaluation :
Production of a personal-career dossier. Oral presentation (30 minutes).
The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :
Maximum 4 semestrial registrations throughout the whole cursus.

Semestre 9

Parcours Formation Initiale EII

1	**EII09-TTI**		**T.C Data Processing and Transmission**	**9.00**
	EII09-CIV	O	Image and Video Compression	2.50
	EII09-TRAN	O	Transcodage Vidéo	0.50
	EII09-VIND	O	Machine Vision	1.00
	EII09-VO	O	Computer Vision	2.00
	EII09-TSS	O	Statistical Signal Processing	2.00
	EII09-CNUM	O	Digital communications	1.00
2	**EII09-P&L**		**T.C Programming and Languages**	**7.00**
	EII09-QLOG	O	Software Quality	3.00
	EII09-PROJ	O	Project "Innovative Technologies"	4.00
3	**EII09-SE**		**Embedded systems**	**8.50**
	EII09-DSP	O	Digital Signal Processor	2.00
	EII09-COAV	O	Advanced Design Methods	1.00
	EII09-HSCD	O	Hardware-Software Co-design Hardware-Software Co-design	1.00
	EII09-SYSC	O	SystemC	1.50
	EII09-MDSP	O	Multicore Digital Signal ProcessingMulticore Digital Signal Processing Multicore Digital Signal Processing	3.00
4	**EII-HUM09**		**Non - scientific syllabus S9**	**5.50**
	EII09-POST	O	4 EII Work Placement - Evaluation	1.00
	EII09-HUMT	O	Convince and Debate	1.00
	HUMT1-PGE-A	C	Economics, Law and Business Studies A (serious game)	2.00
	HUMT1-PGE-B	C	Economics, Law and Business Studies B (Lean six sigma)	2.00
	HUMT1-PGE-C	C	Economics, Law and Business Studies C (human resource management)	2.00
	HUMT1-PGE-D	C	Economics, Law and Business Studies D (Marketing for ICT Companies)	2.00
	HUMT1-PGE-E	C	Economics, Law and Business Studies E (Industrial design and innovation)	2.00
	HUMT1-PGE-F	C	Economics, Law and Business Studies F (Mangement and decision making)	2.00
	HUMT1-ANGL/CONV	C	English S9 Conversation	1.50
	HUMT1-ANGL/TOEIC	C	TOEIC 5th year	1.50

O = compulsary, C= in choice , F= optional

Image and Video Compression	EII09-CIV
Number of hours : 32.00 h	2.50 ECTS credit
CM : 10.00 h, CONF : 6.00 h, TP : 16.00 h	
Reference Teacher(s) : MORIN LUCE, ZHANG LU	

Objectives :
This lecture aims at presenting fundamental and advanced methods dedicated to image and video compression.

Targeted competences are:
-> To know image and video coding scheme through functionality analysis
-> To translate state-of-the-art algorithms into C or Matlab code

Content :
1. Introduction to image coding: PCM, DPCM, MIC, MICD, transform coding
2. Still image standards: JPEG, JPEG-LS, JPEG 2000, LAR
3. Video compression: motion estimation and compensation, standard video codecs: MPEG-2, MPEG-4, AVC, SVC, HEVC
4. Conferences by industrial partners ; conferences may vary each year
examples :
- Standardization, Pierrick Philippe, Orange Labs
- HEVC : High Efficiency Video Coding, The video coding standard for 2013 to 2030 , Félix Henry, Orange Labs
- Quality asssment for video coding, Jérome Fournier, Orange Labs

Bibliography :
[1] T. Ebrahimi, C. Christopoulos, "JPEG 2000 The next generation still image coding system", EUSIPCO'00, 2000
[2] Gregory K. Wallace, "The JPEG Still Picture Compression Standard" , IEEE Transactions on Consumer Electronics, Vol.38, No. 1, Février 1992
[3] Bernd Girod, "Image and Video Compression", lecture notes, Standford University, 2005
[4] Ian E Richardson, "H.264 and MPEG-4 Video Compression", John Wiley ed., 2003
[5] Vector Quantization and Signal Compression, Allen Gersho, Robert M. Gray, Springer, 1992

Requirements :
Signal Processing II (EII07-A2).
Image Processing (EII08-A3)
Statistical Signal Processing (EII09-TSS)

Organisation :
- Revision of lecture notes. Preparation of practical works.
- Labs with EIIMage and VCDemo softwares, implementation of coding algorithms in C language

Evaluation :
One-hour and half written examination (with documents).

Target :
Students in 5EII, M&N, master I-MARS

Transcodage Vidéo	EII09-TRAN
Number of hours : 9.00 h	0.50 ECTS credit
CM : 3.00 h, TP : 6.00 h	
Reference Teacher(s) : MORIN LUCE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Machine Vision	EII09-VIND
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : PRESSIGOUT MURIEL	

Objectives :
To introduce machine vision techniques as applied to the industrial world. To describe the architecture of the main components of a machine vision system.

Content :
1. Main industrial applications (control, identification, automated guided vehicle).
2. Market for machine vision technology in Europe and the USA.
3. Sensor technology: linear array and matrix CCD cameras.
4. Lighting principle.
5. Vision system architecture.
6. Tools for real time picture processing.
7. Vision and robotics.

Bibliography :

Requirements :
EII08-A3 : Image processing

Organisation :
revision and in-depth study of the lectures

Evaluation :
Presence at lectures

Target :
5EII

Computer Vision	EII09-VO
Number of hours : 35.00 h	2.00 ECTS credit
CM : 16.00 h, CONF : 3.00 h, TP : 16.00 h	
Reference Teacher(s) : PRESSIGOUT MURIEL	

Objectives :
This course is an introduction to computer vision techniques with a single camera or with several ones. Estimation processes used in computer vision are also studied.

The targeted skills are :
-> Solve a pose computation problem by using a Gauss-Newton minimization
-> Compute a depth map from stereoscopic images using the epipolar geometry properties
-> Estimate a 2D tranformation using a RANSAC algorithm
-> Solve a vision problem by determining the associated equations and use an existing software platform to implement the solution.

Content :
1. Monocular vision geometry (perspective projection, calibration and pose estimation)
2. Sterevision : 3D reconstruction, epipolar geometry, 2D homography, autocalibration

Pratical exercises are in C++ language.

Bibliography :
1. HORAUD R., MONGA O., ""Vision par ordinateur"", Hermès, 1993.
2. AYACHE N., ""Vision stéréoscopique et perception multi-sensorielle"", Inter-Ed. Science Info, 1988.
3. HARTLEY R., ZISSERMAN A., "Multiple View Geometry in Computer Vision", Second Edition, Cambridge University Press, March 2004.

Requirements :
Optimization (EII08-A3) and object oriented programming (EII08-II1).

Organisation :
Revision of lecture notes. Preparation of practical work.

Evaluation :
Two-hour written examination (no documents) at the end of the semester. Possible oral remedial examination at the end of the year.

Target :
5EII, Media and Networks semester

Statistical Signal Processing	EII09-TSS
Number of hours : 28.00 h	2.00 ECTS credit
CM : 10.00 h, TD : 6.00 h, TP : 12.00 h	
Reference Teacher(s) : BABEL MARIE, PROVOST JEAN-NOEL	

Objectives :
In signal and image processing, signals are very often subject to interference, which may prevent the automatic recognition of the transmitted data. The observation and interpretation of signal interference is of great importance in the realisation of a multimedia communications system. The objective of this module is to present the concepts and provide the necessary tools for good decision-making: the observer looks for the best of all solutions based on previously defined criteria. Therefore, the following subjects are addressed: estimation, detection, matched filtering and signal classification. Emphasis is laid on the Markov chain model, used for classification.

Targeted competences are:
-> To analyse and modelize an estimation/detection problem
-> To propose solutions dedicated to the modelized problem
-> To translate estimation/detection algorithms into Matlab code

Content :
1. Estimation of parameters, maximum likelihood, posterior mode, mean quadratic error, performance of an estimator, sufficiency.
2. Detection: binary decision and hypothesis testing, Bayes' criterion, mean-risk function, Neyman Pearson test, ROC plots.
3. Matched filtering.
4. Markov chains with finite state space, Baum forward-backward equation, hidden Markov models.
5. 2D Markov fields.
5. Supervised and non-supervised classification

Bibliography :
[1] DECLERCQ D., QUINQUIS A., 'Détection et estimation des signaux", Hermes, 1996.
[2] VAN DER HEIJDEN "Classification, parameter estimation and state estimation : an engineering approach using
MatLab", Lavoisier, 2004.
[3] H. L. VAN TREES, "Detection, Estimation, and Modulation Theory, Part I", Wiley, 2001
[4] GUGLIELMI Michel, " Signaux aléatoires : modélisation, estimation, détection", Traité IC2, série Traitement du signal et de l'image, Lavoisier, 2004
[5] S. GEMAN, D. GEMAN. "Stochastic relaxation, Gibbs distributions and the Bayesian restoration of images", in: I.E.E.E. Transactions on Pattern Analysis and Machine Intelligence, 1984, vol. 6, p. 721-741.

Requirements :
Core curriculum mathematics (TCM05-ANAL), Signal processing II (EII07-A2), digital methods (EII07-A1), Control theory II (EII08-A1).

Organisation :
Revision of lecture notes. Preparation of exercises and practical work.

Evaluation :
Two-hour written examination at the end of the semester (Documents authorised).

Target :
5EII

Digital communications	EII09-CNUM
Number of hours : 10.00 h	1.00 ECTS credit
CM : 10.00 h	
Reference Teacher(s) : MENARD DANIEL	

Objectives :
The principles used in digital communications and on the problems encountered on a real communications channel
N.B.: this lecture is in English

Targeted main competences are:
- To take a lecture in English

Content :
- Overview of digital communications: utility, system architecture, communication channel, baseband and radiofrequency signals, transmitter and modulator, receiver and demodulator
- Baseband formats and coding
- Radiofrequency modulations ASK/PSK/FSK/QAM/..., power spectral density
- Modulation performance in the presence of white noise, error probability calculation, Nyquist criteria

Bibliography :
- FONTOLLIET P.G., "Systèmes de télécommunications, bases de transmission", Dunod, 1983
- BIC J.C., DUPONTEIL D., "Eléments de communications numériques", Dunod, 1986
- GLAVIEUX A., JOINDOT M., "Communications numériques", Masson, 1996

Requirements :
Signal Processing (EII07-A2)

Organisation :
- Active pedagogy
- Revision of lecture notes

Evaluation :
Attendance at lectures

Target :
5EII

Software Quality	EII09-QLOG
Number of hours : 38.00 h	3.00 ECTS credit
CM : 16.00 h, TD : 8.00 h, TP : 14.00 h	
Reference Teacher(s) : MARCHAL MAUD	

Objectives :
Management of quality, methodology and standard tools is now essential in the systems and software design. It has to be taken into account both in downstream and upstream tasks.

As far as the conception step is concerned, these lectures accompanied by practical work introduce the basic concepts of software quality approach and of the design and analysis with UML. OMT method principle is also introduced for modelling object-oriented systems. Design pattern are also presented as solutions for recurrent problems in software design.

Regarding the validation step, software testing aims at verifying that the product works as expected. The objective of these lectures is to understand the issues of software testing and how to apply the essential principles at work.

Content :
1. Software quality, Introduction to quality. Objectives and stakes within firms. Software life cycle, V-Model, Spiral Model.
Documents during the different phases. The basic elements of software quality measurement. Structural and temporal complexity, Call and control flow graphs. Static and dynamic software metrics for software quality.Hierarchical system of quality, Quality criteria and factors. Quality management in software lifecycle. Quality controlled development.
2. Object oriented modelling, The interest of modelling, Basic object oriented concepts. Static description of objects and relationships. Notion of object state, object behaviour. Introduction to UML language and OMT method. Modelling of actors, class and object diagrams. Dynamic models. Sequence, communication and class diagrams. Analysis and design related to the interaction between objects. State-transition description. Functional models. Overview of system functionality: Use Cases.
Activities and data flow diagrams. Diagrams illustrating the implementation. Packages. Deployment and component diagrams.
Tools and methods for the different phases of a development.
3. Design patterns
Unserstand the most used design patterns. To be able to identify which design pattern to use for a given case. To be able to code these design patterns.
4. Test
Unit and integration testing. To generate a test coverage to verify the software meets the conception requirements.

Bibliography :
1. F. PAROBRECK, G. BONNO, ""La qualité logicielle"", Dunod, 1991.
2. J.P. MARTIN, ""Qualité du logiciel et système qualité"", Masson, 1992.
3. J. RUMBAUGH, ""OMT, modélisation et conception orientées objet"", Masson, 1995.
4. N. LOPEZ et al., ""Intégrer UML dans vos projets"", Eyrolles, 1997.

Requirements :
Object Oriented Programming (EII08-II1).

Organisation :
Revision of lecture notes. Preparation of exercises.

Evaluation :
Two-hour written examination (with documents) at the end of the semester. Remedial examination at the end of the year (if required).

Target :
5EII

Project "Innovative Technologies"	EII09-PROJ
Number of hours : 40.00 h	4.00 ECTS credit
PR : 40.00 h	
Reference Teacher(s) : MENARD DANIEL	

Objectives :
Targeted main competences are:
- To manage a project within a team on a technical topic proposed by an industrial partner
- To collaborate with an industrial partner and take into account industrial requirements and organization
- To apply technical and management skills acquired during academic lectures
- To practice report writing and oral presentation on technical topics

Content :
- First meeting with industrial partner to write together project functional specifications
- Task scheduling and task repartition
- State of the art and bibliographic research (if necessary)
- Experimental development and validation
- Regular meetings with project advisors (academic/industrial)
- Report writing, presentation slides
- Oral defense of the project

Examples of project topics:
- Visual closed-loop control of a UAV (Unmanned Aerial Vehicle)
- Optimization of an audio resampling rate library
- Development of an oriented-object library for audio fixed-point processing
- Multi-energy heating management
- Physiologic parameters measurement from video sensor
- CPL transmission of video stream on a specific electronic card

Bibliography :

Requirements :

Organisation :
- Teams of 3 to 4 students, including a project leader
- Topics proposed by industrial partners and work at INSA research/teaching labs
- Regular meetings with the academic/industrial advisors
- Autonomous work over the whole semester, with dedicated time shifts (~ 4 hour/week)
- Free access to software and hardware to teaching and research labs, industrial partner might provide software/hardware if necessary for the project

Evaluation :
- Quality of work done
- Written report
- Oral presentation
N.B.: The jury is composed of professors and industrial partners.

Target :
5EII

Digital Signal Processor	EII09-DSP
Number of hours : 28.00 h	2.00 ECTS credit
CM : 10.00 h, TA : 4.00 h, TP : 14.00 h	
Reference Teacher(s) : MENARD DANIEL	

Objectives :
Implement digital signal processing applications on fixed-point DSP

Targeted main competences are:
- Fixed-point conversion of digital signal processing systems
- Develop C code for fixed-point DSP

Content :
- Fixed-point arithmetic
- Fixed-point conversion (dynamic range evaluation, fixed-point coding, numerical accuracy evaluation)

Bibliography :
[1] MADISETTI V., "VLSI Digital Signal Processors", IEEE Press, 1995;
[2] LAPSLEY P. & al., "DSP Processor Fondamentals", IEEE Press, 1995;
[3] BAUDOUIN G. & VIROLLEAU F., "DSP : les processeurs de traitement du signal", Dunod, 1996.

Requirements :
EII07-II1 : Computer Architecture II ;
EII07-A2 : Signal Processing II

Organisation :
- pedagogy based on project.

Evaluation :
- Attendance at lectures and project sessions

Target :
5EII

Advanced Design Methods	EII09-COAV
Number of hours : 22.00 h	1.00 ECTS credit
CM : 6.00 h, PR : 8.00 h, TA : 8.00 h	
Reference Teacher(s) : MENARD DANIEL	

Objectives :
- Advanced hardware design method for complex digital systems
- Study and implementation of a complete design flow, from high-level description to hardware implementation

Targeted main competences are:
- To use efficiently available resources to design a digital system (documentation, internet, supervisor)

Content :
- Advanced synthesizable VHDL, design re-use, hardware IP blocks
- Tests and validation: verification methodology, automatic verification, testbed implementation
- Development software presentation of Mentor Graphics (HDL Designer, Leonardo Spectrum, Modelsim, RTL Precision)
- Project: design, implementation and test of a data transmission system under the HDL Designer environment

Bibliography :
- ZWOLINSKI M., "Digital System Design with VHDL", Prentice Hall, 2000
- SCHNEIDER T., "VHDL - Méthodologie de design et techniques avancées", Dunod, 2001

Requirements :
- VHDL Programming (EII08-II3)
- Programmable Logic (EII07-E3)
- Methodology and Project Management (EII07-PROJ2)

Organisation :
- Active pédagogy
- Revision of lecture notes
- Preparation for project

Evaluation :
- Attendance at lectures and project sessions
- The project report

Target :
5EII, M&N

Hardware-Software Co-design Hardware-Software Co-design	EII09-HSCD
Number of hours : 10.00 h	1.00 ECTS credit
CM : 4.00 h, TP : 6.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
- Technologies of embedded systems, ASICs and FPGAs
- Study of reconfigurable circuits (Xilinx, Altera,...)
- Presentation of rapid prototyping tools, from system level to physical level
- Implementation of a digital system based on Altera's NIOS-II soft processor

Content :
- Technologies of embedded systems, ASICs and FPGAs
- Study of reconfigurable circuits (Xilinx, Altera,...)
- Presentation of rapid prototyping tools, from system level to physical level
- Implementation of a digital system based on Altera's NIOS-II soft processor

Bibliography :
Altera's Guides

Requirements :
Programmable Logic (EII07-E3)

Organisation :
- Active pedagogy
- Preparation for practicals

Evaluation :
- Attendance at lectures and practicals
- Mark of practicals

Target :
5EII, M&N

SystemC	EII09-SYSC
Number of hours : 14.00 h	1.50 ECTS credit
CM : 8.00 h, TP : 6.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
This lecture aims at presenting the System Design languages (SystemC) for complex system designing. Special emphasis will be given on modelling across different levels of abstraction from untimed via timed transaction level models down to register transfer models including the needed refinement steps.
(EII09-SYSC = SRC09-MOCNSYSC)

Content :
1. Requirements for a system methodology in order to design a system. Overview of existing methodologies
2. Presentation of the System C language syntax. :
-Programming environment.
-Concepts of module, port, channel, interface.
Channels, ports, interfaces, Module constructor
Events, Event queue
Thread processes, Method processes
Module instantiation (in modules)
3. Simulation of complex systems with System C.
4. Labs on a transmission system. Simulation of the system and implementation on an embedded SOC.

Bibliography :

Requirements :

Organisation :

Evaluation :
1 hour exam

Target :
5EII, M&N

Multicore Digital Signal ProcessingMulticore Digital Signal Processing Multicore Digital Signal Processing	EII09-MDSP
Number of hours : 30.00 h	3.00 ECTS credit
CM : 8.00 h, PR : 16.00 h, TP : 6.00 h	
Reference Teacher(s) :	

Objectives :
Systems implementing modern Digital Signal Processing (DSP) applications such as telecommunication standard 3GPP Long Term Evolution (LTE) and video compression standard MPEG High Efficiency Video Coding (HEVC) require high execution speed, low power consumption and run-time adaptivity.

To meet these requirements, high performance Systems-on-Chip for DSP such as the 8-core Texas Instruments TMS320TCI6678 or the 256-core Kalray MPPA combine multiple signal processing oriented cores.

Adaptivity, memory limitation and load balancing between cores are hard to obtain. This course intends to give an overview of distributed high performance DSP solutions and of the new challenges brought by latest applications and architectures. Solutions for programming such architectures will be discussed. The focus of the course will be put on software-based solutions using dataflow Models of Computation.

Targeted competences are:
- To program multicore DSPs while understanding their internal mechanisms
- To choose a multicore programming method while understanding its limitations
- To design a high performance digital processing system using available resources efficiently

Content :
- High Performance DSP Applications
- Models of Computation
- Multicore DSP Architectures
- Architecture Models
- Assignment and Ordering Problem
- Multicore Programming Tools

Bibliography :
J Karam, I. AlKamal, A. Gatherer, G. A Frantz, D. V Anderson, and B. L Evans, "Trends in multicore DSP platforms, IEEE SPM, 2009
Hae-woo Park, Hyunok Oh, and Soonhoi Ha, "Multiprocessor SoC Design Methods and Tools", IEEE SPM, 2009
S. Sriram, S. S. Bhattacharyya, "Embedded Multiprocessors : Scheduling and Synchronization - Second Edition", CRC Press, 2009
M. Pelcat, S. Aridhi, J. Piat, J-F. Nezan, "Physical Layer Multicore Prototyping: A Dataflow-Based Approach for LTE eNodeB", Springer, 2012

Requirements :
Computer Architecture I & II (EII06-II2, EII07-II1), C Language (TCM05-INFOC), Digital Signal Processing (EII09-DSP)

Organisation :
- Courses given by internal and external professors
- Practical work and project are based on the dataflow-based programming of the TMDSEVM6678L evaluation board
- The goal of practical work is for students to acquire competences for programming the platform
- The project aims at giving students some programming habits

Evaluation :
Project grading.

Target :
5EII

4 EII Work Placement - Evaluation	EII09-POST
Number of hours : 5.00 h	1.00 ECTS credit
EP : 5.00 h	
Reference Teacher(s) : NEZAN JEAN-FRANCOIS	

Objectives :
Each student presents the work he accomplished during his fourth year work placementp in the form of a poster.

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :
-Oral presentation.
-Quality of the poster.
Evaluation is carried out by a jury composed of teachers from the EII department and constitutes part of the fourth year
internship synthesis mark.

Target :

Convince and Debate	EII09-HUMT
Number of hours : 20.00 h	1.00 ECTS credit
TD : 20.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Economics, Law and Business Studies A (serious game)	HUMT1-PGE-A
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
-Establishing a strong, specific vocabulary base
-Understanding the main issues that industrial companies deal with (in a specific management field).
-Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Business Simulation (serious game) (24h / in English)
The business simulation ¿Global Challenge¿ (a CESIM product) has been designed to improve the understanding and knowledge of the complexity of global business operations in a dynamic, competitive environment. It focuses on strategic management, international management and business policy.
The task for the student teams is to manage a global mobile telecommunications company through technological and market evolution. Students will develop and execute strategies for their simulated company operating in the USA, Asia, and Europe.
The simulation is based on an online platform that allows students to play in their own language (many languages available: English, Spanish, Portuguese, Chinese,¿).

* Law (8h / in French)
Main principles of the French legal system

* Patents (4h / in French)

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies B (Lean six sigma)	HUMT1-PGE-B
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Lean Six Sigma (28h / in French)
Lean Six Sigma is a methodology that enables firms to make their processes more effective and efficient. It¿s the current industry standard for process improvement designed to reduce waste and enhance output quality.

* Law (8h / in French)
Main principles of the French legal system

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies C (human resource management)	HUMT1-PGE-C
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field)
- Understanding the importance of teamwork: making collective decisions and producing the expected work in time

Content :
* Human Resource Management (20h / in French)
    - Main current challenges of Human Resource Management
    - Human Resource Management¿s tools and organization
    - Focus on how team managers deal with Human Resource Management

* Law (8h / in French)
    Main principles of the French legal system

* Social legislation (8h / in French)

* Main principles of French social legislation

* Employment contract

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies D (Marketing for ICT Companies)	HUMT1-PGE-D
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This module is designed to equip students with the knowledge and analytical techniques required for effective strategic marketing management in ICT companies. Through this course, students are faced with a real case study provided by a marketing director of an international ICT company. Students are placed in a decision-making situation and should emerge with a 3 years strategic program.

ICT : Information and Communications Technology

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies E (Industrial design and innovation)	HUMT1-PGE-E
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time.

Content :
The program¿s main objective is to provide a multidisciplinary approach to the field of innovation, strategy and industrial design. This course will give an overview of the innovative process.
During this program, participants will have the opportunity to explore a business case covering the first stage of a product development project.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advice to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies F (Mangement and decision making)	HUMT1-PGE-F
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This course is about how to improve decision making as a future manager.
In addition to calling for academic insights and existing literature, this module provides practical improvement strategies to avoid costly decision making errors.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

English S9 Conversation	HUMT1-ANGL/CONV
Number of hours : 10.00 h	1.50 ECTS credit
TD : 10.00 h	
Reference Teacher(s) : LE TINNIER ANNE	

Objectives :
- Improving communication skills in everyday life situations as well as in a professional or social context.
- Obtaining or reinforcing C1 level, strongly advised/recommended by the CTI. t.

Content :
- Learning by doing: students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
- Expressing oneself accurately and fluently: students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
1. English Grammar in Use (Cambridge University Press)
2. Dictionnaire Collins Cobuild
3. Polycopié de l' INSA

Requirements :
Having taken and passed the TOEIC test during the previous two years (800 required)
or any other B2 certification recognized by the CTI.

Organisation :
- Each class lasts one hour and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
- Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet.

Evaluation :
Continuous assessment: The final mark (out of 20) will be based on the attendance rate and the personal implication of the student during the class.

Target :

TOEIC 5th year	HUMT1-ANGL/TOEIC
Number of hours : 20.00 h	1.50 ECTS credit
TD : 20.00 h	
Reference Teacher(s) : LE VOT PHILIPPE	

Objectives :
- Improving communication skills in everyday life situations as well as in company and business context.
- Obtaining or reinforcing the B2 level requested by the CTI.
- Obtaining 800 score at the final TOEIC test.

Content :
Learning by doing : students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
Expressing oneself accurately and fluently : students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
- English grammar in Use, Intermediate Edition (CUP)
- Robert and Collins bilingual dictionary or Collins Cobuild

Requirements :
Not having already taken and passed the TOEIC test during the previous two years
B1/B2 level advised

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet. B2 level tests are also taken throughout the course.

Evaluation :
Final mark based on :
TOEIC score at final exam + attendance (more than 4 non justified absences result in 0/20 mark).

Target :
5th year students who haven't already passed their TOEIC

Semestre 9

Parcours Media & Networks

1	**M&N09-SEIR**		**Systèmes embarqués - Images- Réseaux**	**18.50**
	EII09-DSP	C	Digital Signal Processor	2.00
	EII09-MDSP	C	Multicore Digital Signal ProcessingMulticore Digital Signal Processing Multicore Digital Signal Processing	3.00
	EII09-COAV	C	Advanced Design Methods	1.00
	SRC09-MOCNSYSC	C	Introduction to SystemC	1.50
	SRC09-TCSN-EMB	C	Introduction to Embedded Systems	1.00
	SRC09-TCSNREAL	C	Real Time Processing	1.50
	SRC09-MOCNPROJ	C	Digital Design Project	1.50
	EII09-CIV	C	Image and Video Compression	2.50
	EII09-VO	C	Computer Vision	2.00
	INF09-OPIRF	C	Image Processing and Pattern Recognition	3.00
	INF09-OPMIV	C	Modeling and Engineering for Biology and Health	3.00
	SRC09-TCRCBASE	C	Communication Networks basics	1.50
	SRC09-PRCNUM	C	Digital communications pre-requisite	1.50
	SRC09-MOCRIP	C	Advanced IP Networks	2.50
	SRC09-MOCRPROJ	C	Projet Tutoré	1.50
	SRC09-MOCRIWIRELESS	C	Wireless Networks	1.50
2	**M&N09-Projet**		**Projet technologique**	**8.00**
	M&N09-PROJ	O	Technical project	8.00
3	**M&N09-HUMAS**		**HUMANITES - M&N**	**3.50**
	HUMT1-ANGL/CONV	C	English S9 Conversation	1.50
	HUMT1-ANGL/TOEIC	C	TOEIC 5th year	1.50
	HUMT1-PGE-A	C	Economics, Law and Business Studies A (serious game)	2.00
	HUMT1-PGE-B	C	Economics, Law and Business Studies B (Lean six sigma)	2.00
	HUMT1-PGE-C	C	Economics, Law and Business Studies C (human resource management)	2.00
	HUMT1-PGE-D	C	Economics, Law and Business Studies D (Marketing for ICT Companies)	2.00
	HUMT1-PGE-E	C	Economics, Law and Business Studies E (Industrial design and innovation)	2.00
	HUMT1-PGE-F	C	Economics, Law and Business Studies F (Mangement and decision making)	2.00
4	**EII-POSTER**		**POSTER**	**1.00**
	EII09-POST	O	4 EII Work Placement - Evaluation	1.00

O = compulsary, C= in choice , F= optional

Digital Signal Processor	EII09-DSP
Number of hours : 28.00 h	2.00 ECTS credit
CM : 10.00 h, TA : 4.00 h, TP : 14.00 h	
Reference Teacher(s) : MENARD DANIEL	

Objectives :
Implement digital signal processing applications on fixed-point DSP

Targeted main competences are:
- Fixed-point conversion of digital signal processing systems
- Develop C code for fixed-point DSP

Content :
- Fixed-point arithmetic
- Fixed-point conversion (dynamic range evaluation, fixed-point coding, numerical accuracy evaluation)

Bibliography :
[1] MADISETTI V., "VLSI Digital Signal Processors", IEEE Press, 1995;
[2] LAPSLEY P. & al., "DSP Processor Fondamentals", IEEE Press, 1995;
[3] BAUDOUIN G. & VIROLLEAU F., "DSP : les processeurs de traitement du signal", Dunod, 1996.

Requirements :
EII07-II1 : Computer Architecture II ;
EII07-A2 : Signal Processing II

Organisation :
- pedagogy based on project.

Evaluation :
- Attendance at lectures and project sessions

Target :
5EII

Multicore Digital Signal ProcessingMulticore Digital Signal Processing Multicore Digital Signal Processing	EII09-MDSP
Number of hours : 30.00 h	3.00 ECTS credit
CM : 8.00 h, PR : 16.00 h, TP : 6.00 h	
Reference Teacher(s) :	

Objectives :
Systems implementing modern Digital Signal Processing (DSP) applications such as telecommunication standard 3GPP Long Term Evolution (LTE) and video compression standard MPEG High Efficiency Video Coding (HEVC) require high execution speed, low power consumption and run-time adaptivity.

To meet these requirements, high performance Systems-on-Chip for DSP such as the 8-core Texas Instruments TMS320TCI6678 or the 256-core Kalray MPPA combine multiple signal processing oriented cores.

Adaptivity, memory limitation and load balancing between cores are hard to obtain. This course intends to give an overview of distributed high performance DSP solutions and of the new challenges brought by latest applications and architectures. Solutions for programming such architectures will be discussed. The focus of the course will be put on software-based solutions using dataflow Models of Computation.

Targeted competences are:
- To program multicore DSPs while understanding their internal mechanisms
- To choose a multicore programming method while understanding its limitations
- To design a high performance digital processing system using available resources efficiently

Content :
- High Performance DSP Applications
- Models of Computation
- Multicore DSP Architectures
- Architecture Models
- Assignment and Ordering Problem
- Multicore Programming Tools

Bibliography :
J Karam, I. AlKamal, A. Gatherer, G. A Frantz, D. V Anderson, and B. L Evans, "Trends in multicore DSP platforms, IEEE SPM, 2009
Hae-woo Park, Hyunok Oh, and Soonhoi Ha, "Multiprocessor SoC Design Methods and Tools", IEEE SPM, 2009
S. Sriram, S. S. Bhattacharyya, "Embedded Multiprocessors : Scheduling and Synchronization - Second Edition", CRC Press, 2009
M. Pelcat, S. Aridhi, J. Piat, J-F. Nezan, "Physical Layer Multicore Prototyping: A Dataflow-Based Approach for LTE eNodeB", Springer, 2012

Requirements :
Computer Architecture I & II (EII06-II2, EII07-II1), C Language (TCM05-INFOC), Digital Signal Processing (EII09-DSP)

Organisation :
- Courses given by internal and external professors
- Practical work and project are based on the dataflow-based programming of the TMDSEVM6678L evaluation board
- The goal of practical work is for students to acquire competences for programming the platform
- The project aims at giving students some programming habits

Evaluation :
Project grading.

Target :
5EII

Advanced Design Methods	EII09-COAV
Number of hours : 22.00 h	1.00 ECTS credit
CM : 6.00 h, PR : 8.00 h, TA : 8.00 h	
Reference Teacher(s) : MENARD DANIEL	

Objectives :
- Advanced hardware design method for complex digital systems
- Study and implementation of a complete design flow, from high-level description to hardware implementation

Targeted main competences are:
- To use efficiently available resources to design a digital system (documentation, internet, supervisor)

Content :
- Advanced synthesizable VHDL, design re-use, hardware IP blocks
- Tests and validation: verification methodology, automatic verification, testbed implementation
- Development software presentation of Mentor Graphics (HDL Designer, Leonardo Spectrum, Modelsim, RTL Precision)
- Project: design, implementation and test of a data transmission system under the HDL Designer environment

Bibliography :
- ZWOLINSKI M., "Digital System Design with VHDL", Prentice Hall, 2000
- SCHNEIDER T., "VHDL - Méthodologie de design et techniques avancées", Dunod, 2001

Requirements :
- VHDL Programming (EII08-II3)
- Programmable Logic (EII07-E3)
- Methodology and Project Management (EII07-PROJ2)

Organisation :
- Active pédagogy
- Revision of lecture notes
- Preparation for project

Evaluation :
- Attendance at lectures and project sessions
- The project report

Target :
5EII, M&N

Introduction to SystemC	SRC09-MOCNSYSC
Number of hours : 14.00 h	1.50 ECTS credit
CM : 8.00 h, TP : 6.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
This lecture aims at presenting the System Design languages (SystemC) for complex system designing. Special emphasis will be given on modelling across different levels of abstraction from untimed via timed transaction level models down to register transfer models including the needed refinement steps.

Content :
1. Requirements for a system methodology in order to design a system. Overview of existing methodologies
2. Presentation of the System C language syntax. :
   -Programming environment.
   -Concepts of module, port, channel, interface.
   Channels, ports, interfaces, Module constructor
   Events, Event queue
   Thread processes, Method processes
   Module instantiation (in modules)
3. Simulation of complex systems with System C.
4. Labs on a transmission system. Simulation of the system and implementation on an embedded SOC.

Bibliography :

Requirements :

Organisation :

Evaluation :
1 hour exam

Target :

Introduction to Embedded Systems	SRC09-TCSN-EMB
Number of hours : 10.00 h	1.00 ECTS credit
CM : 4.00 h, TP : 6.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
Introduction to embedded systems (technology, management, hardware/software co-design). Case study on a SOPC platform (Altera FPGA).

Content :
Technology of embedded systems: ASIC, FPGA, Study of different reconfigurable circuits (Xilinx, Altera, ...). Introduction to rapid prototyping tools from system to physical level.

Bibliography :

Requirements :
SRC07-LPROG

Organisation :

Evaluation :
Practical training session

Target :

Real Time Processing	SRC09-TCSNREAL
Number of hours : 16.00 h	1.50 ECTS credit
CM : 10.00 h, TP : 6.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
Study of real time operating systems and application examples.

Content :
Various fields of applications, embedded systems, kernel architecture, Kernel services (tasks, synchronizations, communications), multi-processes/multi-processors programming, scheduling policies, memory management.

Applications: embedded systems for signal processing (telecommunication, image / video) in automotive, avionics, etc. ....
Systems with strong real time constraints, system management / supervision.

Practical work on MicroC-OSII.

Bibliography :

Requirements :

Organisation :

Evaluation :
2 hours exam

Target :

Digital Design Project	SRC09-MOCNPROJ
Number of hours : 24.00 h	1.50 ECTS credit
TP : 24.00 h	
Reference Teacher(s) :	

Objectives :
The role of this project is to apply all the concepts of Digital Design on a real application.

Content :
This 24 hours project aims to implement all the concepts learned in the SRC09-MOCNVHD and SRC09-SYSC module.
It starts with a SystemC modeling of a complex digital communication circuit (software and hardware blocks) for system simulation and platform sizing.
It ends up with the implementation of the circuit onto a real FPGA platform composed of software and hardware parts.

Bibliography :

Requirements :
SRC09-MOCNVHD and SRC09-SYSC

Organisation :

Evaluation :
Project evaluation

Target :

Image and Video Compression	EII09-CIV
Number of hours : 32.00 h	2.50 ECTS credit
CM : 10.00 h, CONF : 6.00 h, TP : 16.00 h	
Reference Teacher(s) : MORIN LUCE, ZHANG LU	

Objectives :
This lecture aims at presenting fundamental and advanced methods dedicated to image and video compression.

Targeted competences are:
-> To know image and video coding scheme through functionality analysis
-> To translate state-of-the-art algorithms into C or Matlab code

Content :
1. Introduction to image coding: PCM, DPCM, MIC, MICD, transform coding
2. Still image standards: JPEG, JPEG-LS, JPEG 2000, LAR
3. Video compression: motion estimation and compensation, standard video codecs: MPEG-2, MPEG-4, AVC, SVC, HEVC
4. Conferences by industrial partners ; conferences may vary each year
examples :
- Standardization, Pierrick Philippe, Orange Labs
- HEVC : High Efficiency Video Coding, The video coding standard for 2013 to 2030 , Félix Henry, Orange Labs
- Quality asssment for video coding, Jérome Fournier, Orange Labs

Bibliography :
[1] T. Ebrahimi, C. Christopoulos, "JPEG 2000 The next generation still image coding system", EUSIPCO'00, 2000
[2] Gregory K. Wallace, "The JPEG Still Picture Compression Standard" , IEEE Transactions on Consumer Electronics, Vol.38, No. 1, Février 1992
[3] Bernd Girod, "Image and Video Compression", lecture notes, Standford University, 2005
[4] Ian E Richardson, "H.264 and MPEG-4 Video Compression", John Wiley ed., 2003
[5] Vector Quantization and Signal Compression, Allen Gersho, Robert M. Gray, Springer, 1992

Requirements :
Signal Processing II (EII07-A2).
Image Processing (EII08-A3)
Statistical Signal Processing (EII09-TSS)

Organisation :
- Revision of lecture notes. Preparation of practical works.
- Labs with EIIMage and VCDemo softwares, implementation of coding algorithms in C language

Evaluation :
One-hour and half written examination (with documents).

Target :
Students in 5EII, M&N, master I-MARS

Computer Vision	EII09-VO
Number of hours : 35.00 h	2.00 ECTS credit
CM : 16.00 h, CONF : 3.00 h, TP : 16.00 h	
Reference Teacher(s) : PRESSIGOUT MURIEL	

Objectives :
This course is an introduction to computer vision techniques with a single camera or with several ones. Estimation processes used in computer vision are also studied.

The targeted skills are :
-> Solve a pose computation problem by using a Gauss-Newton minimization
-> Compute a depth map from stereoscopic images using the epipolar geometry properties
-> Estimate a 2D tranformation using a RANSAC algorithm
-> Solve a vision problem by determining the associated equations and use an existing software platform to implement the solution.

Content :
1. Monocular vision geometry (perspective projection, calibration and pose estimation)
2. Sterevision : 3D reconstruction, epipolar geometry, 2D homography, autocalibration

Pratical exercises are in C++ language.

Bibliography :
1. HORAUD R., MONGA O., ""Vision par ordinateur"", Hermès, 1993.
2. AYACHE N., ""Vision stéréoscopique et perception multi-sensorielle"", Inter-Ed. Science Info, 1988.
3. HARTLEY R., ZISSERMAN A., "Multiple View Geometry in Computer Vision", Second Edition, Cambridge University Press, March 2004.

Requirements :
Optimization (EII08-A3) and object oriented programming (EII08-II1).

Organisation :
Revision of lecture notes. Preparation of practical work.

Evaluation :
Two-hour written examination (no documents) at the end of the semester. Possible oral remedial examination at the end of the year.

Target :
5EII, Media and Networks semester

Image Processing and Pattern Recognition	INF09-OPIRF
Number of hours : 48.00 h	3.00 ECTS credit
TD : 48.00 h	
Reference Teacher(s) : RICQUEBOURG YANN	

Objectives :
Image Processing and Pattern Recognition is a largely studied domain of Computer Science with various applications. The lectures aims at giving a summary of this subject focused on the main line of recognizing symbols in images. Therefore, the main knowledge leading to this end are exposed: from early vision given by basic digital processing, via features extraction from images, to final recignnition performed by classifiers.

Content :
The documents are in English. The lecture may be in English or in French.
Part 1: Image processing

I. Basics of Digital Images
* What is a digital image? Human visual system
* Color, Histograms
* Pyramids and quad-trees
* Spectral representations
II. Image pre-processing
* Geometric transforms
* Noise reduction,
* Morphologic filters
Part 2: Features

I. Features Detection (locally, low level)
* Edges and Lines
* Keypoints and Corners
* Regions and Blobs
II. Features Extraction (globally or higher level)
* Properties of features
* Geometrical, Frequential, Scale-space Features
III. FEATURES SELECTION
* Distances, Selection
Part 3: Classification

I. Unsupervised Learning / Clustering
* C-Means, Fuzzy C-Means, Possibilistic C-Means
II. Supervised Learning
* First simple classifiers (k-Nearest-Neighbor...)
* Neural Networks
- MultiLayer Perceptron (MLP)
- Radial-Basis Function Neural Networks (RBFN)
* Evaluation: Reject option, Validation
- Fuzzy Inference System (FIS),
- Dynamic Time Warping (DTW),
- Hidden Markov Models (HMM),
- Support Vector Machine (SVM)
III. Improvement strategies
IV. Example of Pattern Recognition System

Bibliography :

Requirements :
None

Organisation :
Test some notions presented during the lectures, and search other notions just mentioned, to perform a solution for the practical
work.

Evaluation :
A practical work on a real-world data set is conducted in parallel of the lecture for the half of the time of the module. The
project tends to implement a complete recognition system, gathering 3 to 4 student groups competiting each other groups.
Results of each group is presented and evaluated at the end of this module.

Target :

Modeling and Engineering for Biology and Health	INF09-OPMIV
Number of hours : 48.00 h	3.00 ECTS credit
TD : 48.00 h	
Reference Teacher(s) : MARCHAL MAUD	

Objectives :
From gene to human body: Computer Science for Biology and Health applications Overview The course sets out to introduce an extensive range of computing facilities vital for Biology and Health Applications. Computer Science tools are naturally used for data storage or data management but also for data analysis. From gene to human body, biological and medical applications become more and more present in our everyday life. The course is composed of two parts:
* a first part is dedicated to bioinformatics and tries to answer to the following questions: what are the links between Biology and Computer
Science? How can algorithms answer to biological problems and inversely how can biological mechanisms answer to computer science problems?
* the second part deals with modeling and instruments developed for Health applications: what are the current instruments and models applied to human body? How to develop tools for Health domain?

Content :
Part 1: Genomic and Bioinformatics
* Genetic data modeling
* Biological sequences alignment
* Phylogenie and study of species evolution
* Genetic algorithms and data analysis
* Population genetics and association studies
Part 2: Models and Instruments for Health applications
* Medical image analysis
* Computer-assisted medical interventions
* Human body modeling and physical simulation (Biomechanical models, interactive simulators, etc)
* Brain-Computer Interactions
Course schedule:
* A new topic for each course
* Presentation-course (1h-2h), Practical exercises with applications to real data (2h-3h)

Bibliography :

Requirements :
Basic understanding of algorithms and skills in programming languages. No particular Biology and Physics expertise will be assumed.

Organisation :

Evaluation :
Assignment:
* Assignment on practical exercises for each course (50%)
* Small project (50%)

Target :

Communication Networks basics	SRC09-TCRCBASE
Number of hours : 26.00 h	1.50 ECTS credit
CM : 22.00 h, TP : 4.00 h	
Reference Teacher(s) : UZEL FABIENNE	

Objectives :
Acquisition of the fundamentals of networking through a description of the main techniques and their applications. Basic concepts of network security.

Content :
Telecommunication networks [6 HC]: Cellular Network: 3G, others (DCS 1800, CDMA). Architecture, radio interface protocol. Global satellite network type star, Eridium, INMARSAT.

Wired networks [12 HC]: IP / TCP / UDP / RIP X25/Frame Relay / ATM, ADSL / xDSL, PLC. Hybridization techniques and wireless communication.

Network security [4HC]

Bibliography :
Gilbert MARTINEAU, Laurent TOUTAIN, Alain LEROY, édition Hermes.
Wireless Ad Hoc and Sensor Networks, Raja Jurdak, Springer.

Requirements :
SRC08-FIBRES, SRC07-CNUM1,SRC08-CNUM2, SRC06-INFO, SRC08-RADIO

Organisation :

Evaluation :
2 hours exam

Target :

Digital communications pre-requisite	SRC09-PRCNUM
Number of hours : 24.00 h	1.50 ECTS credit
CM : 14.00 h	
Reference Teacher(s) : HELARD JEAN FRANCOIS	

Objectives :
To deal with the basis digital communication techniques as channel coding, multicarrier modulations and single carrier transmissions on limited bandwidth channel.

Content :
1. Model of a digital communication system
2. Basis channel coding techniques
Block codes and cyclic block codes. Codes construction. Decoding techniques. Performance and channel coding gain.
Convolutional codes. Representation and main principles. Decoding techniques. Performance and main applications.
3. Single carrier transmission over unlimited and limited bandwidth channels. Nyquist criterion. Equalization techniques.
4. Multicarrier modulations. Frequency and time selectivity of the radio-mobile channel. Multicarrier modulation principle (OFDM). Digital implementation of OFDM with Fast Fourier Transform Demodulation and performance. Applications to broadcast and telecommunication systems.

Bibliography :
M. Joindot, A. Glavieux, "Introductions aux communications numériques", Ed. Dunod,
S. Beneddeto, E. Biglieri, V. Castellani, "Digital transmission theory", Prentice Hall International Editions,
J. G. Proakis., "Digital communications", 6th Edition, Mc Graw-Hill Int. Editions, 2003,
C. Berrou, « Codes et turbocodes », collection IRIS, Springer,
K. Fazel, S. Kaiser, « Multi-Carrier and spread spectrum systems, Wiley.

Requirements :
Modules SRC05-PRER, SRC06-TSIA, SRC07-DESTI, SRC07-SINUM

Organisation :
Courses documents

Evaluation :
Un contrôle continu (Cours, Td, TP)
1 Devoir surveillé de 1 heure.

Target :

Advanced IP Networks	SRC09-MOCRIP
Number of hours : 24.00 h	2.50 ECTS credit
CM : 10.00 h, CM : 8.00 h, TD : 6.00 h	
Reference Teacher(s) : UZEL FABIENNE	

Objectives :
Extensions and new applications of high-speed networks, wireless, wired and embedded. Study of the routing mechanisms and quality of service.

Content :
IP techniques [10HC]: ipv4 to ipv6 Evolutions, ipv4 and ipv6 compatibility, quality of service. Routing inside and between networks (MPLS, BGP)

Wired networks [8HC, 6HTD]: VOIP, IPTV, routing, security VLAN, VPN

Bibliography :
Gilbert MARTINEAU, Laurent TOUTAIN, Alain LEROY, édition Hermes
Réseaux haut débit (2ème édition) (Coll. réseaux et télécommunications) [e-book] , ROLIN Pierre

Requirements :
SRC08-FIBRES, SRC07-CNUM1, SRC08-CNUM2, SRC09-TCRC

Organisation :

Evaluation :
2 hours exam

Target :

Projet Tutoré	SRC09-MOCRPROJ
Number of hours : 24.00 h	1.50 ECTS credit
TP : 24.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Wireless Networks	SRC09-MOCRIWIRELESS
Number of hours : 10.00 h	1.50 ECTS credit
CM : 6.00 h, TD : 4.00 h	
Reference Teacher(s) : EL ZEIN GHAIS	

Objectives :
Review of data wireless protocols, applications.

Content :
Wireless data networks overview: Wimax, 802.11, Bluetooth, ZigBee. Architecture of the networks, signalisation, data flow. Data and voice convergence. PHY , MAC and application layers.

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Technical project	M&N09-PROJ
Number of hours : 360.00 h	8.00 ECTS credit
PR : 50.00 h	
Reference Teacher(s) : MORIN LUCE	

Objectives :
-Manage a project within a team, on a technical topic proposed by an industrial partner.
-Collaborate with an industrial partner and take into account industrial requirements and organization.
-Apply technical and management skills acquired during academic courses.
-Practice report writing and oral presentation on technical topics.

Content :
1. Meet industrial partner and write project functional specifications.
2. Task scheduling and task repartition.
3. State of the art and bibliographic research.
4. Experimental development and validation ; regular meetings with project advisor.
5. Report writing, preparation of presentation slides.
6. Oral defense of the project.

Examples of project topics:
-Visual closed-loop control of an AR-Drone
-Audio bench test for mobile phones
-Calibration of a network of heterogeneous cameras
-Direct WI-FI remote control
-CPL transmission of video stream on an ETTUS card
-Optimization of a conversion of audio sampling rate library on ARM architecture
-RFID for electronic passport reading in multi-platform Windows/Linux environment
-Activity and physiologic parameters measurement with a Kinect sensor

Bibliography :

Requirements :

Organisation :
-Teams of 4 to 6 students, including a project leader
-Topics proposed by industrial partners and work at Insa research/teaching labs.
-Regular meetings with the project advisor (a professor).
-Autonomous work over the whole semester, with dedicated time shifts (6 hour/week)
-Free access to software and hardware to teaching and research labs, industrial partner might provide software/hardware if necessary for the project.

Evaluation :
The work realized by each group is subject to a written report and an oral presentation before an audience comprised of fellow students. The jury is composed of professors and industrial partners.
A final mark awarded based on the quality of the work, written report and oral presentation.

Target :
M&N students from 5EII/5SRC/5INFO

English S9 Conversation	HUMT1-ANGL/CONV
Number of hours : 10.00 h	1.50 ECTS credit
TD : 10.00 h	
Reference Teacher(s) : LE TINNIER ANNE	

Objectives :
- Improving communication skills in everyday life situations as well as in a professional or social context.
- Obtaining or reinforcing C1 level, strongly advised/recommended by the CTI. t.

Content :
- Learning by doing: students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
- Expressing oneself accurately and fluently: students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
1. English Grammar in Use (Cambridge University Press)
2. Dictionnaire Collins Cobuild
3. Polycopié de l' INSA

Requirements :
Having taken and passed the TOEIC test during the previous two years (800 required)
or any other B2 certification recognized by the CTI.

Organisation :
- Each class lasts one hour and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
- Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet.

Evaluation :
Continuous assessment: The final mark (out of 20) will be based on the attendance rate and the personal implication of the student during the class.

Target :

TOEIC 5th year	HUMT1-ANGL/TOEIC
Number of hours : 20.00 h	1.50 ECTS credit
TD : 20.00 h	
Reference Teacher(s) : LE VOT PHILIPPE	

Objectives :
- Improving communication skills in everyday life situations as well as in company and business context.
- Obtaining or reinforcing the B2 level requested by the CTI.
- Obtaining 800 score at the final TOEIC test.

Content :
Learning by doing : students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
Expressing oneself accurately and fluently : students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
- English grammar in Use, Intermediate Edition (CUP)
- Robert and Collins bilingual dictionary or Collins Cobuild

Requirements :
Not having already taken and passed the TOEIC test during the previous two years
B1/B2 level advised

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet. B2 level tests are also taken throughout the course.

Evaluation :
Final mark based on :
TOEIC score at final exam + attendance (more than 4 non justified absences result in 0/20 mark).

Target :
5th year students who haven't already passed their TOEIC

Economics, Law and Business Studies A (serious game)	HUMT1-PGE-A
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
-Establishing a strong, specific vocabulary base
-Understanding the main issues that industrial companies deal with (in a specific management field).
-Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Business Simulation (serious game) (24h / in English)
The business simulation ¿Global Challenge¿ (a CESIM product) has been designed to improve the understanding and knowledge of the complexity of global business operations in a dynamic, competitive environment. It focuses on strategic management, international management and business policy.
The task for the student teams is to manage a global mobile telecommunications company through technological and market evolution. Students will develop and execute strategies for their simulated company operating in the USA, Asia, and Europe.
The simulation is based on an online platform that allows students to play in their own language (many languages available: English, Spanish, Portuguese, Chinese,¿).

* Law (8h / in French)
Main principles of the French legal system

* Patents (4h / in French)

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies B (Lean six sigma)	HUMT1-PGE-B
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Lean Six Sigma (28h / in French)
Lean Six Sigma is a methodology that enables firms to make their processes more effective and efficient. It¿s the current industry standard for process improvement designed to reduce waste and enhance output quality.

* Law (8h / in French)
Main principles of the French legal system

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies C (human resource management)	HUMT1-PGE-C
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field)
- Understanding the importance of teamwork: making collective decisions and producing the expected work in time

Content :
* Human Resource Management (20h / in French)
    - Main current challenges of Human Resource Management
    - Human Resource Management¿s tools and organization
    - Focus on how team managers deal with Human Resource Management

* Law (8h / in French)
    Main principles of the French legal system

* Social legislation (8h / in French)

* Main principles of French social legislation

* Employment contract

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies D (Marketing for ICT Companies)	HUMT1-PGE-D
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This module is designed to equip students with the knowledge and analytical techniques required for effective strategic marketing management in ICT companies. Through this course, students are faced with a real case study provided by a marketing director of an international ICT company. Students are placed in a decision-making situation and should emerge with a 3 years strategic program.

ICT : Information and Communications Technology

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies E (Industrial design and innovation)	HUMT1-PGE-E
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time.

Content :
The program¿s main objective is to provide a multidisciplinary approach to the field of innovation, strategy and industrial design. This course will give an overview of the innovative process.
During this program, participants will have the opportunity to explore a business case covering the first stage of a product development project.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advice to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies F (Mangement and decision making)	HUMT1-PGE-F
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This course is about how to improve decision making as a future manager.
In addition to calling for academic insights and existing literature, this module provides practical improvement strategies to avoid costly decision making errors.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

4 EII Work Placement - Evaluation	EII09-POST
Number of hours : 5.00 h	1.00 ECTS credit
EP : 5.00 h	
Reference Teacher(s) : NEZAN JEAN-FRANCOIS	

Objectives :
Each student presents the work he accomplished during his fourth year work placementp in the form of a poster.

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :
-Oral presentation.
-Quality of the poster.
Evaluation is carried out by a jury composed of teachers from the EII department and constitutes part of the fourth year
internship synthesis mark.

Target :

Academic year 2013/2014

Courses offered by the programme

Informatique (INFO)
Computer Science

Semester(s) : 1-2-3-4-5-6-7-8-9

Commonly used abbreviations
CM : Lectures
TD : Tutorials
TP : Laboratory Work
CONF : Conferences
TA : Personal Work
PR : Project
ST : Internship
DIV : Miscellaneous

Semestre 5

Parcours Formation Initiale INFO

1	**TCM05**		**Science and technology of engineer S5**	**9.00**
	TCM05-ANAL	O	Mathematical Analysis for the Engineer	2.00
	TCM05-PROBA	O	Probability Tools for Engineers	2.00
	TCM05-INFOC	C	C language	3.00
	TCM05-PROG	C	C and Matlab programming	3.00
	TCM05-RISQ	O	Risk Management	2.00
2	**INF05-1**		**System and Architecture**	**5.00**
	INF05-FUS	O	Use and functionalities of an operating system	2.00
	INF05-LGSEQ	O	Sequential Logic	3.00
3	**INF05-2**		**Algorithmics**	**6.00**
	INF05-GRLAN	O	Grammars and Languages	3.00
	INF05-STDON	O	Data Structures - Java	3.00
4	**INF05-3**		**Stochastic Assembly Language**	**5.00**
	INF05-MSTOC	O	Stochastic Models	2.00
	INF05-ETUPR	O	Theoritical and pratical study	1.00
	INF05-ASSBL	O	Assembly Language	2.00
5	**INF-HUM05**		**Humanities S5**	**5.00**
	INF05-ANGL	O	English	2.00
	INF05-PSH	O	Monographs	2.00
	INF05-EPS	O	Sport and physical Education	1.00
7	**HUMT1-ELSA Mus**		**Music with studies**	**1.00**
	HUMT1-MUS	F	Music with studies	1.00
8	**HUMT1-ELSA Tek**		**Light & sound engineering for theatre with studies**	**1.00**
	HUMT1-TEK	F	Light & sound engineering for theatre with studies	1.00
9	**HUMT1-ELSA Thea**		**Theatre with studies**	**1.00**
	HUMT1-THEA	F	Theatre with studies	1.00

O = compulsary, C= in choice , F= optional

Mathematical Analysis for the Engineer	TCM05-ANAL
Number of hours : 28.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : BRIANE MARC	

Objectives :
Integration, Fourier transform, complex variables

Content :
1. Integration
Convergence theorems
Integrals with a parameter
Integrable functions
Fubini's theorems and convolution
Change of variables
2. Fourier transform
Fourier transform of a integrable function
Inversion theorem
Fourier transform of a square-integrable function
Plancherel theorem
Fourier transform and convolution
3. Complex variables
Holomorphic functions
Entire functions
Exponential and logarithmic functions
Cauchy's formula
Residues method

Bibliography :
G. GASQUET, P. WITOMSKI : « Analyse de Fourier et applications ». Masson, 1990.

Requirements :
Mathematical analysis of first and second year

Organisation :
30h

Evaluation :
1 written examination

Target :

Probability Tools for Engineers	TCM05-PROBA
Number of hours : 28.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : HERVE LOIC	

Objectives :
Probability calculus
- Large-samples
- Elements of statistics

Content :
1. Probability distributions. Examples.
2. Gaussian models.
3. Characteristic functions.
4. Limit theorems for Large-samples. Statistical applications.

Bibliography :
Modélisation probabiliste et statistique- Bernard Garel - Collection POLYTECH des éditions CEPADUES

Requirements :
Bases of analysis and linear algebra. Elements of probability theory of STP03-PROBA « Introduction aux probabilités »

Organisation :
30h

Evaluation :
One two hours written examination.

Target :

C language	TCM05-INFOC
Number of hours : 42.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 8.00 h, TP : 20.00 h	
Reference Teacher(s) : LEPLUMEY IVAN	

Objectives :
Basic understanding of the C programming language.
Ability to resolve all common problems.
Find the minimal intersection of needs / C. language.
Writing and comprehension of the code. Syntax and associated semantic.

Content :
1. Introduction to C programming language:
   Introduction.
   Chain of production, from the code source to the executable.

2. Basic C:
   Lexical entities.
   Language syntax.
   Variable declaration.
   Predefined types.
   Operators and expressions.
   General structure of a program.
   Basic input/output.
   Control structures and instructions.
   Fields: 1st form.
   Functions and pass-by-value parameter passing.

3. Advanced C:
   Pointers.
   Functions and pass-by-address parameter passing.
   Standard library functions.
   Memory models for functions and pointers.
   Fields : 2nd form.
   New types and types constructor.
   Explicit type conversion.
   File input/output.
   Allocation class.
   Dynamic Allocation.
   Pointers to functions.

Bibliography :
J.P. BRAQUELAIRE. Méthodologie de la programmation en langage C - Principes et applications. Manuels Informatiques Masson. Masson, 1993.
J.P. BRAQUELAIRE. Méthodologie de la programmation en langage C - Norme C99 - API POSIX. Sciences Sup. Dunod, 2005.
C. DELANOY. Programmer en langage C, avec exercices corrigés. Eyrolles, 1997.
B.W. KERNIGHAN and D.M. RITCHIE. Le langage C. Manuels Informatiques Masson. Masson, 1990.
J.L NEBUT. Le langage C - définition de la norme ANSI. Technical Report Cours C81, IFSIC -Université de Rennes 1, juillet 1989.

Requirements :
Understanding of Algorithms Foundations

Organisation :
Revision of the lecture notes.
Preparation for the practical work.
14hours of course, 8 hours of directed work and 20 hours of practical work

Evaluation :

2-hour written examination at the end of the semester (documents allowed).

Target :

C and Matlab programming	TCM05-PROG
Number of hours : 35.00 h	3.00 ECTS credit
CM : 9.00 h, TD : 8.00 h, TP : 18.00 h	
Reference Teacher(s) : MORIN LUCE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Risk Management	TCM05-RISQ
Number of hours : 21.00 h	2.00 ECTS credit
CM : 21.00 h	
Reference Teacher(s) : GALL PHILIPPE	

Objectives :
The engineer must always remain master of his choices and his actions within the limits defined by acceptable risk.

Content :
I- THE PRINCIPAL CONCEPTS OF RISK ANALYSIS: Dangerous situations. The five dimensions: facts, models, objectives, norms, values. The dissonances between players in a network. The deficits that affect dimensions. Options for
preventative action.
II. DANGER: AN INTRINSIC REALITY. WHEN AND WHERE TO EXPECT DANGER. Danger inherent to the natural
environment. Climate-related uncertainties. Terrestrial uncertainties. Fire as a man-made danger: facilities, production,
creation, etc. Sources of danger in the workplace: electrical, mechanical, chemical, toxicological, radiation, etc.
III - RISK: A LIKELY EVENT WHICH INDUCES DANGER: Characterisation of risk or estimation of danger: probability
and gravity. Natural or man-made danger. Error or approximation. Economic and financial risk. Complexity of the models.
Sport-related risk. Information-related risk. Alarm-related risk. Numerical treatment of problems. Risk; chemical-related risk.
IV. SECURITY: Development of a secure environment. Regulations: logic, criticism and use; technical regulations.
V. PREVENTION AND ASSUMING RESPONSIBILITY: JURIDICAL ASPECTS.

Bibliography :
Risque et Génie Civil - AFGC - 8 -10 nov 2000, Presse des Ponts et Chaussées Konstantin PROTASSOV, 1999,
""Probabilités et Incertitudes"", PUG Michèle NEUILLY - CETAMA
""Modélisation e estimation des erreurs de mesure"" GIS - MR-GenCi J.A. CALGARO, 1996,
- Introduction aux Eurocodes, Presse de l'ENPC Peter G. NEUMANN, 1995,
Computer-Related Risks, Addison-Wesley/ACM Press, ISBN 0-201-55805-X, 384pp

Requirements :

Organisation :

Evaluation :
Two-hour written examination in French.

Target :

Use and functionalities of an operating system	INF05-FUS
Number of hours : 20.00 h	2.00 ECTS credit
CM : 8.00 h, TP : 12.00 h	
Reference Teacher(s) : LEPLUMEY IVAN	

Objectives :
The objective of this module is to introduce tools found in UNIX/LINUX systems and the basic concepts of IDE (Integrated
Development Environement).

Content :
* Command languages: Interactive use on Linux : Bash.
* Filesystems: Internal organisation. Notion of links. Protection.
* Script language: Bash. Perl. PHP.
* Tools: Separate compilation. Make. SVN.

Bibliography :
"Linux in a Nutshell", Jessica Perry Hekman - O'Reilly
"Bash Guide for Beginners", Newman Cameron, O'Reilly
"Learning Perl", Randal L. Schwartz - O'Reilly Media
"Version Control with Subversion" - O'Reilly
http://svnbook.red-bean.com

Requirements :
Knowledge of a programming language.

Organisation :
Revision of class notes.
Completion of practical work.
Practice of the methods studied during practical work in other modules.

Evaluation :
Two-hour examination at the end of the first semester (Documents allowed).

Target :

Sequential Logic	INF05-LGSEQ
Number of hours : 30.00 h	3.00 ECTS credit
CM : 8.00 h, TD : 12.00 h, TP : 10.00 h	
Reference Teacher(s) : ARNALDI BRUNO	

Objectives :
* Theoretical and practical basis for designing and analysing the physical structure of the computer and in particular the
architectural elements relating to sequential systems. *Basic architectural concepts of the high-level computer are addressed:
System_state, automata, control flow and microcode. *This architecture-based module is an essential complement to other
basic modules on the computer science course.

Content :
The following points are addressed:
* Sequential circuits.
* Control units.
* Types of random access memory.

Bibliography :

Requirements :
Combinatory logic.

Organisation :
Revision of class notes. Preparation of exercises and practical work (two hours per week).

Evaluation :
Two-hour examination at the end of the semester.
Mark for practical work.

Target :

Grammars and Languages	INF05-GRLAN
Number of hours : 40.00 h	3.00 ECTS credit
CM : 16.00 h, TD : 24.00 h	
Reference Teacher(s) : BENMAKROUHA FARIDA	

Objectives :
A study of regular and context-free languages with their closure properties. Various description approaches are used:
grammars, automata, regular expressions, system equations. A thorough knowledge of these description models enables the
most appropriate choice for developing description of translation programs.

Content :
Mathematics preliminaries
Regular languages and finite state machines
Regular expressions
Context-free grammars
Context-free languages
Pushdown automata

Bibliography :
"Langages algébriques", Jean-Marie Autebert, Masson, 1994.
"Introduction to the theory of Computation", Michael Sipser, 1997.

Requirements :
No prerequisites

Organisation :
Studying course work and preparing tutorials (2 hours per week)

Evaluation :
Two-hour open-book written examination

Target :

Data Structures - Java	INF05-STDON
Number of hours : 42.00 h	3.00 ECTS credit
CM : 22.00 h, TP : 20.00 h	
Reference Teacher(s) : RICQUEBOURG YANN	

Objectives :
* Development of an understanding of object-oriented programming (inheritance, polymorphism and generic programming). *
Modelling, choice and use of standard data structures (stacks, queues, heaps, lists, sets). * Use of the Java Collections
Framework. * Designing of data structures suited to complex models (graphs, trees).

Content :
* Object-oriented programming (Reminder).
* Abstract data types.
* Implicit data structure (stacks, queues).
* Explicit data structures and notion of iterators (sets, lists).
* Tables.
* Binary trees.
* Graphs.
* Complements on arrays, heaps and sorting algorithms.

Bibliography :
* Art of Computer Programming, Vol. 1-3, Knuth, Addison-Wesley, 1973.
* Structures de données et algorithmes, Aho, Hopcroft, Ullman, Addison-Wesley, 1987.
* A Practical Introduction to Data Structures , Clifford A. Shaffer, Prentice Hall 1998.
* Java Collections, John Zukowski, a! Apress 2001.

Requirements :
Detailed knowledge of the Java language.

Organisation :
Development of the individual work. Preparation of practical work (4 hours per week).

Evaluation :
Two-hour examination at the end of the semester.

Target :

Stochastic Models	INF05-MSTOC
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : LEGUESDRON Abdelly	

Objectives :
* The study of one particular category of stochastic model: Markov chains. * Markov chains distinguish themselves from other
models by the fact that their evolution in time depends only on the present and not on the past. * Markov chains are used for
modelling a number of queuing phenomena, especially those that concern computer system applications. Examples and
applications deal mostly with this domain.

Content :
DISCRET-TIME MARKOV CHAINS
Transition probability matrix. Transition diagram. The Chapman-Kolmogorov equations. State classification. Recurrence and
transience. Ergodics. Asymptotic behaviour.
CONTINUOUS-TIME MARCOV CHAINS
Transition probability. The Chapman-Kolmogorov equations. Infinitesimal generator. Transitory regime. State classification.
Asymptotic behaviour.
EXAMPLES OF PROCESSES
Birth and death process. Poison process.
APPLICATION TO QUEUEING PHENOMENA
Queues: M/M/1. M/M/s. M/M/infinite. M/M/s/s.

Bibliography :
W. Feller. Introduction to Probability Theory and its Applications, Vol. I et II, J. Wiley and Sons, 1971
Vidyadhar G. Kulkarni. Modeling and Analysis of Stochastic Systems. Chapman et Hall, 1995
Averill M. Lad, W. Davis Kelton. Simulation Modeling et Analysis. 2nd Edition, , McGrall-Hill Int. Editions, 1991
J. Medhi. Stochastic Models in Queueing Theory. Academic Press, 1991
A. Ruegg. Processus stochastiques (tome 6). Presses polytechniques romandes
K. S. Trivedi. Probability and Statistics with Reliability, Queueing and Computer Science Applications. Prentice-Hall, 1982.

Requirements :

Organisation :

Evaluation :
Two-hour examination at the end of the semester.

Target :

Theoritical and pratical study	INF05-ETUPR
Number of hours : 6.00 h	1.00 ECTS credit
EP : 6.00 h	
Reference Teacher(s) : GOURANTON VALERIE	

Objectives :
* During the 3-year computer science course, students must explore a number of curriculum related fields.
* This practical study module focuses on the need for an engineer to be able to adapt and obtain new skills autonomously given the continuous speed of change in technology.
*Students put to practical use the know-how and knowledge acquired during the computer science course.

Content :
* This module allows technical and theoretical comprehension of specific computer science related subjects which are not a
part of the curriculum.
* The teacher provides each group with the necessary documentation to enable them to begin their project. If necessary, they
may complement those documents.
* State of the art concerning a subject.
* Objectives and general specifications of the application that will be implemented in the next semester (S6) in the module
"Practical Study".
* Students work in teams of three or four.

Bibliography :

Requirements :

Organisation :
Although this module consists of six hours of supervised group-work, much of the input is left up to the individual (approximately two hours per week).

Evaluation :
* English language
* Presentation of the state of the art at the end of the semester.

Target :

Assembly Language	INF05-ASSBL
Number of hours : 35.00 h	2.00 ECTS credit
CM : 12.00 h, TP : 23.00 h	
Reference Teacher(s) : ROZE MARCHAND LAURENCE	

Objectives :
This module, which takes place in the first semester, is the first step of a recurring objective to familiarise students with
imperative language translation (compilation, linkage) and the execution scheme of such languages. The aim is, at the end of the year, to write a compiler : a software that will translate a personnal language into n assembly language. During practical work, students programme using "assembly language". The objective is to respect a strict translation scheme as if it were produced a "compiler".

Content :
* Introduction to the basics of the Pentium processor (instructions, address mechanisms).
* Translation schemes (translation data structures, data structures, procedures).
* Memory management: static and dynamic memory allocation (stack, heap).
* Automatic program translator.
* Assembler, linker, loader.

Bibliography :
Schémas de traduction. Recueil de sujets de travaux pratiques. M.J. Pédrono, L. Rozé

Requirements :
Knowledge of a programming language.

Organisation :
Revision of lesson notes. Preparation of exercises and practical work (1h30 per week).

Evaluation :
Two-hour written examination.
Mark for practical work.

Target :

English	INF05-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) :	

Objectives :
Improving expression, understanding and interaction skills in everyday life as well as social and professional environments.

Language objectives :
Acquiring or reinforcing B2 level (as requested by the CEFR for languages) and C1 level for the most advanced students.

Content :
Doing-by-learning approach
Listening, speaking, writing in a motivating environment and approach to help and guide students in their analysing, experimenting, implementing process.
Acquiring the right vocabulary and grammar to deal with professional and social situations in an autonomous way.

Pedagogical approach:
* Creativity and personal involvement-based activities such as rôle plays, debates, oral presentations, graph and diagrams analysis, radio programs recordings, video creation, subtitling and dubbing, CV/resume writing
* Most of these activities cover the professional scope of the speciality of the student's department in a multicultural environment.
* Resources: press article, video and audio documents from the international press and television chanels.

Bibliography :
- Robert et Collins bilingual dictionary or Collins Cobuild
- English Grammar in Use (Cambridge University Press)

Requirements :
B1/B2 level and a good handling of the first two post-baccalaureate program required.

Organisation :
Each course lasts 2 hours. 56 hours a year.
The classes take place in fully equipped rooms -video, audio material as well as multimedia lab- which enables the students to make the best of their time in an adapted and stimulating environment.

Evaluation :
Writing / reading test at the end of the semester: 2hrs

Target :

Monographs	INF05-PSH
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : PRIGENT HELENE	

Objectives :
Overview: Students choose and plan an appropriate project in accordance with the objectives. They carry out rigorous research
on the theme and interview specialists (Emphasis is placed on the use of project management tools and teamwork). A
Presentation is given in front of an invited audience. An inter-departmental competition to finish.

Content :
The aim of this module is to broaden the students' knowledge of their chosen professional field and of the prevailing social and
managerial environment. Students must structure their thinking to argue their point and make sense of the various sources of
information studied. Particular emphasis is placed on the importance of the use and quotation of trustworthy sources. The
monographs, which are archived in the library, will then represent a reliable, recent source of information.
The methodological tools required for project management (aims, organisational chart, task-delegation, work schedule) are
applied, resulting in well-written documents and improved public-speaking skills. Teamwork is particularly encouraged.
The teacher ensures that teams never lose sight of their stated objectives.
The advantages and pitfalls of research via the internet are discussed. Interviews are organised with people from within INSA
(Mr. Aubel of CEIP and various teacher-researchers), and with various engineers and managers from elsewhere. Their thoughts
are added systematically to the monograph to support the analysis. The library and the multimedia centre also prove to be
reliable sources of information.
Proper writing style and editing technique are essential; The main rules of editing a quality document are studied, including
structure of a report, style, bibliography, etc.
At least one rehearsal precedes the final oral presentation in order to give the students confidence and highlight the importance
of a well-delivered speech. Students learn how to create a Power Point presentation.
The last classes focus on the voice, gestures, and carefully communicating information in a clear and rigorous way. The oral
presentation event is open to students, teachers and those interviewed in the course of research. The formal nature of this event
is of significant importance as it underlines INSA's policy for the training of generalist engineers.
An inter-departmental competition is held to reward the three best monographs of the year. The objective is threefold: - to
promote the importance of the students' work - to bring together those interviewed and explain to them our approach - to
promote exchange between departments.

Bibliography :
Timbal-Duclaux L.: L'Expression écriteEcrire pour communiquer. Editions ESF 1994. Claret J. :Organiser la pensée. Editions ESF, 1989.
Quivy R. et Van Campenhoudt L. : Manuel de recherche en sciences sociales. Editions Dunod 1995.
Licette C. : La prise de parole en public. Editions Studyrama 2002.

Requirements :

Organisation :
Research. Writing of progress reports and press reviews.

Evaluation :
Two marks;
- For quality of the monograph.
- For the final oral presentation.

Target :

Sport and physical Education	INF05-EPS
Number of hours : 26.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : LE LAGADEC PIERRE	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O., kayak
or golf.
Organisation: Two 14-hour sports or physical activity programmes in groups of twenty-four.

Bibliography :
Several specialized books are available to the students at the library. Links to internet sites are posted on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Music with studies	HUMT1-MUS
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
- This module aims to enable students who have already reached a good level in music to continue practicing. - Group rehearsals. - Music as a means of developing the collaborative and adaptive abilities that are essential to any teamwork situation.

Content :
- Weekly group rehearsals.
- Classical, jazz or folk music taught by music teachers.
- Use of facilities at INSA-Rennes.
- At least 2 concerts per year.

Bibliography :

Requirements :
At least 5 years of practice.
The ability to read sheet music.
Admission to the "Music with Studies" section is decided upon through an audition conducted by the music teachers.

Organisation :
2 hours per week

Evaluation :
Validation of first semester : no mark awarded

Target :

Light & sound engineering for theatre with studies	HUMT1-TEK
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
Teach students how to deal with the technical aspects of theatre plays, concerts, public-address systems for conferences, recordings...

Content :
Microphones, sound recording, sound software,stage/light mixing techniques, lighting desks and sound control systems : theoretical and practical experience.

Bibliography :

Requirements :
None

Organisation :
Workshops on Thurday afternoon in local venues or at INSA

Evaluation :
Validation of first semester (no mark awarded)

Target :
Any year

Theatre with studies	HUMT1-THEA
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
- The art of oral expression.
- Performing before an audience.
- Further improve one's general knowledge.

Content :
- Reading and analysis of modern and classical drama.
- Theatre workshops run by professionals.
- Live performance.

Students may choose this optional module at the beginning of the first, second, third or fourth year of studies. In doing so, an engagement is undertaken to complete two semesters (For evaluation see below).
The module covers both semesters of the academic year and is concluded by a performance.
There are two parts to the "Theatre with Studies" module:
1) Drama culture: Reading of works (one complete work and extracts which are likely to reveal the various facets of dramatic repertory). The fundamentals of drama history and acting techniques (Classic Greek drama, Diderot and Brecht dramas, etc).
Philosophical thought on "the world of the Theatre" and "the theatre of our World". The economics of setting up and running a theatre play.
Valérie Derrien-Remeur, PhD in French language and literature and head of the Department of Théâtre-Etudes oversees this module. The sessions take place on Thursday afternoons. The INSA library is associated with this module with the objective of building a corpus of works which students may consult and borrow.
2) In preparation for the end-of-year performance, every two weeks there are professionally-supervised drama-practice workshops. The professional (recruited by Valérie Derrien-Remeur) not only directs the show but is also in charge of the decor, costumes, sound and lighting, and furthermore, manages casting through specifically designed exercises.
Note: The "Theatre with Studies" section is open to all INSA students, however, given that the ultimate objective of the module is the theatre performance and that the means at our disposal are limited, we regret that no more than 30 students can enrol; each module is open to a maximum of 15 students.

Bibliography :
Bernardy M. : Traité de diction française à l'usage de l'honnête homme. Editions de l'aube, 1994. Boal A. : Jeux pour l'acteur et le non acteur. Editions La Découverte, 1997.

Requirements :

Organisation :

Evaluation :
Validation of first semester (no mark awarded)

Target :

Semestre 6

Parcours Formation Initiale INFO

1	**TCM06**		**Science and technology of engineer S6**	**4.00**
	TCM06-CAPT	C	Introduction to SENSORS	1.00
	TCM06-ENRG	C	Energy	1.00
	TCM06-IMO	O	Introduction to Production and quality Management	1.00
	TCM06-SHES1	O	Science Humaine Economique et Sociale 1	1.00
	TCM06-SHES2	O	Science Humaine Economique et Sociale 2	1.00
2	**INF06-1**		**Graphs and Architecture**	**7.00**
	INF06-ALGO	O	Graphs and Algorithms	3.00
	INF06-ETUPR	O	Practical Study	1.50
	INF06-ARCHI	O	Architecture	2.00
	INF06-CONF	O	Industrial conference S6	0.50
3	**INF06-2**		**Database Compiler**	**7.00**
	INF06-BD	O	Databases	2.00
	INF06-COMPL	O	Project: Compiler	3.00
	INF06-ACQUI	O	Knowledge Acquisition	2.00
4	**INF06-3**		**Fundamentals of course**	**6.00**
	INF06-STAT	C	Introduction to statistical inference	2.00
	INF06-PROGICIELS	C	Buisness Software	2.00
	INF06-ANANUM	C	Numerical Analysis	2.00
	INF06-ARCHIAV	C	Advanced Architecture	2.00
	INF06-SCRIPT	C	Script Programming	1.00
	INF06-PFONC	C	Functional Programming	3.00
5	**INF-HUM06**		**Humanities S6**	**6.00**
	INF06-ANGL	O	English	2.00
	INF06-PSH	O	Monographs	2.00
	INF06-EPS	O	Sport and physical Education	1.00
	INF06-PPI	O	Professional Project	1.00
6	**HUMT2-SAM(2)**		**SAM : APES Responsabilités Associatives**	**2.00**
	HUMT2-APES ASSO	F	Association membership & responsabilities 2 credits	2.00
7	**HUMT2-SAM(3)**		**SAM : APES Responsabilités Associatives**	**3.00**
	HUMT2-APES RESP	F	Association membership & responsabilities 3 credits	3.00
8	**HUMT2-SAM(1)**		**"SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility)**	**1.00**
	HUMT2-APES	F	APES	1.00

O = compulsary, C= in choice , F= optional

Introduction to SENSORS	TCM06-CAPT
Number of hours : 35.00 h	1.00 ECTS credit
CM : 21.00 h, TD : 14.00 h	
Reference Teacher(s) : DURAND OLIVIER	

Objectives :
In Europe, the sensors market has been estimated to 10 billions Euros in 2007, corresponding to 28% of the glogal world
market, with an estimated growth more than 6% per year and sustained by the security systems, the automotive, aeronautics
and defence. Nowadays, the sensors market swipes to the electronic instrument mass market. Such a market generates a large
amount of employment in a wide range of industries. The aim of this course is a general overview of the properties and the
applications of sensors, with a global understanding, as general knowledge, of the different phenomena used for the sensors
elaboration.

Content :
General introduction to sensors. Active and passive sensor conditioners. Basics of semiconductor physics. Optical sensors.
Notions on the photovoltaic cells. Temperature sensors. Position and displacement sensors. Magnetic sensors. Mechanical
sensors. Introduction to microsensors.

Bibliography :
Les capteurs en instrumentation industrielle (G. Asch et collaborateurs), Dunod Handbook of Modern Sensors 2nd edition (J. Fraden), AIP Presss, Woodbury, New York Principe généraux des capteurs, cours CNAM (F. Lepoutre)
Cours capteurs (M. Hubin) : http://perso.orange.fr/michel.hubin/capteurs/instrum.htm

Requirements :
No prerequisite.

Organisation :
Homework.

Evaluation :
Written examination on work covered during lectures and tutorials.

Target :

Energy	TCM06-ENRG
Number of hours : 42.00 h	1.00 ECTS credit
TD : 12.00 h	
Reference Teacher(s) : CORNET CHARLES	

Objectives :
Impact of the choice energy sources of the 21st century. Photovoltaic cells and the thermal efficiency of buildings in terms of
cost, efficiency and environmental impact. Inventory of the energy sources currently in use. Thermodynamic tools. Overview
of the different methods of energy production including combustion engines, boilers, nuclear energy, renewable energies, etc.
Presentation of the different means of transport and energy transfer; thermal isolation or conduction, convection, material
transfer, inverted cycle machines, etc.

Content :
24 hours of lectures, 12 hours of tutorials and 6 hours of practical training.
Introduction to energy management and analysis of the current energy situation. The tools of energy engineering: Fick's laws
of diffusion, black body, thermal machines and basic reminders of thermodynamics. Production of energy: nuclear, thermal
combustion, boiler. Renewable energies: wind power, solar, geothermic energy, etc. Delivery of energy: insulation, conduction, convection, electricity and gas transport, etc.
Chapter I: Introduction to energy engineering.
(I) The energy context
1/ Definitions
2/ Overview of the current energy situation
(II) Energy prospects
1/ Supply and demand
2/ Technological orientation
3/ Conclusions
(III) Energy
1/ The different forms of energy
2/ Energy conversion
3/ Stocking and transport of energy.
Chapter II: Engineering tools for Energy
(I) - Transport phenomena
1/ Particle diffusion
2/ Thermal diffusion
3/ Fourier/Ohm/Fick Analogy
4/ Convection
(II) Energy transfer by radiation: black body model
1/ classic description
2/ quantum description - Planck's law
3/ Spectral characteristics of radiation
4/ Interest of the model
(III) Thermodynamics (Reminder)
1/ Thermal machines and cycles
2/ Energetic and entropic outcomes
3/ Diathermy machines
4/ Performance and efficiency.
Chapter III: The production of energy
(I) Nuclear energy
1/ Principle
2/ Fission and nuclear power
3/ Perspectives : toward thermonuclear fusion
(II) Combustion and combustion engines
1/ Combustion and fuels
2/ Ovens and boilers
3/ Combustion engines
(III) Renewable energies : solar, wind power, etc.
1/ Renewable energies

2/ Geothermic and ocean energy
3/ The thermal conversion of solar energy
4/ Photovoltaic solar energy
5/ Wind power
6/ Other energies.
Chapter IV: Transport and transfer of energy
(I) Heat transfer
1/ Heat transfer by thermal conduction: Applications to insulation
2/ Heat transfer by convection: heat exchangers
(II) Material transfers
1/ Pressure or load losses
2/ Turbo machines
(III) Transport of electricity: three-phase current.

Bibliography :
Energétique : concept et applications : Michel Feidt Systèmes énergétiques : (2004) (bibliothèque insa rennes)
Energies renouvelables : (2006) (bibliothèque insa rennes)

Requirements :
Mathematics: differential equations, complex numbers.
Other: Thermodynamics of diffusion and thermodynamic potentials , entropy, efficiency. Fluid mechanism (Bernoulli's
principle), understanding of semiconductors.

Organisation :
Preparation for tutorials, conferences. Internet research.

Evaluation :
2-hour examination based on the lectures and tutorials.

Target :

Introduction to Production and quality Management	TCM06-IMO
Number of hours : 28.00 h	1.00 ECTS credit
CM : 14.00 h, TD : 10.00 h, TP : 4.00 h	
Reference Teacher(s) : SORRE FREDERIC	

Objectives :
Introduction to production management and quality issues: Nowadays, companies must adopt methods associated with tools,
which will allow them to manage production effectively. Overview of the organisation of a factory.

Content :
PART ONE: Production management
(I) Introduction: definition of production management, classification of production systems.
(II) Scheduling in specialised workshops: scheduling on a machine, scheduling with two or three production centres.
(III) Stock management: stock management policies, associated costs, fixed interval order system for stock with a turnover of
zero, re-order point-management.
(IV) Production planning: Planning of the number of components required, basic principles of MRP2, load adjustment, capacity.
(V) "Just-in-time" techniques: origin and principle of JIT, key factors, the Kanban method.
PART TWO: Quality:
(I) Quality of industrial products: the concepts, Quality function, and the international norms for quality control management.
(II) Quality tools: 5S, SMED, TPM, control system and reception control system.
PART THREE: Case study - A presentation by representatives of manufacturers.

Bibliography :
Gestion de la production - Blondel - DUNOD\ n
La gestion de production - Bénassy - HERMES
Contrôle de la qualité - Jaupi - DUNOD
Industrialisation des produits mécanique (Tome 1) - Linarès-Marty - HERMES

Requirements :

Organisation :

Evaluation :
Two-hour written examination. Continuous assessment of Practical work.

Target :

Science Humaine Economique et Sociale 1	TCM06-SHES1
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Science Humaine Economique et Sociale 2	TCM06-SHES2
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Graphs and Algorithms	INF06-ALGO
Number of hours : 52.00 h	3.00 ECTS credit
CM : 20.00 h, TD : 18.00 h	
Reference Teacher(s) : QUICHAUD DANIELE	

Objectives :
* The fundamentals of graph theory. * Common types of graph problems and their classic resolution algorithms. * Study
begins with non-valued graphs and continues with valued graphs.

Content :
Non-valued graphs:
* Basic definitions.
* Graph representation.
* Graph operations.
* Graph properties.
* Connexity.
* Cycles.
* Trees and arborescence.
* Stable sets and absorbent sets. Graph colouring.
Valued graphs:
* Minimum spanning tree.
* Optimal paths.
* Applications: Scheduling problems. Flows in transportation networks.

Bibliography :
* Algorithmique des graphes. J.M. Hélary, polycopié IFSIC, Juin 1999
* Graphes et algorithmes. M. Gondran, M. Minoux. Lavoisier, 2009 (4th Edition)
* Types de données et algorithmes. C. Froidevaux, M.C. Gaudel, M. Soria. Ediscience international, 1994.

Requirements :
None.

Organisation :
Revision of class notes. Preparation of exercises.

Evaluation :
Two hours written examination at the end of the semester (with free access to written documents).

Target :

Practical Study	INF06-ETUPR
Number of hours : 10.00 h	1.50 ECTS credit
PR : 10.00 h	
Reference Teacher(s) : GOURANTON VALERIE	

Objectives :
* Implementation of the application defined in semester 5 in module "Theoretical and Practical Study".

Content :
* This module allows technical and practical comprehension of specific computer science related subjects which are not a part
of the curriculum.
* Detailed specifications for the Implementation of the application defined in semester 5.
* Students work in teams of three or four.

Bibliography :

Requirements :
Module "Theoretical and Practical Study" S5.

Organisation :
Although this module consists of ten hours of supervised group-work, much of the input is left up to the individual (approximately two hours per week).

Evaluation :
* French language
* Each group submits a six-page global report along with technical annexes.
* Presentation of the application at the end of the semester.
* Demonstration.

Target :

Architecture	INF06-ARCHI
Number of hours : 26.00 h	2.00 ECTS credit
CM : 8.00 h, TD : 10.00 h, TP : 8.00 h	
Reference Teacher(s) : GARCIA PASCAL	

Objectives :
The aim of this module is to show how to conceptually create a computer from basic components (NAND logic gate and D
flip-flop).

Content :
* Von Neumann architecture.
* Memories.
* Implementation of a simplified architecture.
* Component access.
* Input/output.
* Memory hierarchy.
* Programming of input/output component on a microcontroller (used in the Mindstorms Lego).

Bibliography :
Computer organization and design, D.A.Patterson and J.L. Hennessy
* The elements of computing systems, N.Nissan and S.Schocken
* Architecture et organisation des systèmes, J.Ristori and L.Ungaro

Requirements :
Combinatory and sequential logic.

Organisation :

Evaluation :
Two-hour examination at the end of the semester.

Target :

Industrial conference S6	INF06-CONF
Number of hours : 8.00 h	0.50 ECTS credit
CONF : 8.00 h	
Reference Teacher(s) : COUASNON BERTRAND	

Objectives :
The purpose of this module is to complete the curriculum by knowledge, practices, industrial problems not seen in other modules. It gives students a better knowledge of business world, its internal and external ecosystem, professions. It is also a way to build links between students and companies.

Content :
Conferences are done by industrial contributors, on different subjects like :

- Introduction to project management
    - The offshore model in computer engineering and maintenance companies
    - Latest trends of costumer relation for the generation Y

Conferences can be 2 hours long, several modules of 2 hours or organized on a whole day.

Bibliography :

Requirements :

Organisation :
A group of student volunteers, with the teacher in charge of the module, define and organize the different conferences.

Evaluation :
Validation on the presence of the student

Target :

Databases	INF06-BD
Number of hours : 26.00 h	2.00 ECTS credit
CM : 10.00 h, TD : 10.00 h, TP : 6.00 h	
Reference Teacher(s) : GOURANTON VALERIE	

Objectives :
* An introduction to the problematics of the design and implementation of databases. * Data access performances, emphasising
request optimisation.

Content :
* Relational design schemes.
* Functional constraints and dependency.
* Calculus of implied dependency.
* Minimum cover and minimum closure of a functional dependency set.
* Normalisation.
* Relational schemes decomposition criteria and algorithms (3NF and BCNF).
* Classic implementations of relational memories.
* Algorithm complexity and organisation.
* Study of basic organisations: Heap, hash tables, B-trees.
* Primary and secondary indexes.
* Request optimisation.
Bibliography:
* Bases de données. G. Gardarin, Eyrolles, 5e tirage, 2003
* Database Management Systems. R. Ramakrishnan, J. Gehrke, McGraw Higher Education, 3rd edition, 2003
* Bases de données : des systèmes relationnels aux systèmes à objets. C. Delobel, Ch. Lécluse, Ph. Richard - InterÉditions,
1991
* Polycopiés : Bases de données : le modèle relationnel. D. Herman et al, Université de Rennes I. 1997
* Bases de données (transparents des cours). V. Gouranton, Insa de Rennes, 2011

Bibliography :

Requirements :
Experience in use of data bases (design, implementation, inquiring).
Relational algebra and SQL.
An imperative programming language.

Organisation :
Revision of class notes. Preparation of exercises and laboratory work.

Evaluation :
two hours written examination (with access to documents).

Target :

Project: Compiler	INF06-COMPL
Number of hours : 38.00 h	3.00 ECTS credit
PR : 8.00 h, TD : 30.00 h	
Reference Teacher(s) : ROZE MARCHAND LAURENCE	

Objectives :
* A continuation of its sister module in the first semester, this second part aims to familiarise students with the imperative
language translation chain, to introduce them to compiling techniques and involve them in an extensive project (groups of 4). *
Compilation, linking and execution schemes of imperative languages. * Students learn to write a compiler.

Content :
* Finite state automata programming.
* Stack automata and LL(1) grammars.
* Lexical analysis and syntactical analysis DGD.
* JAVACC scanner generator.
* Identifiers table, type control, code production.
* Execution schemes -> virtual machine -> Pentium machine.

Bibliography :
Projet compilateur. L. Rozé, M.J. Pédrono La programmation par syntaxe. B. Groc et M. Bouhier. Dunod, 1990

Requirements :
The first semester module on execution schemes and compiling.

Organisation :
Implementing the compiler: 1h30 per week.

Evaluation :
Three-hour written examination on compiling.

Target :

Knowledge Acquisition	INF06-ACQUI
Number of hours : 26.00 h	2.00 ECTS credit
CM : 18.00 h, TD : 2.00 h, TP : 6.00 h	
Reference Teacher(s) : QUICHAUD DANIELE	

Objectives :
* The aim of this module is to study and put into practice a number of methods which allow data to be summarised, explored
and described.
* During laboratory work students use SPAD software. This allows the application of theoretical knowledge to real data samples of various origins: telecommunications, commerce, etc.

Content :
Mathematics and statistics (review)
Factorial methods:
* Principal component analysis.
* Simple factorial analysis of correspondence.
Automated classification (unsupervised).
* Reallocation methods: Aggregation around mobile centres. Aggregation around the k-means.
* Hierarchical classification: Minimal jump aggregation criterion, Ward's inertia criterion.
Supervised classification
* System Vector Machines (SVM)

Bibliography :
Cornejuols, Kodratoff, Miclet- Apprentissage artificiel. Eyrolles, 2002.
Lebart, Morineau, Piron - Statistique exploratoire multidimentionnelle. Dunod, 1995.Jambu
- Exploration informatique et statistique des données. Dunod, 1987. Escofier, Pagès
- Analyses factorielles simples et multiples. Dunod, 1990.

Requirements :
Bachelor level linear algebra. Basic probability tools.

Organisation :
Revision of lecture notes. Practical work tasks.

Evaluation :
Two-hour written examination at the end of the semester.

Target :

Introduction to statistical inference	INF06-STAT
Number of hours : 26.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 14.00 h	
Reference Teacher(s) : LEDOUX JAMES	

Objectives :
Introduction to the statistical methodology. Basics on statistical inference: estimation and test of statistical hypotheses.
Illustrations using SAS software will be proposed in program INF06-PROGICIELS.

Content :
o Statistical models. Parametric statistics
o Standard point methods (maximum of likelihood, moments, ...)
o Confidence intervals
o Tests on point estimators, comparison of groups

Bibliography :
N. Savy - Statistiques et probabilités pour modéliser et décider. Ellipses, 2006
G. Saporta - Probabilités, analyse des données et statistique. Technip. 2006

Requirements :
STP03-PROBA et TCM05-PROB

Organisation :
Revision of class notes. Preparation of practical work.

Evaluation :
Two-hour written examination at the end of the semester.

Target :

Buisness Software	INF06-PROGICIELS
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : MONIER LAURENT	

Objectives :
* Introduction to modern, scientific calculus resolution software by means of mechanical problem solving.
* Master the basics of a statistical analysis software (SAS).

Content :
PART ONE: Using of MATLAB (12h).
1) Ordinary differential equations
2) Numerical integration scheme
Application: pray-predator systems : parametric oscillators (chaos phenomena).
3) Partial derivative equations
4) Simplified study of an automobile suspension system; Springs subject to various nonlinear constraints

PART TWO: Using of SAS (14h).
- Overview of SAS
- Data manipulation using the DATA step
- Base SAS procedures
- SAS/GRAPH Software
- Reporting using Output Delivery System
- Statistical procedures and simulation

Bibliography :
Kontchou Kouomegni H. et Decourt O. (2007)
SAS : Maîtriser SAS Base et SAS Macro, SAS 9.2 et versions antérieures : Dunod (2ème édition).

Decourt O. (2008)
Reporting avec SAS : Mettre en forme et diffuser vos résultats avec SAS 9 et SAS 9 BI : Dunod.

Ringuedé S. (2011)
SAS Introduction pratique : du data management au reporting : Pearson Education (2ème édition).

Requirements :

Organisation :
Preparation of practical work.

Evaluation :
Written examination.
Mark of pratical work (SAS)

Target :

Numerical Analysis	INF06-ANANUM
Number of hours : 26.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 8.00 h, TP : 6.00 h	
Reference Teacher(s) : HADDOU MOUNIR	

Objectives :
* Modelling real problems often leads to the resolution of linear systems. The aim of this module is to introduce the primary resolution methods.
* Direct methods: Searching for a solution in a finite number of steps.
* Iterative methods: Writing a fixed point equation and solving it recursively. In theory, the iterative methods find a solution in an infinite number of iteration steps. In practice, the calculus is ended as soon as the stop criterion is attained, therefore obtaining an approximate solution.
* A look at the choice of numerical methods to be used, their rapidity and the stability of the numerical solutions found.

Content :
* Matrix analysis, vector norms and matrices norms.
* Condition number, sensivity analysis of the solutions.
* Numerical methods for linear systems :
* Direct and iterative methods (Gauss, Cholesky, Gauss-Seidel, Jacobi, etc...)
* Descent methods (gradient, conjugate-gradient,¿)

Bibliography :
* P.G. Ciarlet. Introduction à l'analyse numérique matricielle et à l'optimisation. Collection Mathématiques Appliquées pour la maîtrise. Edition Masson.
* P. Lascaux, R. Théodor. Analyse numérique matricielle appliquée à l'art de l'ingénieur. Edition Dunod.
* A. Quarteroni, R. Sacco, F. Saleri. Méthodes numériques pour le calcul scientifique. Programmes en Matlab,collection IRIS, Springer.
* M. Schatzman. Analyse numérique. Une approche mathématique. Edition Dunod.

Requirements :
Mathematics; as studied in the first two years at INSA.

Organisation :
Mathematics; as studied in the first two years at INSA.

Evaluation :
Two-hour written examination.

Target :

Advanced Architecture	INF06-ARCHIAV
Number of hours : 26.00 h	2.00 ECTS credit
TD : 14.00 h, TP : 12.00 h	
Reference Teacher(s) : GARCIA PASCAL	

Objectives :
MIPS architecture case study and introduction to operating systems.

Content :
* MIPS architecture.
* Introduction to operating systems.
* Realisation of a thread manager.

Bibliography :
Computer organisation and design. D.A.Patterson and J.L. Hennessy.
Operating system design, the Xinu approach. D.Comer.
Operating systems, the Minix book. A.S.Tanenbaum and A.S.Woodhull.

Requirements :
Architecture and organisation of operating systems.

Organisation :

Evaluation :
Two-hour written examination at the end of the semester.

Target :

Script Programming	INF06-SCRIPT
Number of hours : 14.00 h	1.00 ECTS credit
TP : 14.00 h	
Reference Teacher(s) : LEPLUMEY IVAN	

Objectives :
Scripting languages part (14 hours of laboratory work): Greater understanding of scripting languages (Perl, PHP) by applying
them to various examples.

Content :
Use of Scripting languages (Perl, PHP...) for:
* XML data parsing (DOM, SAX).
* Human-machine interface definition (Gtk).
* Network programming (socket, cURL).
* Regular expressions (PHP, Perl).
* Construction of dynamic images (libray GD)

Bibliography :
"Programmation en Perl", L. Wall, T. Christiansen, J. Orwant, O'Reilly, 2001
"Langages de script sous Linux", Christophe Blaess, Eyrolles, 2001

Requirements :
Scripting language part: Module on the use and functions of Operating systems (first semester).

Organisation :
Scripting language part: Revision of class notes.

Evaluation :
Scripting language part: Continuous evaluation.

Target :

Functional Programming	INF06-PFONC
Number of hours : 38.00 h	3.00 ECTS credit
CM : 12.00 h, TD : 2.00 h, TP : 24.00 h	
Reference Teacher(s) :	

Objectives :
* Concepts of functional programming.
* Methods applied in the development of large-scale software applications.

Content :
* Expressions, definitions and basic types.
* Use of n-tuples.
* Analysis of the central element of the language; the function.
* Use of pattern filtering, polymorphism and type expressions.
* Definition and employment of various data structures.
* Definition of new value types: sum types and product types.
* List-related functions and functional methods.
* Imperative aspects of programming.
* The exception mechanism: Definition, triggering, catching.
* Input-output and sequence.
* Mutable data structures such as vectors.
* Modular programming by abstract data type implementation.
* Case study.

Bibliography :
"Approche fonctionnelle de la programmation"", G. Cousineau et M. Mauny, Ediscience, 1994
Développement d'applications avec Objective Caml,
http://www.pps.univ-paris-diderot.fr/Livres/ora/DA-OCAML/

Requirements :
None.

Organisation :
Revision of lesson notes. Preparation of lessons and laboratory work. (1h30 per week).

Evaluation :
Two-hour examination (access to documents).

Target :

English	INF06-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : LE VOT PHILIPPE	

Objectives :
Improving expression, understanding and interaction skills in everyday life as well as social and professional environments.

Language objectives :
Acquiring or reinforcing B2 level (as requested by the CEFR for languages) and C1 level for the most advanced students.

Content :
* Doing-by-learning approach
* Listening, speaking, writing in a motivating environment and approach to help and guide students in their analysing, experimenting, implementing process.
* Acquiring the right vocabulary and grammar to deal with professional and social situations in an autonomous way.

Pedagogical approach:
* Creativity and personal involvement-based activities such as rôle plays, debates, oral presentations, graph and diagrams analysis, radio programs recordings, video creation, subtitling and dubbing, CV/resume writing
* Most of these activities cover the professional scope of the speciality of the student's department in a multicultural environment.
* Resources: press article, video and audio documents from the international press and television chanels.

Bibliography :
- Robert et Collins bilingual dictionary or Collins Cobuild
- English Grammar in Use (Cambridge University Press)

Requirements :
B1/B2 level and a good handling of the first two post-baccalaureate program required.

Organisation :
Each course lasts 2 hours. 56 hours a year.
The classes take place in fully equipped rooms -video, audio material as well as multimedia lab- which enables the students to make the best of their time in an adapted and stimulating environment.

Evaluation :
* Writing / reading test at the end of the semester: 2hrs
* Individual oral (face-to-face) : 15 mn

Target :

Monographs	INF06-PSH
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : DERRIEN-REMEUR VALERIE	

Objectives :
Overview: Students choose and plan an appropriate project in accordance with the objectives. They carry out rigorous research
on the theme and interview specialists (Emphasis is placed on the use of project management tools and teamwork). A
Presentation is given in front of an invited audience. An inter-departmental competition to finish.

Content :
The aim of this module is to broaden the students' knowledge of their chosen professional field and of the prevailing social and
managerial environment. Students must structure their thinking to argue their point and make sense of the various sources of
information studied. Particular emphasis is placed on the importance of the use and quotation of trustworthy sources. The
monographs, which are archived in the library, will then represent a reliable, recent source of information.
The methodological tools required for project management (aims, organisational chart, task-delegation, work schedule) are
applied, resulting in well-written documents and improved public-speaking skills. Teamwork is particularly encouraged.
The teacher ensures that teams never lose sight of their stated objectives.
The advantages and pitfalls of research via the internet are discussed. Interviews are organised with people from within INSA
(Mr. Aubel of CEIP and various teacher-researchers), and with various engineers and managers from elsewhere. Their thoughts
are added systematically to the monograph to support the analysis. The library and the multimedia centre also prove to be
reliable sources of information.
Proper writing style and editing technique are essential; The main rules of editing a quality document are studied, including
structure of a report, style, bibliography, etc.
At least one rehearsal precedes the final oral presentation in order to give the students confidence and highlight the importance
of a well-delivered speech. Students learn how to create a Power Point presentation.
The last classes focus on the voice, gestures, and carefully communicating information in a clear and rigorous way. The oral
presentation event is open to students, teachers and those interviewed in the course of research. The formal nature of this event
is of significant importance as it underlines INSA's policy for the training of generalist engineers.
An inter-departmental competition is held to reward the three best monographs of the year. The objective is threefold: - to
promote the importance of the students' work - to bring together those interviewed and explain to them our approach - to
promote exchange between departments.

Bibliography :
Timbal-Duclaux L.: L'Expression écriteEcrire pour communiquer. Editions ESF 1994.
Claret J. :Organiser la pensée. Editions ESF, 1989.
Quivy R. et Van Campenhoudt L. : Manuel de recherche en sciences sociales. Editions Dunod 1995.
Licette C. : La prise de parole en public. Editions Studyrama 2002.

Requirements :

Organisation :
Research. Writing of progress reports and press reviews.

Evaluation :
- Monograph.
- Oral Presentation.

Target :

Sport and physical Education	INF06-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : LE LAGADEC PIERRE	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O., kayak
or golf.

Bibliography :
Several specialized books are available to the students at the library. Links to internet sites are given on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Professional Project	INF06-PPI
Number of hours : 6.00 h	1.00 ECTS credit
PR : 6.00 h	
Reference Teacher(s) : LE BAIL SYLVIE	

Objectives :
Students are encouraged to reflect upon their future careers.

Content :
1. Discovering enterprises: working for an enterprise, the relationship between "technicians" and other teams: marketing,
direction, sales, finance. 2. Analysis of professional ambition with the aid of human resource specialists and company
directors. 3. Meetings: each department sets up meetings to illustrate the situations particular to their sector.
Detailed programme:
Stage1: In groups of twelve, working alongside consultants and company directors on "how to establish and develop a
professional project".
Stage 2: Discovery of the different professions. Meeting professionals. The student is to set up meetings with two professionals
with the objective of understanding the relationship between the engineering department and the other departments of the
enterprise: marketing, sales, finance, human resources, etc.
Stage 3: Debriefing (with the human resources consultants).
The objective is to have the student to refine his professional project with respect to the enterprise. Students must prepare a
document in advance of the interview containing the following; How did you relate to your interviewee? How did you obtain a
meeting? Did you come across difficulties? How did you prepare for your interview? What were your main objectives? What
can you say about the course of your interview? Have you achieved your objectives (Give details)? And finally, what will you
do differently in future interviews?
Networking: how to use first contacts in an enterprise to achieve further goals.
In the framework of their professional project, fifth year students will attend a conference on job opportunities in their chosen
domain. Examples: High quality car production and the requirements of this sector (GMA). Images and networks (ESC-EII-Info). Setting up business in the information technology sector (EII-ESC-Info). Purchasing: the opportunities for the
engineer (GMA). The different professions open to civil engineering students (GCU). Microelectronics and nanotechnology:
job opportunities (MNT).
Write and present a synthesis report on a topic related to economic or social news, or linked to a career project.
An inter-departmental competition takes place to find the "monograph of the year".

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Association membership & responsabilities 2 credits	HUMT2-APES ASSO
Number of hours : 14.00 h	2.00 ECTS credit
DIV : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Association membership & responsabilities 3 credits	HUMT2-APES RESP
Number of hours : 20.00 h	3.00 ECTS credit
DIV : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

APES	HUMT2-APES
Number of hours : 30.00 h	1.00 ECTS credit
DIV : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Semestre 7

Parcours Formation Initiale INFO

1	**INF07-1**		**Software Engineering**	**7.00**
	INF07-POO	O	Object Oriented Programming	2.50
	INF07-MODEL	O	Modeling and Software Design	2.50
	INF07-TPCPOO	O	Practical Work: Object - Oriented Programming	2.00
2	**INF07-2**		**Logic and logic programming**	**5.50**
	INF07-LOGIQUE	O	Logic	2.00
	INF07-PRLOG	O	Logic Programming	3.00
	INF07-CONF	O	Industrial conference S7	0.50
3	**INF07-3**		**Fundamentals of course**	**5.00**
	INF07-COMPIL	C	Compilation	5.00
	INF07-AAD	C	Statistical learning	2.50
	INF07-MSA1	C	Regression modelling	2.50
4	**INF07-4**		**System and project**	**7.50**
	INF07-SYST1	O	Systems: The Fundamentals	3.50
	INF07-GEST	O	Project Management for computer science	0.50
	INF07-PROJ1	O	Project: Preliminary Study and Specifications	3.50
5	**INF-HUM07**		**Humanities S7**	**5.00**
	INF07-ANGL	O	English	2.00
	INF07-ECOG	O	Economy and Business Management 1	2.00
	INF07-EPS	O	Sport and Physical Education	1.00

O = compulsary, C= in choice , F= optional

Object Oriented Programming	INF07-POO
Number of hours : 44.00 h	2.50 ECTS credit
CM : 24.00 h, TD : 20.00 h	
Reference Teacher(s) : ANQUETIL ERIC	

Objectives :
Object-oriented programming is a powerful tool to cope with the development of real applications. It helps to define projects with an effective monitoring of the different phases of evolution. This course emphasizes the fundamental principles associated with object-oriented programming. It is performed in parallel with the object modeling module (INF07-MODEL) to fully understand all aspects of the notion of "object": Analysis, Design and Object Oriented Programming.
The two main languages ??presented in this course are: C + + and JAVA. C + + is presented from basic concepts to more advanced concepts. Only the most advanced concepts of the Java language are explored in detail, in addition to the introductory course in Java provided in the module pre-specialization semester (S4). This course also includes an awareness of UI development in DotNET (WPF and C #).
This module consists of 24 hours of courses and 7 hours of TPs._In parallel with this course, students will conduct a tutored project (see INF07-TPCPOO) in pairs to acquire in the context of a project-based teaching the theoretical statements of the course.

Content :
Object-oriented programming in C++.
* Notion of object in C++: Construction of objects, Interfaces, Encapsulation, etc.
* Memory management : Dynamic memory allocation, Destructor, Assignment statement..
* Basic elements of C++: Input/Output management, String, etc.
* Object conception in C++: Aggregation, Inheritance, Polymorphism, Access control, etc.
* Multiple inheritance / Template.
* STL.

Introduction of new object oriented programming concepts in Java.
* Streams.
* Serialisation.
* Generics.

#Conception and advanced programming in Java and C++.
* Exceptions handling.
* RTTI.
* Internal class.
* Design Pattern implementation.
* Programming and use of frameworks.
* DotNET, .wpf and MVVM IHM programming
* Java Native Interface (JNI).

Bibliography :
* Conception orientée objets et applications- G. Booch - Addison-Wesley
* The C++ programming language (third edition) - B. Stroustrup - Addison-Wesley
* Thinking in Java - Bruce Eckel

Requirements :
Basic understanding of algorithmics.
C programming and basic object-oriented programming in Java (see the "introduction to object oriented programming in Java"
module taught as part of the prespecialisation course).

Organisation :
Revision of class notes (1h per week)

Evaluation :
Two-hour written examination at the end of the semester.

Target :

Modeling and Software Design	INF07-MODEL
Number of hours : 30.00 h	2.50 ECTS credit
CM : 24.00 h, TD : 6.00 h	
Reference Teacher(s) : MARCHAL MAUD	

Objectives :
* Information systems and software engineering requires efficient modelling tools and effective and clear methods. This
module is designed to educate students in the problems of design and software analysis.
* The standardised object-oriented modelling language, UML is used as well as methodological elements from UMP and OMT.
* Design patterns are also presented to channel the efficient design of the system.
* Basic concepts of the Human-Computer Interaction (HCI) domain are also explained to provide students with knowledge needed for the conception of interactive systems.
* Model-Driven Engineering is explained and illustrated throw concrete use cases.
* Fluency in the use of these tools is essential in most businesses.

Content :
* Object-Oriented Modelling. Basic concepts
* UML language
* Design Patterns
* Human-Computer Interaction
* HCI Architectural Patterns
* Model Driven Engineering

Bibliography :
* G. Booch ,Conception orientée objets et applications,Addison-Wesley
* P. Muller, Modélisation objet avec UML, Eyrolles
* N. Lopez, J. Migueis, E. Pichon, Intégrer UML dans vos projets, Eyrolles
* J. Rumbaugh, OMT
* E. Gamma,R. Helm , R. Johnson , J. Vlissides, Design Patterns : catalogue de modèles de conception réutilisables
* J.-M. Jézéquel, M. Train, C. Mingins, Design Patterns and contracts, Addison-Wesley, 1999

Requirements :
Knowledge of object-oriented languages (Java, C++).

Organisation :
Revision of class notes. Preparation of exercises and individual work assignments. Analysis, design and implementation of a
project.

Evaluation :
Two-hour written examination with documents.
Evaluation for a project work at the end of the semester.

Target :

Practical Work: Object - Oriented Programming	INF07-TPCPOO
Number of hours : 30.00 h	2.00 ECTS credit
PR : 14.00 h, TP : 12.00 h	
Reference Teacher(s) : ANQUETIL ERIC	

Objectives :
The concepts of the courses Object-oriented programming and modeling (INF07-POO, INF07-MODEL) are implemented through a tutored project. Through a project-based teaching, this project aims to initiate students, with the implementation of a software, to the following aspects: modeling, integration of multi-language library (C + + / C #) and development of a GUI in DotNET (WPF).

Content :
The concepts discussed are: UML Designs, DLL, C + +, C #, WPF.

Bibliography :
Conception orientée objets et applications- G. Booch - Addison-Wesley_# The C++ programming language (third edition) - B. Stroustrup - Addison-Wesley_# Thinking in Java - Bruce Eckel

Requirements :
Basic understanding of algorithms.
C programming and basic object oriented programming in Java (see the "introduction to object-oriented programming in Java"
module taught as part of the prespecialisation module).

Organisation :
The project is conducted in pairs, representing approximately one hundred hours of development including thirty tutored hours.

Evaluation :
Report and presentation at the end of the semester

Target :

Logic	INF07-LOGIQUE
Number of hours : 20.00 h	2.00 ECTS credit
TD : 20.00 h	
Reference Teacher(s) : GARCIA PASCAL	

Objectives :
* The essential basics in first-order logic.
* Introduction of formal systems of proof.
* Control formal system.
* Resolution.

Content :
* Propositional language.
* Syntax and semantics of the propositional language.
* Truth table. Valid consequence.
* Syntax and semantic deduction theorems.
* Formal systems. Theorem. Proof.
* Resolution in the propositional language, predicate language.
* Predicate language syntax and semantics.
* Interpreting. Logic consequence.
* Syntax and semantic deduction theorems.
* Formal Systems. Theorem. Proof.
* Resolution in the predicate language (unification, instantiation).

Bibliography :
Systèmes formels, Introduction à la logique et à la théorie des langages, Benzaken, Masson , 1991. Outils logiques pour l'intelligence artificielle , J.P. Delahaye, Eyrolles, 1986.

Requirements :
None.

Organisation :
Revision of lecture notes (one hour per week).

Evaluation :
one-hour 30 minutes written examination with documents at mid-term.

Target :

Logic Programming	INF07-PRLOG
Number of hours : 36.00 h	3.00 ECTS credit
CM : 12.00 h, TP : 24.00 h	
Reference Teacher(s) : SEBILLOT PASCALE	

Objectives :
This course unit aims to present and implement the fundamental principles of logic programming. Basic mechanisms of the Prolog language are described both from the logical and the operational points of view. Relation-based knowledge bases manipulation and recursive programming are presented. Cut, negation and syntactic analysis are other keypoints of the course. These notions are illustrated by practical work, in ECLiPSe, together with extra openings to expert systems, or meta(interpreter), etc.

Content :
1) Prolog's basic mechanisms
* terms, clauses
* unification
* demonstration
* search tree
2) Prolog to define and question relations
3) Recursive programming
* lists
* trees
4) Cut and negation
5) Syntactic analysis
* principles
* attributed grammars
* DCGs

Bibliography :
- The Art of Prolog, Leon Sterling and Ehud Shapiro, 2nd edition, The MIT Press, 1994
- The Craft of Prolog, Richard A. O'Keefe, The MIT Press, 1990
- Programming in Prolog, William F. Clocksin and Chris S. Mellish, 5th edition, Springer Verlag, 200

Requirements :
None.

Organisation :
Deepening of the courses; preparation of practical work

Evaluation :
One 1.5 hour written examination at the end of the semester, and some practical work.

Target :

Industrial conference S7	INF07-CONF
Number of hours : 16.50 h	0.50 ECTS credit
CONF : 10.00 h	
Reference Teacher(s) : COUASNON BERTRAND	

Objectives :
The purpose of this module is to complete the curriculum by knowledge, practices, industrial problems not seen in other modules. It gives students a better knowledge of business world, its internal and external ecosystem, professions. It is also a way to build links between students and companies.

Content :
Conferences are done by industrial contributors, on different subjects like:

- Vocal technologies and sound processing. Where are we now?
- Scrum method & CMMI
- How advance and take responsibilities with a computer science master degree?
- Working abroad / Understand and adapt to cultural differences

Conferences can be 2 hours long, several modules of 2 hours or organized on a whole day.

Bibliography :

Requirements :

Organisation :
A group of student volunteers, with the teacher in charge of the module, define and organize the different conferences.

Evaluation :
Validation on the presence of the student

Target :

Compilation	INF07-COMPIL
Number of hours : 56.00 h	5.00 ECTS credit
CM : 30.00 h, TD : 2.00 h, TP : 24.00 h	
Reference Teacher(s) :	

Objectives :
* A compiler is a programme which takes as input another program in a source language and which transforms it into an
equivalent program in a target language.
* The notion of "programme" has to be understood in a broad sense. It may be a text
containing formatting instructions or an executable programme.
* The objectives of compilation at large can be numerous: text formatting, executable code generation, programme analysis, debugging, testing, etc.
* The aim of the 4th year compilation course is to give students the tools to detect and evaluate a compilation problem. In particular, error and ambiguity detection and recovery are emphasised.
* The course takes advantage of the practical experience of the students, and tackles the clarification of concepts and presentation of basic techniques in perspective.
* Laboratory work enables students to understand the implementation techniques.
* Programming is carried out in ML, a declarative language well suited to compiler implementation.
* Automatic code generator tools such as Lex and Yacc are introduced and used at the end of the course.
* A compilation exercise is also done during Prolog Laboratory work.

Content :
* Compilation stakes.
* Lexical analysis.
* Syntactic analysis: Descendant analysis LL(1) and LL(k). Ascendant analysis LR, SLR, LALR.
* Semantic analysis: Attributed grammars, Dataflow Analysis, Milner Type inference.
* Code generation : Register allocation, Garbage collection.

Bibliography :
Les compilateurs - théorie, construction, génération. R. Wilhelm et D. Maurer, Masson, 1994.
Compilateurs - Principes, techniques et outils, A. Aho, R. Sethi et J. Ullman, InterEditions, 1989.
Compilation - Support de cours. M. Ducassé, INSA de Rennes, mis à jour tous les ans.

Requirements :
Modules on grammars and languages.

Organisation :
Revision of class notes. Preparation of laboratory work assignments.

Evaluation :
Three-hour closed-book, written examination at the end of the semester.
Assessment of laboratory work.

Target :

Statistical learning	INF07-AAD
Number of hours : 26.00 h	2.50 ECTS credit
CM : 12.00 h, TD : 10.00 h, TP : 4.00 h	
Reference Teacher(s) : DUPUY JEAN-FRANCOIS	

Objectives :
This module will introduce two methods for decision making. The course will be based on examples. At the end of the module, the students will be able to recognize situations where these methods can be used and to apply them with standard softwares.

Content :
Principal components analysis
Data, notations, examples
Individual study
Variable study
Interpretation of the results
A user-friendly package: FactoMineR

Logistic model
Introductory examples
Notations and definition
Estimation: principle and algorithm
Hypothesis testing

Case studies on real data examples

Bibliography :
F. Husson, S. Lê, J. Pagès. Analyse de données avec R. PUR, 2008.
J.J. Faraway. Extending the linear model with R. Chapman and Hall, 2005.

Requirements :
The course of « Méthodes Statistiques » (3rd year) or equivalent skills in statistical inference.

Organisation :
Lectures and practical exercices with the R software.

Evaluation :
A 2-hour examination at the end of the lectures (weight 2) and TD/TP assessment (weight 1).

Target :

Regression modelling	INF07-MSA1
Number of hours : 26.00 h	2.50 ECTS credit
CM : 12.00 h, TD : 10.00 h, TP : 4.00 h	
Reference Teacher(s) : DUPUY JEAN-FRANCOIS	

Objectives :
This module will introduce the linear model. The course will be based on examples. At the end of the course, the students will be able to: i) recognize problems where the linear model can be used, ii) estimate the parameters of a linear model using classical softwares, iii) interpret the results.

Content :
*Real data examples
*Basic linear algebra for linear models
*Matrix formulation
*The linear model : definition and hypothesis
*The linear model in 4 formulas
*Tests and confidence intervals
*Case study with SAS and R

Bibliography :
J.-M. Azaïs, J.M. Bardet. Le modèle linéaire par l¿exemple. Dunod, 2006.
A. Hamon, N. Jégou. Statistique descriptive : cours et exercices corrigés. PUR, 2008.

Requirements :
The course of « Méthodes Statistiques » (3rd year) or equivalent skills in statistical inference.

Organisation :
Lectures and practical exercises with the R Software.

Evaluation :
Final exam (2h, coeff. 2) and practical work examination (coeff. 1).

Target :

Systems: The Fundamentals	INF07-SYST1
Number of hours : 56.00 h	3.50 ECTS credit
CM : 18.00 h, TD : 18.00 h, TP : 18.00 h	
Reference Teacher(s) : BERTIER MARIN	

Objectives :
* How operating-system resource management mechanisms function. This makes operating system usable for conception and
application programming.
* The concept of parallelism is essential.
* The concepts of process and threads, synchronization mechanisms and Input/Output are presented.
* Practical work enables students to understand how to use process-management mechanisms for applications.

Content :
* Introduction to operating systems.
* Process life cycle. Representation/creation.
* Process Synchronisation. Deadlocks.
* Input/Output. Tubes and files.
* Multithreading.
* Synchronisation.
* Object conception in a parallel framework.
* Virtual machines.
* SMP. Multicores. GPU. Hyperthreading.

Bibliography :
Griffiths : Architecture des systèmes d'exploitation - Hermès Krakowiak : Principes des systèmes d'exploitation des ordinateurs
- Dunod Tanenbaum : Les systèmes d'exploitation - InterEditions Tanenbaum : Systèmes d'exploitation. Systèmes centralisés, systèmes distribués - InterEditions Camillerapp : Systèmes - Notes de cours, polycopié INSA

Requirements :
Module on Computer Architecture.

Organisation :
Revision of class notes. Preparation of exercises and oral examinations. Practical work tasks.

Evaluation :
* A three-hour written examination (with documents) at the end of the semester.
* Mark for practical work.

Target :

Project Management for computer science	INF07-GEST
Number of hours : 16.00 h	0.50 ECTS credit
CM : 10.00 h, DIV : 4.00 h, TP : 2.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Project: Preliminary Study and Specifications	INF07-PROJ1
Number of hours : 45.00 h	3.50 ECTS credit
PR : 45.00 h	
Reference Teacher(s) : ANQUETIL ERIC	

Objectives :
The goal of the project is to initiate students to work in team (5-7 students / project) on a significant achievement (1500h / project). The project is tutored. The aim is to implement a number of methods of software engineering and project management as seen through the courses associated with this module (a course of 10 hours of project management is included in this module)._Essential educational objectives are:_Introduction to team work, use of methods and software engineering tools, time management, planning, communication, phases of analysis, specification, implementation and validation, technical Reading, Writing Technical Reports , Acquisition of presentation skills.

Content :
The first semester is devoted to the study of the scope and definition of the functional specifications of the software. It will conclude with an initial project planning. It will establish the roadmap : organization, distribution, and synchronization tasks, indicators, time-constraints, etc.

Bibliography :
* Peopleware, Productive projects and team. T. DeMarco et T. Lister. Dorset House Publishing Co. 1987.
* Cas pratiques de conduite de projets. P.T. Quang et J. Joskowicz. Eyrolles, 1993.

Requirements :
Project 2 follows in the second semester.

Organisation :
Students are expected to invest a great deal of time in this project.

Evaluation :
Towards the end of December, each project group hands in two reports containing the domain study and the functional analysis._A presentation is given at the end of the semester during which the essential report results are presented in front of a panel of three judges composed of the group's project manager (Teacher), report reviewer and another project supervisor.

Target :

English	INF07-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : RANNOU ISABELLE	

Objectives :
Contact: isabelle.rannou@insa-rennes.fr.
Acquiring the required skills for working in a firm as an engineer. Reaching the required level (B2) is compulsory in order to graduate.

Content :
-Learning by doing:
The student will have to be able to talk and listen, write documents while showing he/she can solve problems, reason, convince and demonstrate in an articulate manner.
-Expressing oneself accurately and fluently.
The student will engage in activities requiring creative and reactive skills (such as debates, role-plays, individual oral presentations using PowerPoint, projects), which will be based on scientific topics and current events.
-Writing CVs and cover letters
-Scientific English
-Discovering the professional world in an international context
-Preparing for the TOEIC (during the second semester, a specific ¿Toeic Booster¿ course will be available)

Bibliography :
- Robert and Collins Dictionary (bilingual edition), Collins Cobuild (English only)
- English Grammar in Use (Cambridge University Press)

Requirements :
1st, 2nd and 3rd year English courses (or equivalent)

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia language lab and computer rooms are also available and make it possible for the students to work in a stimulating environment. Our teaching resources include press articles, audio and video documents (TV reports, extracts from films and series). We also use the Internet.
Regular personal work is obviously required. The student must be curious and practise English outside the classroom as well.

Evaluation :
One two-hour written exam.

Target :

Economy and Business Management 1	INF07-ECOG
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course focuses on the complexity of the decision-making process in a company.

Main learning outcomes:
- Understanding information relative to marketing and finance
- The ability to use specific tools and vocabulary in the field of management
- Understanding the importance of teamwork: making collective decisions and producing the expected work in time

Content :
The course is mainly focused around a Business simulation game called Simbrand, which empowers participants to run their own virtual businesses. Just like in real life, the teams compete against each other in order to gain market shares. The right decisions lead to success while the wrong ones engender invaluable problem solving experiences. The learning process becomes efficient and fun, and allows ¿learning by doing¿ as well as ¿learning from mistakes¿.

As an outcome of the simulation exercise, participants will fully comprehend the different aspects of the marketing decision making process, their relationship with each other, and their impact on the company¿s overall results. In addition, participants will gain invaluable experience in teamwork and problem solving.

The simulation is based on an online platform that allows students to play in their own language (many languages available: English, Spanish, Portuguese, Chinese ¿).

Bibliography :
Provided during the course

Requirements :
None.

Organisation :
2 hours per week

Evaluation :
Each team produces a written report in French and makes an oral presentation in English

Target :

Sport and Physical Education	INF07-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : HINAULT YVAN	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O., kayak
or golf.

Bibliography :
Several specialized books are available to the students at the library. Links to internet sites are given on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Semestre 8

Parcours Formation Initiale INFO

1	**INF08-1**		**Software Engineering**	**6.50**
	INF08-VERIF	O	Formal Verification	3.00
	INF08-PROJ2	O	Project: Design and Implementation	2.00
	INF08-RESARCH	O	From Service Oriented Architectures to Networks	1.50
2	**INF08-2**		**Data and programming**	**6.50**
	INF08-ACQUI	O	Data-Based Knowledge Acquisition 2: Symbolic Methods	2.50
	INF08-CONTR	O	Constraint Programming	1.50
	INF08-COMPX	O	Complexity	2.00
	INF08-SICONF	O	Industrial conference S8	0.50
3	**INF08-3**		**Fundamentals of course**	**4.00**
	INF08-SYST2	C	Parallel Programming & advanced operating systems	2.50
	INF08-RES	C	Computer Networks	1.50
	INF08-DATA	C	Big Data and Applications	2.50
	INF08-OPT	C	Optimization	1.50
4	**INF-STAGE08**		**Work placement**	**8.00**
	INF08-STAGE	O	Summer Work Placement	8.00
5	**INF-HUM08**		**Humanities S8**	**5.00**
	INF08-ANGL	O	English	2.00
	INF08-ECOG	O	Economy and business Management 2 (Economic, legal and social issues)	2.00
	INF08-EPS	O	Sport and Physical Education	1.00
7	**HUMT2-SAM(3)**		**SAM : APES Responsabilités Associatives**	**3.00**
	HUMT2-APES RESP	F	Association membership & responsabilities 3 credits	3.00
8	**HUMT2-SAM(1)**		**"SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility)**	**1.00**
	HUMT2-APES	F	APES	1.00
9	**HUMT2-SAM(2)**		**SAM : APES Responsabilités Associatives**	**2.00**
	HUMT2-APES ASSO	F	Association membership & responsabilities 2 credits	2.00
11	**HUMT2-ELSA ES**		**High Level Sport with Studies / Sports Management MODULE**	**1.00**
	HUMT2-ES	F	High-Level sport with studies	1.00

O = compulsary, C= in choice , F= optional

Formal Verification	INF08-VERIF
Number of hours : 44.00 h	3.00 ECTS credit
CM : 22.00 h, TD : 22.00 h	
Reference Teacher(s) : DUCASSE MIREILLE	

Objectives :
It is difficult to picture software engineering without the use of formal methods. Software applications are becoming increasingly involved in activities with high levels of responsibility. With large-scale responsibilities including the global economy and human lives at stake, software applications must be flawless.

Formal methods require theoretical bases, which are hard to acquire through work-experience alone, therefore, their introduction is considered a fundamental feature of the computer science curriculum.

This module focuses on the B method developed by J.R. Abrial, which has numerous advantages. It is close to object-oriented programming. The theory behind it, although generous, is rather simple. It is based essentially on first-order logic and set theory. In critical software development, the B method has the advantage of being both state-of-the-art and already proven in practice, as seen at RATP, the major transport operator for the Paris area.

Content :
* Proof mechanisms: Review of clause logic. Predicate logic. Induction.
* Specification language: Generalised substitutions. Sets. Functions and relations. Abstract machines. Refinement.
* Programming language: Abstract machines. Refinement. Implementation. Importation.
* Case studies.

Bibliography :
* Assigning programs to meanings, the ""B"" Book, Jean-Raymond Abrial. Cambridge University Press, 1996.
* Introduction à la spécification, Henri Habrias. Masson éditeur, Collection ""Méthodologies du Logiciel,"" 1993.
* Introduction à la méthode
B. Support de cours, d'après des transparents de J.-R. Abrial. M. Ducassé, INSA de Rennes, mis à jour tous les ans.

Requirements :
First-order logic basic knowledge.

Organisation :
Organization : 22hours of lectures and 22h of class work sessions.

Two non-graded orals take place during the last two class work sessions. In small groups, students work on subjects taken from previous years' examinations, then they present their solutions to the class under the supervision of the teacher.

Personal work : Revision of lecture notes. Preparation of exercises for class work and orals.

Evaluation :
Three-hour written examination, at the end of the semester, without access to documentation except for the booklet collecting all the notations.

Target :

Project: Design and Implementation	INF08-PROJ2
Number of hours : 45.00 h	2.00 ECTS credit
PR : 45.00 h	
Reference Teacher(s) : ANQUETIL ERIC	

Objectives :
The goal of the project is to initiate students to work in team (5-7 students / project) on a significant achievement (1500h / project). The project is tutored. The aim is to implement a number of methods of software engineering and project management as seen through the courses associated with this module (a course of 10 hours of project management is included in this module)._Essential educational objectives are:_Introduction to team work, use of methods and software engineering tools, time management, planning, communication, phases of analysis, specification, implementation and validation, technical Reading, Writing Technical Reports , Acquisition of presentation skills.

Content :
The second semester is dedicated to the design, realisation, validation and delivery of the project. Students are given a three-week period, during which no other modules are taught, in order to facilitate the projects. The teacher assumes the role of project manager. Meetings between the project manager and the students take place every week.

Bibliography :
* Peopleware, Productive p rojects and team. T. DeMarco et T. Lister. Dorset House, Publishing Co. 1987.
* Cas pratiques de conduite de projets. P.T. Quang et J. Joskowicz. Eyrolles, 1993.

Requirements :
Project 1 (first semester).

Organisation :
During the second semester every student is assigned a list of tasks to accomplish._Task monitoring sheets must be filled in, enabling the project manager (Teacher) to oversee progress and establish objectives_on a weekly basis.

Evaluation :
Students deliver several reports: a report containing the applications design specifications and a global description of its implementation; online documentation of the application; a report containing the test phases, the user manual and the project management balance sheet; two HTML pages, one in French and the other in English, containing a global description of the project.
An oral presentation takes place at the end of the semester during which students outlay the results of their projects before a jury comprising the project manager (Teacher), a critic and an observer. The students are charged with demonstrating the operational functionality of the software including quality and validity of tests.

Target :

From Service Oriented Architectures to Networks	INF08-RESARCH
Number of hours : 24.00 h	1.50 ECTS credit
CM : 12.00 h, TP : 12.00 h	
Reference Teacher(s) : PAZAT JEAN-LOUIS	

Objectives :
Get basic understanding of Service Oriented Architectures and Web Services Get basic knowledge about computer networks

Content :
- Service Oriented Architectures
- Web services
- BPEL
- Remote Method Invocation: Java RMI
- Computer networks: OSI model, IP, UDP
- Application level protocols: TELNET, FTP, HTTP

Bibliography :
Service-Oriented Architecture (SOA): Concepts, Technology, and Design by Thomas Erl
Analyse Structurée Des Réseaux - Des Applications De L'internet Aux Infrastructures De Télécommunication, par James Kurose et Keith Ross

Requirements :
Basic knowledge of Operating Systems

Organisation :
read lessons

Evaluation :
1 written examination (2hours)

Target :

Data-Based Knowledge Acquisition 2: Symbolic Methods	INF08-ACQUI
Number of hours : 36.00 h	2.50 ECTS credit
CM : 22.00 h, TD : 2.00 h, TP : 12.00 h	
Reference Teacher(s) : SEBILLOT PASCALE	

Objectives :
In the 3rd year, the module Data-Based Knowledge Acquisition 1 focuses on machine learning methods based on numeric
clues. In complement, the present course unit aims at presenting and using supervised and unsupervised symbolic machine
learning techniques, and at applying them to non structured data (especially textual ones). The aim is both to provide the
students with a set of techniques able to make knowledge emerge from data, and to give them fundamental elements to be able
to choose one machine learning method according to data quality and applicative goals, and to correctly evaluate the learning.

Content :
1) Supervised symbolic machine learning
- inductive logic programming
- grammatical inference
- decision trees
This part of the course presents the following concepts: characteristics of data, noise, classifier, and evaluation
2) Unsupervised symbolic machine learning
- association rules
- multidimensional data mining
- formal and logical concept analysis
Key points here are lattices, ordered sets, and formal concepts
3) Application to non structured data
- textual information retrieval: basic and advanced methods, search engines, etc.

Bibliography :
- A. Cornuéjols, L. Miclet. Apprentissage artificiel. Eyrolles. 2002
- B. Ganter, G. Stumme, R. Wille. Formal Concept Analysis. Springer. 2005
- J. Han, M. Kamber. Data Mining. Academic Press. 2001

Requirements :
The 3rd year Data-Based Knowledge Acquisition 1 course unit, or at least, knowledge about statistical machine learning
techniques; notions of set theory

Organisation :
Deepening of the courses; preparation of practical work; realization of final practical work and presentation of a synthesis

Evaluation :
A two-hour written examination at the end of the semester, and practical work

Target :

Constraint Programming	INF08-CONTR
Number of hours : 26.00 h	1.50 ECTS credit
CM : 10.00 h, TP : 16.00 h	
Reference Teacher(s) : DUCASSE MIREILLE	

Objectives :
Many difficult problems of everyday life are known as "constraint problems", for example timetable making or resource allocation. These problems are highly combinatorial. To automate their resolution one should use appropriate tools. Indeed, programming with traditional languages requires the programmer to manage an important complexity. Programming is difficult, the response time and the needed computational resources quickly become unbearable.

Constraint programming uses constraint solvers. The solvers support a large part of the complexity of the problems. However, their use is difficult, it requires a good knowledge base and specific expertise. This module lays the first foundations for constraint programming in the context of logic programming.

Content :
* Introduction to Constraints
* From Prolog to Constraints
* Finite Constraint Domains
* Programming with Finite Domain Constraints
* Examples of Applications

Bibliography :
* Programming with constraints. An introduction, Kim Marriott and Peter J. Stuckey, MIT Press, 1998. Programmation
* Constraint logic programming using ECLiPSe, Krysztof R. Apt and Mark G. Wallace, Cambridge University Press, 2007
* Constraint (Logic) Programming, Mireille Ducassé, Lecture and Labs Hands-out, updated every year.

Requirements :
Practical experience of Prolog programming.

Organisation :
Organization : 10h of lecture, 16h of labs.

The lecture hands-out are in English. The ECLiPSe-Prolog environment is used for the labs.

Personal work : Revision of lecture notes. Preparation of labs (two hours per week).

Evaluation :
Two-hour written examination at the end of the semester, without access to documentation except an A4 hand-written sheet.

Target :

Complexity	INF08-COMPX
Number of hours : 28.00 h	2.00 ECTS credit
CM : 8.00 h, TD : 20.00 h	
Reference Teacher(s) : MARCHAL MAUD	

Objectives :
* Introducing the concepts of algorithms complexity.
* The exact or approximate resolution of linear or simple nonlinear recurrence in order to calculate time complexity.
* Understanding Complexity classes.

Content :
* Resolution of linear recurrence relations using the characteristic equation method.
* Generator series to solve nonlinear recurrence equations (e.g. Quicksort).
* Recurrence involving several suites (mutual recursion). Recurrence with several parameters (example of the kth smallest
element).
* Divide and conquer. Dynamic programming. Heuristic pruning. Accurate and appproximate greedy algorithms.
* Metaheuristics.
* Complexity classes.

Bibliography :
Introduction à l'analyse des algorithms, Robert Sedgewick et Philippe Flajolet, International Thomson Publishing France,1996.
Concrete Mathematics, Ronald L. Graham, Donald E. Knuth, Oren Patashnik, Addison-Wesley Publishing Company ,1990.

Requirements :
Basic understanding of algorithms.

Organisation :
Revision of class notes (two hours per week).

Evaluation :
two-hour written examination with documents at the end of the semester.

Target :

Industrial conference S8	INF08-SICONF
Number of hours : 40.00 h	0.50 ECTS credit
CM : 12.00 h, CONF : 12.00 h	
Reference Teacher(s) : COUASNON BERTRAND	

Objectives :
The purpose of this module is to complete the curriculum by knowledge, practices, industrial problems not seen in other modules. It gives students a better knowledge of business world, its internal and external ecosystem, professions. It is also a way to build links between students and companies.

Content :
The "stage dating" allows students to have several short interviews of 10mn with different companies.

Conferences are done by industrial contributors, on different subjects like:
- Computer science in the financial world
- Startup creation
- Conception user-oriented
- Introduction to Corporate Information Systems
- Complex projects management
- Continuous integration

Conferences can be 2 hours long, several modules of 2 hours or organized on a whole day.

Bibliography :

Requirements :

Organisation :
A group of student volunteers, with the teacher in charge of the module, define and organize the different conferences.

Evaluation :
Validation on the presence of the student

Target :

Parallel Programming & advanced operating systems	INF08-SYST2
Number of hours : 48.00 h	2.50 ECTS credit
CM : 24.00 h, TP : 24.00 h	
Reference Teacher(s) : PAZAT JEAN-LOUIS	

Objectives :
Understand and practice of parallel programming. Get knowledge on advanced features of modern operating systems and Clouds.

Content :
Parallel Programming :
* Introduction to parallelism: Hardware and Software
* Programming with Threads: P_Threads
* High Level Synchronization tools
* Design Principles for Parallel Programming in Java
* Distributed Programming : Communicating Processes, MPI

Advanced Operating Systems:
* Distributed File Systems
* Memory management
* Deadlock detection and avoidance
* Virtualization, Hypervisors
* Clouds

Bibliography :
Parallel Programming: for Multicore and Cluster Systems. Thomas Rauber, Gudula Rünger . 1998.
ISBN 978-3-642-04817-3.

Using MPI: Portable Parallel Programming with the Message-Passing Interface. William Gropp, Ewing Lusk, and Anthony Skjellum. 1999 by MIT Press
ISBN: 9780262571326.

Using MPI-2, by William Gropp, Ewing Lusk, and Rajeev Thakur, MIT Press, 1999;
ISBN 0-262-57133-1.

Concurrent Programming in Java(TM): Design Principles and Pattern (2nd Edition) Doug Lea. 1999.
ISBN 978-0201310092

Modern operating systems. Andrew S. Tanenbaum 3rd edition. 2007. ISBN 978-0136006633

Requirements :
Basic knowledge of operating systems, Mastering C and Java programming

Organisation :
Lectures and practical works

Evaluation :
2 written examination (2 hours)

Target :
4th years students in computer science (master level course). ¿LSR¿

Computer Networks	INF08-RES
Number of hours : 26.00 h	1.50 ECTS credit
CM : 14.00 h, TD : 4.00 h, TP : 8.00 h	
Reference Teacher(s) : UZEL FABIENNE	

Objectives :
Understanding the fundamentals of computer networks: transmission errors correction, stream check, addressing and naming
process, routing.

Content :
* Primary notions: transmission devices properties, layer model.
* X25: study of the physical and link level.
* Data link layer protocols: Ethernet, WiFi.
* TCP/IP: Addressing. ARP. TCP. UDP. Higher level protocols.
* Naming: DNS. Messaging. FTP, HTTP, URL. MIB. ASN1. LDAP.
* Routing: Static routing. Internal router. RIP. Routing for mobile devices.
* IPv6: IPv4 limitations. Address management. ICMPv6. Auto-configuration.

Bibliography :
Tanenbaum : Computer Networks
Comer : Internetworking with TCP/IP
Stevens : TCP/IP Illustrated Vol 2 and 3 - Addison-Wesley
Huitema : Routing in the Internet
Hagen : IPv6 Essentials - O'Reilly
Camillerapp : Réseaux - Notes de cours, polycopié INSA

Requirements :
General knowledge of computer science.

Organisation :
Revision of lecture notes. Preparation of exercises. Practical work.

Evaluation :
Three-hour written examination based on the content of both lectures and practical work (with access to documentation).

Target :

Big Data and Applications	INF08-DATA
Number of hours : 52.00 h	2.50 ECTS credit
CM : 24.00 h, TD : 8.00 h, TP : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Optimization	INF08-OPT
Number of hours : 26.00 h	1.50 ECTS credit
CM : 14.00 h, TD : 12.00 h	
Reference Teacher(s) : HADDOU MOUNIR	

Objectives :
Overview of the problems and methods related to optimisation. Focus on continuous optimization. Introduction to Linear integer programming.

Content :
* Introduction and examples, Linear programming.
* Unconstrained optimisation: Optimality conditions. Gradient method. Nexton method.
* Constrained optimization: Optimality conditions. Feasible methods. Penalty methods.
* Introduction to Linear Integer programming.
* "Branch and bound" algorithms. Lagrangian relaxation methods.

Bibliography :
"Programmation mathématique" - M. MINOUX
"Méthodes d'optimisation combinatoire"
- A. GERMA, O. HUDRY
"Optimisation numérique. Aspects théoriques et pratiques" - J.F. BONNANS, J.C. GILBERT, C. LEMARECHAL, C.
SAGASTIZABAL

Requirements :
Basics of analysis and linear algebra.

Organisation :
20h.

Evaluation :
Two-hour examination at the end of the semester.

Target :

Summer Work Placement	INF08-STAGE
Number of hours : 240.00 h	8.00 ECTS credit
ES : 240.00 h	
Reference Teacher(s) : RICQUEBOURG YANN	

Objectives :
Work-placements take place in companies or in research laboratories for a period of three months. For many students this
represents their first job experience. The placement is carried out on an individual basis and many students see it as the first
opportunity to assess their capacities in a job directly related to their field of studies. Students must write a report on the
placement.

Content :
Examples of previous placement subjects:
* Models for 4D imaging: Life science application in cellular biology.
* Design of a search engine in PHP on MySQL.
* Computerisation of geographic data.
* Improvement of cardiac simulation software.
* CVnet: Human resources management.
* Development of an encryption module using public and private keys.
* Integration of a media synchronisation tool on a videoconferencing platform.
* PC cluster administration tools.
* Achievement of an interactive application for digital television.
* Study and development of a tool for statistical analysis of subscribers in a management system.
* Extension of GCC compiler for code optimisation.
* Creation of software application for security analysis of the bank's computer system.
* Exploitation of test results on a software application to help the air traffic control

Bibliography :

Requirements :
Students must draw upon their experience of two years specialising in computer science.
Note: The internship usually takes place upon completion of the second year of specialisation and occasionally after one year
specialising in computer science.

Organisation :
The student integrates the company on a full-time basis.
Updates to internship report while working at the company leading to finished report.

Evaluation :
Mark awarded by the internship supervisor for work accomplished.
Mark for written report.

Target :

English	INF08-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : RANNOU ISABELLE	

Objectives :
Contact : isabelle.rannou@insa-rennes.fr.
Acquiring the required skills for working in a firm as an engineer. Reaching the required level (B2) is compulsory in order to graduate.

Content :
-Learning by doing:
The student will have to be able to talk and listen, write documents while showing he/she can solve problems, reason, convince and demonstrate in an articulate manner.
-Expressing oneself accurately and fluently.
The student will engage in activities requiring creative and reactive skills (such as debates, role-plays, individual oral presentations using PowerPoint, projects), which will be based on scientific topics and current events.
-Writing CVs and cover letters
-Scientific English
-Discovering the professional world in an international context
-Preparing for the TOEIC (during the second semester, a specific ¿Toeic Booster¿ course will be available)

Bibliography :
- Robert and Collins Dictionary (bilingual edition), Collins Cobuild (English only)
- English Grammar in Use (Cambridge University Press)

Requirements :
1st, 2nd and 3rd year English courses (or equivalent)

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia language lab and computer rooms are also available and make it possible for the students to work in a stimulating environment. Our teaching resources include press articles, audio and video documents (TV reports, extracts from films and series). We also use the Internet.
Regular personal work is obviously required. The student must be curious and practise English outside the classroom as well.

Evaluation :
TOEIC test (end of semester)
An individual oral presentation

Target :

Economy and business Management 2 (Economic, legal and social issues)	INF08-ECOG
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course focuses on economic, legal and social matters. Students are encouraged to develop their curiosity and their ability to analyse topics related to the general environment of a company.

Main learning outcomes:
- Understanding key concepts related to a firm¿s environment and strategies

- The accumulation of high-quality information on these topics
- Establishing a strong, specific- vocabulary base
- Understanding how different stakeholders act

Content :
- Economics: How markets operate. Growth, financing and regulation of the economy
- Law: Corporate law. Industrial and intellectual property rights
- Management: Project management. Corporate social responsibility

Bibliography :
Provided during the course

Requirements :
None.

Organisation :
2 hours per week

Evaluation :
Continuous assessment (collective work) + final examination (2 hours)

Target :

Sport and Physical Education	INF08-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : HINAULT YVAN	

Objectives :
Team work. Discovery of one's capabilities. Communication. Invention. Autonomy. Self-discovery and Management
responsibilities.

Content :
Whole class: "role of the coach, role of the referee, management" (knowledge of the rules, getting involved, leading, decision
making and communicating). Practice and knowledge of the sociomotive roles involved in the strategies of team attack and
team defence. Finding one's place in a group and awareness of your team-mates and their responsibilities.
Organisation: two 15-hour and one 30-hour sports or physical activity programme in groups.

Bibliography :
Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Association membership & responsabilities 3 credits	HUMT2-APES RESP
Number of hours : 20.00 h	3.00 ECTS credit
DIV : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

APES	HUMT2-APES
Number of hours : 30.00 h	1.00 ECTS credit
DIV : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Association membership & responsabilities 2 credits	HUMT2-APES ASSO
Number of hours : 14.00 h	2.00 ECTS credit
DIV : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

High-Level sport with studies	HUMT2-ES
Number of hours : 6.00 h	1.00 ECTS credit
CM : 6.00 h	
Reference Teacher(s) : VAILLANT GERARD	

Objectives :
Students must set out and structure a personal project to establish the best possible coherence between engineering studies at
INSA and a career as a high-level athlete. Acquisition of specific knowledge and know-how.

Content :
- Lessons and conferences on the tools of project management.
- Guided work on project building (personal career).
- Stress management. Relaxation therapy. Action type profiling. Mental preparation. Athletic traumatology. Motivation.
Dietetics. Physical preparation.
Organisation : Lessons, and evening conferences.

Bibliography :
Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education website.

Requirements :

Organisation :

Evaluation :
Production of a personal-career dossier. Oral presentation (30 minutes).
The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :
Maximum 4 semestrial registrations throughout the whole cursus.

Semestre 9

Parcours Master Recherche Informatique

2	INF-HUM09		Humanities S9	5.50
	HUMT1-ANGL/CONV	C	English S9 Conversation	1.50
	HUMT1-ANGL/TOEIC	C	TOEIC 5th year	1.50
	HUMT1-PGE-A	C	Economics, Law and Business Studies A (serious game)	2.00
	HUMT1-PGE-B	C	Economics, Law and Business Studies B (Lean six sigma)	2.00
	HUMT1-PGE-C	C	Economics, Law and Business Studies C (human resource management)	2.00
	HUMT1-PGE-D	C	Economics, Law and Business Studies D (Marketing for ICT Companies)	2.00
	HUMT1-PGE-E	C	Economics, Law and Business Studies E (Industrial design and innovation)	2.00
	HUMT1-PGE-F	C	Economics, Law and Business Studies F (Mangement and decision making)	2.00
	INF09-DROIT	C	Legal Training for Engineers	2.00
	INF09-COLQ	C	Colloquium	2.00

O = compulsary, C= in choice , F= optional

English S9 Conversation	HUMT1-ANGL/CONV
Number of hours : 10.00 h	1.50 ECTS credit
TD : 10.00 h	
Reference Teacher(s) : LE TINNIER ANNE	

Objectives :
- Improving communication skills in everyday life situations as well as in a professional or social context.
- Obtaining or reinforcing C1 level, strongly advised/recommended by the CTI. t.

Content :
- Learning by doing: students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
- Expressing oneself accurately and fluently: students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
1. English Grammar in Use (Cambridge University Press)
2. Dictionnaire Collins Cobuild
3. Polycopié de l' INSA

Requirements :
Having taken and passed the TOEIC test during the previous two years (800 required)
or any other B2 certification recognized by the CTI.

Organisation :
- Each class lasts one hour and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
- Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet.

Evaluation :
Continuous assessment: The final mark (out of 20) will be based on the attendance rate and the personal implication of the student during the class.

Target :

TOEIC 5th year	HUMT1-ANGL/TOEIC
Number of hours : 20.00 h	1.50 ECTS credit
TD : 20.00 h	
Reference Teacher(s) : LE VOT PHILIPPE	

Objectives :
- Improving communication skills in everyday life situations as well as in company and business context.
- Obtaining or reinforcing the B2 level requested by the CTI.
- Obtaining 800 score at the final TOEIC test.

Content :
Learning by doing : students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
Expressing oneself accurately and fluently : students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
- English grammar in Use, Intermediate Edition (CUP)
- Robert and Collins bilingual dictionary or Collins Cobuild

Requirements :
Not having already taken and passed the TOEIC test during the previous two years
B1/B2 level advised

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet. B2 level tests are also taken throughout the course.

Evaluation :
Final mark based on :
TOEIC score at final exam + attendance (more than 4 non justified absences result in 0/20 mark).

Target :
5th year students who haven't already passed their TOEIC

Economics, Law and Business Studies A (serious game)	HUMT1-PGE-A
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
-Establishing a strong, specific vocabulary base
-Understanding the main issues that industrial companies deal with (in a specific management field).
-Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Business Simulation (serious game) (24h / in English)
The business simulation ¿Global Challenge¿ (a CESIM product) has been designed to improve the understanding and knowledge of the complexity of global business operations in a dynamic, competitive environment. It focuses on strategic management, international management and business policy.
The task for the student teams is to manage a global mobile telecommunications company through technological and market evolution. Students will develop and execute strategies for their simulated company operating in the USA, Asia, and Europe.
The simulation is based on an online platform that allows students to play in their own language (many languages available: English, Spanish, Portuguese, Chinese,¿).

* Law (8h / in French)
Main principles of the French legal system

* Patents (4h / in French)

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies B (Lean six sigma)	HUMT1-PGE-B
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Lean Six Sigma (28h / in French)
Lean Six Sigma is a methodology that enables firms to make their processes more effective and efficient. It¿s the current industry standard for process improvement designed to reduce waste and enhance output quality.

* Law (8h / in French)
Main principles of the French legal system

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies C (human resource management)	HUMT1-PGE-C
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field)
- Understanding the importance of teamwork: making collective decisions and producing the expected work in time

Content :
* Human Resource Management (20h / in French)
    - Main current challenges of Human Resource Management
    - Human Resource Management¿s tools and organization
    - Focus on how team managers deal with Human Resource Management

* Law (8h / in French)
    Main principles of the French legal system

* Social legislation (8h / in French)

* Main principles of French social legislation

* Employment contract

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies D (Marketing for ICT Companies)	HUMT1-PGE-D
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This module is designed to equip students with the knowledge and analytical techniques required for effective strategic marketing management in ICT companies. Through this course, students are faced with a real case study provided by a marketing director of an international ICT company. Students are placed in a decision-making situation and should emerge with a 3 years strategic program.

ICT : Information and Communications Technology

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies E (Industrial design and innovation)	HUMT1-PGE-E
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time.

Content :
The program¿s main objective is to provide a multidisciplinary approach to the field of innovation, strategy and industrial design. This course will give an overview of the innovative process.
During this program, participants will have the opportunity to explore a business case covering the first stage of a product development project.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advice to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies F (Mangement and decision making)	HUMT1-PGE-F
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This course is about how to improve decision making as a future manager.
In addition to calling for academic insights and existing literature, this module provides practical improvement strategies to avoid costly decision making errors.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Legal Training for Engineers	INF09-DROIT
Number of hours : 14.00 h	2.00 ECTS credit
CM : 14.00 h	
Reference Teacher(s) :	

Objectives :
To give to final-year engineers, whether or not in project manager positions, the key legal concepts for understanding the protection of intellectual creations and software, the contractual mechanisms for producing software content, and the terms of software licenses.

Content :
5 independent modules CM1 to CM5

CM1: COMPUTER CREATIONS AND ACTORS

CM 2: GENERIC CONTRACTUAL STRUCTURES AND RESPONSIBILITIES

CM 3: SPECIFIC CONTRACTUAL STRUCTURES

CM 4: SOFTWARE LICENSES (INCLUDING GPL)

CM 5: CREATION AND ADMINISTRATION OF WEB SITES

Bibliography :
On the internet : http://www.legalis.net/

Books : Informatique, T_I_coms, Internet - Ed Francis Lefebvre 2012

Requirements :
passing the introductory module to general law (8H Lectures)

Organisation :
Lectures (7 x 2H)

Evaluation :
final exam

Target :

Colloquium	INF09-COLQ
Number of hours : 23.00 h	2.00 ECTS credit
CM : 23.00 h	
Reference Teacher(s) :	

Objectives :
The objective of this course unit is for the student to make a first oral presentation of scientific research results in limited time (15 mn). This course unit is mandatory for all students of the MRI curriculum. The presentation describes the research results related to its internship subject. This exercice is made of three steps: mastering of presentation techniques, rehearsal with the master thesis supervisor, and effective presentation. The presentation is evaluated by a panel. The colloquium is opened to all institutions of the Matisse doctoral school.

Content :
* Knowledge of presentation preparation software
* Knowledge of oral presentation techniques
* Knowledge of the presented research topic
* Ability to make a presentation in front of public
* Ability to make a clear and synthetic presentation of research works
* Ability to organize and give a presentation in limited time

Bibliography :

Requirements :

Organisation :

Evaluation :
A grade is attributed according to precise criterion regarding both the scientific contents and the form of the presentation.

Target :

Semestre 9

Parcours Média & Networks

1	**M&N09-SEIR**		**Systèmes embarqués - Images- Réseaux**	**18.50**
	EII09-DSP	C	Digital Signal Processor	2.00
	EII09-MDSP	C	Multicore Digital Signal ProcessingMulticore Digital Signal Processing Multicore Digital Signal Processing	3.00
	EII09-COAV	C	Advanced Design Methods	1.00
	SRC09-MOCNSYSC	C	Introduction to SystemC	1.50
	SRC09-TCSN-EMB	C	Introduction to Embedded Systems	1.00
	SRC09-TCSNREAL	C	Real Time Processing	1.50
	SRC09-MOCNPROJ	C	Digital Design Project	1.50
	EII09-CIV	C	Image and Video Compression	2.50
	EII09-VO	C	Computer Vision	2.00
	INF09-OPIRF	C	Image Processing and Pattern Recognition	3.00
	INF09-OPMIV	C	Modeling and Engineering for Biology and Health	3.00
	SRC09-TCRCBASE	C	Communication Networks basics	1.50
	SRC09-PRCNUM	C	Digital communications pre-requisite	1.50
	SRC09-MOCRIP	C	Advanced IP Networks	2.50
	SRC09-MOCRPROJ	C	Projet Tutoré	1.50
	SRC09-MOCRIWIRELESS	C	Wireless Networks	1.50
2	**M&N09-Projet**		**Projet technologique**	**8.00**
	M&N09-PROJ	O	Technical project	8.00
3	**M&N09-HUMAS**		**HUMANITES - M&N**	**3.50**
	HUMT1-ANGL/CONV	C	English S9 Conversation	1.50
	HUMT1-ANGL/TOEIC	C	TOEIC 5th year	1.50
	HUMT1-PGE-A	C	Economics, Law and Business Studies A (serious game)	2.00
	HUMT1-PGE-B	C	Economics, Law and Business Studies B (Lean six sigma)	2.00
	HUMT1-PGE-C	C	Economics, Law and Business Studies C (human resource management)	2.00
	HUMT1-PGE-D	C	Economics, Law and Business Studies D (Marketing for ICT Companies)	2.00
	HUMT1-PGE-E	C	Economics, Law and Business Studies E (Industrial design and innovation)	2.00
	HUMT1-PGE-F	C	Economics, Law and Business Studies F (Mangement and decision making)	2.00

O = compulsary, C= in choice , F= optional

Digital Signal Processor	EII09-DSP
Number of hours : 28.00 h	2.00 ECTS credit
CM : 10.00 h, TA : 4.00 h, TP : 14.00 h	
Reference Teacher(s) : MENARD DANIEL	

Objectives :
Implement digital signal processing applications on fixed-point DSP

Targeted main competences are:
- Fixed-point conversion of digital signal processing systems
- Develop C code for fixed-point DSP

Content :
- Fixed-point arithmetic
- Fixed-point conversion (dynamic range evaluation, fixed-point coding, numerical accuracy evaluation)

Bibliography :
[1] MADISETTI V., "VLSI Digital Signal Processors", IEEE Press, 1995;
[2] LAPSLEY P. & al., "DSP Processor Fondamentals", IEEE Press, 1995;
[3] BAUDOUIN G. & VIROLLEAU F., "DSP : les processeurs de traitement du signal", Dunod, 1996.

Requirements :
EII07-II1 : Computer Architecture II ;
EII07-A2 : Signal Processing II

Organisation :
- pedagogy based on project.

Evaluation :
- Attendance at lectures and project sessions

Target :
5EII

Multicore Digital Signal ProcessingMulticore Digital Signal Processing Multicore Digital Signal Processing	EII09-MDSP
Number of hours : 30.00 h	3.00 ECTS credit
CM : 8.00 h, PR : 16.00 h, TP : 6.00 h	
Reference Teacher(s) :	

Objectives :
Systems implementing modern Digital Signal Processing (DSP) applications such as telecommunication standard 3GPP Long Term Evolution (LTE) and video compression standard MPEG High Efficiency Video Coding (HEVC) require high execution speed, low power consumption and run-time adaptivity.

To meet these requirements, high performance Systems-on-Chip for DSP such as the 8-core Texas Instruments TMS320TCI6678 or the 256-core Kalray MPPA combine multiple signal processing oriented cores.

Adaptivity, memory limitation and load balancing between cores are hard to obtain. This course intends to give an overview of distributed high performance DSP solutions and of the new challenges brought by latest applications and architectures. Solutions for programming such architectures will be discussed. The focus of the course will be put on software-based solutions using dataflow Models of Computation.

Targeted competences are:
- To program multicore DSPs while understanding their internal mechanisms
- To choose a multicore programming method while understanding its limitations
- To design a high performance digital processing system using available resources efficiently

Content :
- High Performance DSP Applications
- Models of Computation
- Multicore DSP Architectures
- Architecture Models
- Assignment and Ordering Problem
- Multicore Programming Tools

Bibliography :
J Karam, I. AlKamal, A. Gatherer, G. A Frantz, D. V Anderson, and B. L Evans, "Trends in multicore DSP platforms, IEEE SPM, 2009
Hae-woo Park, Hyunok Oh, and Soonhoi Ha, "Multiprocessor SoC Design Methods and Tools", IEEE SPM, 2009
S. Sriram, S. S. Bhattacharyya, "Embedded Multiprocessors : Scheduling and Synchronization - Second Edition", CRC Press, 2009
M. Pelcat, S. Aridhi, J. Piat, J-F. Nezan, "Physical Layer Multicore Prototyping: A Dataflow-Based Approach for LTE eNodeB", Springer, 2012

Requirements :
Computer Architecture I & II (EII06-II2, EII07-II1), C Language (TCM05-INFOC), Digital Signal Processing (EII09-DSP)

Organisation :
- Courses given by internal and external professors
- Practical work and project are based on the dataflow-based programming of the TMDSEVM6678L evaluation board
- The goal of practical work is for students to acquire competences for programming the platform
- The project aims at giving students some programming habits

Evaluation :
Project grading.

Target :
5EII

Advanced Design Methods	EII09-COAV
Number of hours : 22.00 h	1.00 ECTS credit
CM : 6.00 h, PR : 8.00 h, TA : 8.00 h	
Reference Teacher(s) : MENARD DANIEL	

Objectives :
- Advanced hardware design method for complex digital systems
- Study and implementation of a complete design flow, from high-level description to hardware implementation

Targeted main competences are:
- To use efficiently available resources to design a digital system (documentation, internet, supervisor)

Content :
- Advanced synthesizable VHDL, design re-use, hardware IP blocks
- Tests and validation: verification methodology, automatic verification, testbed implementation
- Development software presentation of Mentor Graphics (HDL Designer, Leonardo Spectrum, Modelsim, RTL Precision)
- Project: design, implementation and test of a data transmission system under the HDL Designer environment

Bibliography :
- ZWOLINSKI M., "Digital System Design with VHDL", Prentice Hall, 2000
- SCHNEIDER T., "VHDL - Méthodologie de design et techniques avancées", Dunod, 2001

Requirements :
- VHDL Programming (EII08-II3)
- Programmable Logic (EII07-E3)
- Methodology and Project Management (EII07-PROJ2)

Organisation :
- Active pédagogy
- Revision of lecture notes
- Preparation for project

Evaluation :
- Attendance at lectures and project sessions
- The project report

Target :
5EII, M&N

Introduction to SystemC	SRC09-MOCNSYSC
Number of hours : 14.00 h	1.50 ECTS credit
CM : 8.00 h, TP : 6.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
This lecture aims at presenting the System Design languages (SystemC) for complex system designing. Special emphasis will be given on modelling across different levels of abstraction from untimed via timed transaction level models down to register transfer models including the needed refinement steps.

Content :
1. Requirements for a system methodology in order to design a system. Overview of existing methodologies
2. Presentation of the System C language syntax. :
   -Programming environment.
   -Concepts of module, port, channel, interface.
   Channels, ports, interfaces, Module constructor
   Events, Event queue
   Thread processes, Method processes
   Module instantiation (in modules)
3. Simulation of complex systems with System C.
4. Labs on a transmission system. Simulation of the system and implementation on an embedded SOC.

Bibliography :

Requirements :

Organisation :

Evaluation :
1 hour exam

Target :

Introduction to Embedded Systems	SRC09-TCSN-EMB
Number of hours : 10.00 h	1.00 ECTS credit
CM : 4.00 h, TP : 6.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
Introduction to embedded systems (technology, management, hardware/software co-design). Case study on a SOPC platform (Altera FPGA).

Content :
Technology of embedded systems: ASIC, FPGA, Study of different reconfigurable circuits (Xilinx, Altera, ...). Introduction to rapid prototyping tools from system to physical level.

Bibliography :

Requirements :
SRC07-LPROG

Organisation :

Evaluation :
Practical training session

Target :

Real Time Processing	SRC09-TCSNREAL
Number of hours : 16.00 h	1.50 ECTS credit
CM : 10.00 h, TP : 6.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
Study of real time operating systems and application examples.

Content :
Various fields of applications, embedded systems, kernel architecture, Kernel services (tasks, synchronizations, communications), multi-processes/multi-processors programming, scheduling policies, memory management.

Applications: embedded systems for signal processing (telecommunication, image / video) in automotive, avionics, etc. ....
Systems with strong real time constraints, system management / supervision.

Practical work on MicroC-OSII.

Bibliography :

Requirements :

Organisation :

Evaluation :
2 hours exam

Target :

Digital Design Project	SRC09-MOCNPROJ
Number of hours : 24.00 h	1.50 ECTS credit
TP : 24.00 h	
Reference Teacher(s) :	

Objectives :
The role of this project is to apply all the concepts of Digital Design on a real application.

Content :
This 24 hours project aims to implement all the concepts learned in the SRC09-MOCNVHD and SRC09-SYSC module.
It starts with a SystemC modeling of a complex digital communication circuit (software and hardware blocks) for system simulation and platform sizing.
It ends up with the implementation of the circuit onto a real FPGA platform composed of software and hardware parts.

Bibliography :

Requirements :
SRC09-MOCNVHD and SRC09-SYSC

Organisation :

Evaluation :
Project evaluation

Target :

Image and Video Compression	EII09-CIV
Number of hours : 32.00 h	2.50 ECTS credit
CM : 10.00 h, CONF : 6.00 h, TP : 16.00 h	
Reference Teacher(s) : MORIN LUCE, ZHANG LU	

Objectives :
This lecture aims at presenting fundamental and advanced methods dedicated
to image and video compression.

Targeted competences are:
-> To know image and video coding scheme through functionality analysis
-> To translate state-of-the-art algorithms into C or Matlab code

Content :
1. Introduction to image coding: PCM, DPCM, MIC, MICD, transform coding
2. Still image standards: JPEG, JPEG-LS, JPEG 2000, LAR
3. Video compression: motion estimation and compensation, standard video codecs: MPEG-2, MPEG-4, AVC, SVC, HEVC
4. Conferences by industrial partners ; conferences may vary each year
examples :
- Standardization, Pierrick Philippe, Orange Labs
- HEVC : High Efficiency Video Coding, The video coding standard for 2013 to 2030 , Félix Henry, Orange Labs
- Quality asssment for video coding, Jérome Fournier, Orange Labs

Bibliography :
[1] T. Ebrahimi, C. Christopoulos, "JPEG 2000 The next generation still image coding system", EUSIPCO'00, 2000
[2] Gregory K. Wallace, "The JPEG Still Picture Compression Standard" , IEEE Transactions on Consumer Electronics, Vol.38, No. 1, Février 1992
[3] Bernd Girod, "Image and Video Compression", lecture notes, Standford University, 2005
[4] Ian E Richardson, "H.264 and MPEG-4 Video Compression", John Wiley ed., 2003
[5] Vector Quantization and Signal Compression, Allen Gersho, Robert M. Gray, Springer, 1992

Requirements :
Signal Processing II (EII07-A2).
Image Processing (EII08-A3)
Statistical Signal Processing (EII09-TSS)

Organisation :
- Revision of lecture notes. Preparation of practical works.
- Labs with EIIMage and VCDemo softwares, implementation of coding algorithms in C language

Evaluation :
One-hour and half written examination (with documents).

Target :
Students in 5EII, M&N, master I-MARS

Computer Vision	EII09-VO
Number of hours : 35.00 h	2.00 ECTS credit
CM : 16.00 h, CONF : 3.00 h, TP : 16.00 h	
Reference Teacher(s) : PRESSIGOUT MURIEL	

Objectives :
This course is an introduction to computer vision techniques with a single camera or with several ones. Estimation processes used in computer vision are also studied.

The targeted skills are :
-> Solve a pose computation problem by using a Gauss-Newton minimization
-> Compute a depth map from stereoscopic images using the epipolar geometry properties
-> Estimate a 2D tranformation using a RANSAC algorithm
-> Solve a vision problem by determining the associated equations and use an existing software platform to implement the solution.

Content :
1. Monocular vision geometry (perspective projection, calibration and pose estimation)
2. Sterevision : 3D reconstruction, epipolar geometry, 2D homography, autocalibration

Pratical exercises are in C++ language.

Bibliography :
1. HORAUD R., MONGA O., ""Vision par ordinateur"", Hermès, 1993.
2. AYACHE N., ""Vision stéréoscopique et perception multi-sensorielle"", Inter-Ed. Science Info, 1988.
3. HARTLEY R., ZISSERMAN A., "Multiple View Geometry in Computer Vision", Second Edition, Cambridge University Press, March 2004.

Requirements :
Optimization (EII08-A3) and object oriented programming (EII08-II1).

Organisation :
Revision of lecture notes. Preparation of practical work.

Evaluation :
Two-hour written examination (no documents) at the end of the semester. Possible oral remedial examination at the end of the year.

Target :
5EII, Media and Networks semester

Image Processing and Pattern Recognition	INF09-OPIRF
Number of hours : 48.00 h	3.00 ECTS credit
TD : 48.00 h	
Reference Teacher(s) : RICQUEBOURG YANN	

Objectives :
Image Processing and Pattern Recognition is a largely studied domain of Computer Science with various applications. The lectures aims at giving a summary of this subject focused on the main line of recognizing symbols in images. Therefore, the main knowledge leading to this end are exposed: from early vision given by basic digital processing, via features extraction from images, to final recignnition performed by classifiers.

Content :
The documents are in English. The lecture may be in English or in French.
Part 1: Image processing

I. Basics of Digital Images
* What is a digital image? Human visual system
* Color, Histograms
* Pyramids and quad-trees
* Spectral representations
II. Image pre-processing
* Geometric transforms
* Noise reduction,
* Morphologic filters
Part 2: Features

I. Features Detection (locally, low level)
* Edges and Lines
* Keypoints and Corners
* Regions and Blobs
II. Features Extraction (globally or higher level)
* Properties of features
* Geometrical, Frequential, Scale-space Features
III. FEATURES SELECTION
* Distances, Selection
Part 3: Classification

I. Unsupervised Learning / Clustering
* C-Means, Fuzzy C-Means, Possibilistic C-Means
II. Supervised Learning
* First simple classifiers (k-Nearest-Neighbor...)
* Neural Networks
- MultiLayer Perceptron (MLP)
- Radial-Basis Function Neural Networks (RBFN)
* Evaluation: Reject option, Validation
- Fuzzy Inference System (FIS),
- Dynamic Time Warping (DTW),
- Hidden Markov Models (HMM),
- Support Vector Machine (SVM)
III. Improvement strategies
IV. Example of Pattern Recognition System

Bibliography :

Requirements :
None

Organisation :
Test some notions presented during the lectures, and search other notions just mentioned, to perform a solution for the practical
work.

Evaluation :
A practical work on a real-world data set is conducted in parallel of the lecture for the half of the time of the module. The
project tends to implement a complete recognition system, gathering 3 to 4 student groups competiting each other groups.
Results of each group is presented and evaluated at the end of this module.

Target :

Modeling and Engineering for Biology and Health	INF09-OPMIV
Number of hours : 48.00 h	3.00 ECTS credit
TD : 48.00 h	
Reference Teacher(s) : MARCHAL MAUD	

Objectives :
From gene to human body: Computer Science for Biology and Health applications Overview The course sets out to introduce an extensive range of computing facilities vital for Biology and Health Applications. Computer Science tools are naturally used for data storage or data management but also for data analysis. From gene to human body, biological and medical applications become more and more present in our everyday life. The course is composed of two parts:
* a first part is dedicated to bioinformatics and tries to answer to the following questions: what are the links between Biology and Computer
Science? How can algorithms answer to biological problems and inversely how can biological mechanisms answer to computer science problems?
* the second part deals with modeling and instruments developed for Health applications: what are the current instruments and models applied to human body? How to develop tools for Health domain?

Content :
Part 1: Genomic and Bioinformatics
* Genetic data modeling
* Biological sequences alignment
* Phylogenie and study of species evolution
* Genetic algorithms and data analysis
* Population genetics and association studies
Part 2: Models and Instruments for Health applications
* Medical image analysis
* Computer-assisted medical interventions
* Human body modeling and physical simulation (Biomechanical models, interactive simulators, etc)
* Brain-Computer Interactions
Course schedule:
* A new topic for each course
* Presentation-course (1h-2h), Practical exercises with applications to real data (2h-3h)

Bibliography :

Requirements :
Basic understanding of algorithms and skills in programming languages. No particular Biology and Physics expertise will be assumed.

Organisation :

Evaluation :
Assignment:
* Assignment on practical exercises for each course (50%)
* Small project (50%)

Target :

Communication Networks basics	SRC09-TCRCBASE
Number of hours : 26.00 h	1.50 ECTS credit
CM : 22.00 h, TP : 4.00 h	
Reference Teacher(s) : UZEL FABIENNE	

Objectives :
Acquisition of the fundamentals of networking through a description of the main techniques and their applications. Basic concepts of network security.

Content :
Telecommunication networks [6 HC]: Cellular Network: 3G, others (DCS 1800, CDMA). Architecture, radio interface protocol. Global satellite network type star, Eridium, INMARSAT.

Wired networks [12 HC]: IP / TCP / UDP / RIP X25/Frame Relay / ATM, ADSL / xDSL, PLC. Hybridization techniques and wireless communication.

Network security [4HC]

Bibliography :
Gilbert MARTINEAU, Laurent TOUTAIN, Alain LEROY, édition Hermes.
Wireless Ad Hoc and Sensor Networks, Raja Jurdak, Springer.

Requirements :
SRC08-FIBRES, SRC07-CNUM1,SRC08-CNUM2, SRC06-INFO, SRC08-RADIO

Organisation :

Evaluation :
2 hours exam

Target :

Digital communications pre-requisite	SRC09-PRCNUM
Number of hours : 24.00 h	1.50 ECTS credit
CM : 14.00 h	
Reference Teacher(s) : HELARD JEAN FRANCOIS	

Objectives :
To deal with the basis digital communication techniques as channel coding, multicarrier modulations and single carrier transmissions on limited bandwidth channel.

Content :
1. Model of a digital communication system
2. Basis channel coding techniques
Block codes and cyclic block codes. Codes construction. Decoding techniques. Performance and channel coding gain.
Convolutional codes. Representation and main principles. Decoding techniques. Performance and main applications.
3. Single carrier transmission over unlimited and limited bandwidth channels. Nyquist criterion. Equalization techniques.
4. Multicarrier modulations. Frequency and time selectivity of the radio-mobile channel. Multicarrier modulation principle (OFDM). Digital implementation of OFDM with Fast Fourier Transform Demodulation and performance. Applications to broadcast and telecommunication systems.

Bibliography :
M. Joindot, A. Glavieux, "Introductions aux communications numériques", Ed. Dunod,
S. Beneddeto, E. Biglieri, V. Castellani, "Digital transmission theory", Prentice Hall International Editions,
J. G. Proakis., "Digital communications", 6th Edition, Mc Graw-Hill Int. Editions, 2003,
C. Berrou, « Codes et turbocodes », collection IRIS, Springer,
K. Fazel, S. Kaiser, « Multi-Carrier and spread spectrum systems, Wiley.

Requirements :
Modules SRC05-PRER, SRC06-TSIA, SRC07-DESTI, SRC07-SINUM

Organisation :
Courses documents

Evaluation :
Un contrôle continu (Cours, Td, TP)
1 Devoir surveillé de 1 heure.

Target :

Advanced IP Networks	SRC09-MOCRIP
Number of hours : 24.00 h	2.50 ECTS credit
CM : 10.00 h, CM : 8.00 h, TD : 6.00 h	
Reference Teacher(s) : UZEL FABIENNE	

Objectives :
Extensions and new applications of high-speed networks, wireless, wired and embedded. Study of the routing mechanisms and quality of service.

Content :
IP techniques [10HC]: ipv4 to ipv6 Evolutions, ipv4 and ipv6 compatibility, quality of service. Routing inside and between networks (MPLS, BGP)

Wired networks [8HC, 6HTD]: VOIP, IPTV, routing, security VLAN, VPN

Bibliography :
Gilbert MARTINEAU, Laurent TOUTAIN, Alain LEROY, édition Hermes
Réseaux haut débit (2ème édition) (Coll. réseaux et télécommunications) [e-book] , ROLIN Pierre

Requirements :
SRC08-FIBRES, SRC07-CNUM1, SRC08-CNUM2, SRC09-TCRC

Organisation :

Evaluation :
2 hours exam

Target :

Projet Tutoré	SRC09-MOCRPROJ
Number of hours : 24.00 h	1.50 ECTS credit
TP : 24.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Wireless Networks	SRC09-MOCRIWIRELESS
Number of hours : 10.00 h	1.50 ECTS credit
CM : 6.00 h, TD : 4.00 h	
Reference Teacher(s) : EL ZEIN GHAIS	

Objectives :
Review of data wireless protocols, applications.

Content :
Wireless data networks overview: Wimax, 802.11, Bluetooth, ZigBee. Architecture of the networks, signalisation, data flow. Data and voice convergence. PHY , MAC and application layers.

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Technical project	M&N09-PROJ
Number of hours : 360.00 h	8.00 ECTS credit
PR : 50.00 h	
Reference Teacher(s) : MORIN LUCE	

Objectives :
-Manage a project within a team, on a technical topic proposed by an industrial partner.
-Collaborate with an industrial partner and take into account industrial requirements and organization.
-Apply technical and management skills acquired during academic courses.
-Practice report writing and oral presentation on technical topics.

Content :
1. Meet industrial partner and write project functional specifications.
2. Task scheduling and task repartition.
3. State of the art and bibliographic research.
4. Experimental development and validation ; regular meetings with project advisor.
5. Report writing, preparation of presentation slides.
6. Oral defense of the project.

Examples of project topics:
-Visual closed-loop control of an AR-Drone
-Audio bench test for mobile phones
-Calibration of a network of heterogeneous cameras
-Direct WI-FI remote control
-CPL transmission of video stream on an ETTUS card
-Optimization of a conversion of audio sampling rate library on ARM architecture
-RFID for electronic passport reading in multi-platform Windows/Linux environment
-Activity and physiologic parameters measurement with a Kinect sensor

Bibliography :

Requirements :

Organisation :
-Teams of 4 to 6 students, including a project leader
-Topics proposed by industrial partners and work at Insa research/teaching labs.
-Regular meetings with the project advisor (a professor).
-Autonomous work over the whole semester, with dedicated time shifts (6 hour/week)
-Free access to software and hardware to teaching and research labs, industrial partner might provide software/hardware if necessary for the project.

Evaluation :
The work realized by each group is subject to a written report and an oral presentation before an audience comprised of fellow students. The jury is composed of professors and industrial partners.
A final mark awarded based on the quality of the work, written report and oral presentation.

Target :
M&N students from 5EII/5SRC/5INFO

English S9 Conversation	HUMT1-ANGL/CONV
Number of hours : 10.00 h	1.50 ECTS credit
TD : 10.00 h	
Reference Teacher(s) : LE TINNIER ANNE	

Objectives :
- Improving communication skills in everyday life situations as well as in a professional or social context.
- Obtaining or reinforcing C1 level, strongly advised/recommended by the CTI. t.

Content :
- Learning by doing: students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
- Expressing oneself accurately and fluently: students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
1. English Grammar in Use (Cambridge University Press)
2. Dictionnaire Collins Cobuild
3. Polycopié de l' INSA

Requirements :
Having taken and passed the TOEIC test during the previous two years (800 required)
or any other B2 certification recognized by the CTI.

Organisation :
- Each class lasts one hour and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
- Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet.

Evaluation :
Continuous assessment: The final mark (out of 20) will be based on the attendance rate and the personal implication of the student during the class.

Target :

TOEIC 5th year	HUMT1-ANGL/TOEIC
Number of hours : 20.00 h	1.50 ECTS credit
TD : 20.00 h	
Reference Teacher(s) : LE VOT PHILIPPE	

Objectives :
- Improving communication skills in everyday life situations as well as in company and business context.
- Obtaining or reinforcing the B2 level requested by the CTI.
- Obtaining 800 score at the final TOEIC test.

Content :
Learning by doing : students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
Expressing oneself accurately and fluently : students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
- English grammar in Use, Intermediate Edition (CUP)
- Robert and Collins bilingual dictionary or Collins Cobuild

Requirements :
Not having already taken and passed the TOEIC test during the previous two years
B1/B2 level advised

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet. B2 level tests are also taken throughout the course.

Evaluation :
Final mark based on :
TOEIC score at final exam + attendance (more than 4 non justified absences result in 0/20 mark).

Target :
5th year students who haven't already passed their TOEIC

Economics, Law and Business Studies A (serious game)	HUMT1-PGE-A
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
-Establishing a strong, specific vocabulary base
-Understanding the main issues that industrial companies deal with (in a specific management field).
-Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Business Simulation (serious game) (24h / in English)
The business simulation ¿Global Challenge¿ (a CESIM product) has been designed to improve the understanding and knowledge of the complexity of global business operations in a dynamic, competitive environment. It focuses on strategic management, international management and business policy.
The task for the student teams is to manage a global mobile telecommunications company through technological and market evolution. Students will develop and execute strategies for their simulated company operating in the USA, Asia, and Europe.
The simulation is based on an online platform that allows students to play in their own language (many languages available: English, Spanish, Portuguese, Chinese,¿).

* Law (8h / in French)
Main principles of the French legal system

* Patents (4h / in French)

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies B (Lean six sigma)	HUMT1-PGE-B
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Lean Six Sigma (28h / in French)
Lean Six Sigma is a methodology that enables firms to make their processes more effective and efficient. It¿s the current industry standard for process improvement designed to reduce waste and enhance output quality.

* Law (8h / in French)
Main principles of the French legal system

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies C (human resource management)	HUMT1-PGE-C
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field)
- Understanding the importance of teamwork: making collective decisions and producing the expected work in time

Content :
* Human Resource Management (20h / in French)
    - Main current challenges of Human Resource Management
    - Human Resource Management¿s tools and organization
    - Focus on how team managers deal with Human Resource Management

* Law (8h / in French)
    Main principles of the French legal system

* Social legislation (8h / in French)

* Main principles of French social legislation

* Employment contract

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies D (Marketing for ICT Companies)	HUMT1-PGE-D
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This module is designed to equip students with the knowledge and analytical techniques required for effective strategic marketing management in ICT companies. Through this course, students are faced with a real case study provided by a marketing director of an international ICT company. Students are placed in a decision-making situation and should emerge with a 3 years strategic program.

ICT : Information and Communications Technology

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies E (Industrial design and innovation)	HUMT1-PGE-E
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time.

Content :
The program¿s main objective is to provide a multidisciplinary approach to the field of innovation, strategy and industrial design. This course will give an overview of the innovative process.
During this program, participants will have the opportunity to explore a business case covering the first stage of a product development project.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advice to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies F (Mangement and decision making)	HUMT1-PGE-F
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This course is about how to improve decision making as a future manager.
In addition to calling for academic insights and existing literature, this module provides practical improvement strategies to avoid costly decision making errors.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Semestre 9

Parcours Formation Initiale INFO

1	**INF09-1**		**Software Engineering**	**9.50**
	INF09-VVT	O	Software testing	4.00
	INF09-BDSIM	O	Advanced Databases and Modern Information Systems	4.00
	INF09-CP	O	Competitive programming	1.50
2	**INF09-2**		**projects and implementation**	**8.00**
	INF09-SFFS	O	From Know-How to let know	2.00
	INF09-CCU	O	User-Centered System Design	3.00
	INF09-OPCAO	C	Virtual Reality	3.00
	INF09-OPIA	C	Artificial Intelligence	3.00
3	**INF09-3**		**Fundamentals of course**	**7.00**
	INF09-CONF	O	Industrial conference S9	0.50
	INF09-OPMIV	C	Modeling and Engineering for Biology and Health	3.00
	INF09-OPIRF	C	Image Processing and Pattern Recognition	3.00
	INF09-MODEL	C	Modeling and scientific computing	1.50
	INF09-CRYPT	C	Cryptography	2.00
	INF09-COMP	C	Component-based software engineering	1.00
	INF09-AD	C	Distributed Algorithms	1.00
	INF09-SECU	C	Security	1.50
4	**INF-HUM09**		**Humanities S9**	**5.50**
	HUMT1-ANGL/CONV	C	English S9 Conversation	1.50
	HUMT1-ANGL/TOEIC	C	TOEIC 5th year	1.50
	HUMT1-PGE-A	C	Economics, Law and Business Studies A (serious game)	2.00
	HUMT1-PGE-B	C	Economics, Law and Business Studies B (Lean six sigma)	2.00
	HUMT1-PGE-C	C	Economics, Law and Business Studies C (human resource management)	2.00
	HUMT1-PGE-D	C	Economics, Law and Business Studies D (Marketing for ICT Companies)	2.00
	HUMT1-PGE-E	C	Economics, Law and Business Studies E (Industrial design and innovation)	2.00
	HUMT1-PGE-F	C	Economics, Law and Business Studies F (Mangement and decision making)	2.00
	INF09-DROIT	C	Legal Training for Engineers	2.00
	INF09-COLQ	C	Colloquium	2.00

O = compulsary, C= in choice , F= optional

Software testing	INF09-VVT
Number of hours : 64.00 h	4.00 ECTS credit
CM : 20.00 h, TP : 18.00 h	
Reference Teacher(s) : BLOUIN ARNAUD	

Objectives :
In industrial software developments the verification and validation activities cover between 35% and 55% of the production cost of software, maintenance and evolution excluded. Currently, test is a major technique for the verification and validation.
The goal of this lecture is to train students to the different software testing practices. Several fundamental principles are introduced (test goal, covering metric, specification). Different techniques (unit, integration, and system testing) and development contexts (object-oriented, security, and model-based testing testing) will be detailed.

The concepts introduced are illustrated during practical works. These practical works mainly use Java and Eclipse (unit testing, mutation analysis, interaction testing, and GUI testing). The lectures are completed with industrial lectures introducing: test in the validation team of big companies ; a test lab ; a testing tool editor.

Content :
Lectures:
* Principles of software testing
* Object-oriented software testing
* Unit testing, mutation analysis, interaction testing, GUI testing
* Model-based testing

Practical works
Unit testing, mutation analysis, interaction testing, GUI testing with Eclipse and Java

Bibliography :

Requirements :

Organisation :

Evaluation :
Two-hour written examination at the end of the semester (with documents).

Target :

Advanced Databases and Modern Information Systems	INF09-BDSIM
Number of hours : 40.00 h	4.00 ECTS credit
CM : 22.00 h, EP : 6.00 h, TD : 2.00 h, TP : 10.00 h	
Reference Teacher(s) : SEBILLOT PASCALE	

Objectives :
This module has two main objectives: on the one hand, it provides an in-depth presentation of fundamental technical aspects of
traditional Database Management Systems (DBMSs); on the other hand, it offers a study of the evolution of DBMSs towards
the current flexible information systems, which manage distributed and heterogeneous data exchanged in XML. This course
unit provides the basics necessary for the construction of information systems capable of exploiting the multiple sources of
data in a company, or exchanged between partners.

Content :
1) In-depth presentation of fundamental aspects necessary for the practical management of relational DBMSs.
- Transactions. Concurrency control. Active DBMSs.
- Tuning.
2) XML
- Basic elements.
- DTD, XML schemas.
- XPath, CSS, XSL.
- DOM, SAX.
- XQuery.
3) Evolution of relational DBMSs towards open and flexible information systems.
- Heterogeneity and XML as an exchange format for data.
- XML DBMSs.
- Federated databases and data warehouses.

Bibliography :
- Database Management Systems, R. Ramakrishnan et J. Gehrke, McGraw-Hill Higher Education, 2003
- XML, langage et applications, A. Michard, Eyrolles, 2000
- XML, des bases de données aux services Web, G. Gardarin, Dunod, 2002

Requirements :
Basics of relational DBMSs.

Organisation :
Revision of class notes. Preparation of the practical work and project.

Evaluation :
A two-hour written examination and a project.

Target :

Competitive programming	INF09-CP
Number of hours : 20.00 h	1.50 ECTS credit
CM : 10.00 h, TP : 10.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

From Know-How to let know	INF09-SFFS
Number of hours : 30.00 h	2.00 ECTS credit
TD : 10.00 h	
Reference Teacher(s) : COUASNON BERTRAND	

Objectives :
This module has two objectives:
- The study of a technology not integrated in the courses of the Computer Science department: Know-How;
- The presentation of the expertise acquired to the other students: Let Know.

Content :
It comes in two ways depending on the choice of students:
1) Intervention in front of their colleagues
The students propose topics not covered in the curriculum they would like to know. In groups of 4 students, they study and
prepare a 3 hours technology session organized as they wish (eg in the form of lectures and practicals) for their colleagues.
Examples of topics: Ajax, Silverlight, Erlang, MDA, SAX, Ruby on Rails, Video Streaming, Cuda...
The study of the subject is in autonomy but a teacher supervises the preparation of the course and attends the presentation
during the session.
2) Collaboration with a company
A subject of study may be proposed by a company. In this case a group of students work in cooperation with the company and
prepare also a presentation of their work to their colleagues.

Bibliography :

Requirements :
None

Organisation :
Preparations of the course (the slot of the module is used only for presentations).

Evaluation :
Notation of the presented course.

Target :

User-Centered System Design	INF09-CCU
Number of hours : 46.00 h	3.00 ECTS credit
CM : 40.00 h, EP : 4.00 h, TD : 2.00 h	
Reference Teacher(s) : DUCASSE MIREILLE	

Objectives :
User-centered system design involves users throughout the process of design. The users take part as experts of the use of the technology in its context, and as innovators while contributing ideas which allow to explore new ways of design.

This course is divided into two parts:

1- 20 hours of lectures carried out by ergonomists and designers coming from professional environments
2- an exercise of participative design which aims at collectively proposing improvements for an Internet site. That takes the form of a series of supervised practical exercises where particular techniques are implemented.

The main objective is to make the students aware that they will enormously gain to consult their potential users. A second objective is to grasp the contribution of concrete use-scenarios to understand the core of a system. A third objective is to analyze the situations of group work to know which technical types to use in which types of situations.

Content :
The approached techniques are:
* Role-play
* Interview of users, not computer specialists
* Specification of concrete and precise use-scenarios
* Brainstorming
* Prototyping
* Audit by people external to the project, users and pairs
* Birds of a Feather

Bibliography :
* Key principles for user-centred systems design. Jan Gulliksen, Bengt Göransson, Inger Boivie, Stefan Blomkvist, Jenny Persson et Åsa Cajander. Behaviour & Information Technology 22.6 (2003).
* Collaboration Engineering. Kolfschoten, Gwendolyn L., de Vreede, Gert-Jan, & Briggs, Robert O. 2010. In: Kilgour, D. Marc, & Eden, Colin, Kilgour, D. Marc, & Eden, Colin (eds), Handbook of Group Decision and Negotiation. Advances in Group Decision and Negotiation, vol. 4. Springer Netherlands (2010).
* Using Video to support interaction design. Wendy Mackay, INRIA, 2001.
* Conception participative. Lecture Hands-out (in French). M. Ducassé, INSA de Rennes, updated every year.

Requirements :
None

Organisation :
Organization

24h of lecture, 20h of supervised group work, 2 à 4h of stage preparation.

The interviews take place outside of supervised meetings. Each student is responsible for two interviews, s-he assists moreover students of her-his group to take notes at, at least, two other interviews.

The students work within a group. Concerning the participative design exercise, one student per group is responsible for the processing of each stage for this group. That responsibility is revolving. Each student is responsible on average for two stages, it attends the preparation of those stages and those which immediately precede them, in company of the other persons in charge and of the supervisor. These preparation meetings last 1 hour. During supervised stages, the supervisor moves from one group to another group and intervenes only when she considers it necessary.

Each supervised meeting ends with an analysis of its processes and students make a synthesis of what they learned. Which were the difficulties of implementation? When can one apply the technique of the day? In which

types of groups? What should it be paid attention at if one wants to use such a technique?

Evaluation :
* A report is collectively made to be sent to the persons in charge of the analyzed Internet site. Each group contributes to each chapter.
* Each student returns, moreover, a personal synthesis telling what s-he has learned attending this course and the points which could be improved.
* A collective presentation of group works is given at the end of the semester, if possible in front of at least one of the people responsible for the analyzed web site.

The note takes those three elements into account, with a large weight on the contribution to the collective report.

Target :

Virtual Reality	INF09-OPCAO
Number of hours : 48.00 h	3.00 ECTS credit
TD : 48.00 h	
Reference Teacher(s) : ARNALDI BRUNO	

Objectives :
* This module is designed to explore the fundamentals of virtual reality.
* Introduction to all the technologies exploited in the general context of interactive applications.
* Particular interested is paid to the following three points:
- Principles of real-time visualisation.
- Principles of movement generation.
- Principles of interaction.

Content :
* Real-time visualisation. Geometric modelling by plane polygonal facets. Graphic pipeline. Geometric transformation.
Filtering. Depth-buffer algorithm. Smoothing. Lighting treatment. Links with hardware. Large data bases.
* Movement generation. Classification of models. Descriptive models. Movement interpolation. Procedural animation. Model
generator. Physical model, movement control.
* Interaction. Virtual-reality devices. Hardware configurations. Interaction paradigms and metaphors. Constraints on the
application.

Bibliography :
J.D. Foley, A. Van Dam, ""Fundamentals of Interactives Computer Graphics"" (sec. Ed), Addison-Wesley, 1982.
Le Traité de la Realité Virtuelle, 2ème édition, Edition des Presses de l'Ecole Nationale des Mines de Paris, Volume 1 et Volume 2, Gratuit en version électronique pour les étudiants http://www.caor.ensmp.fr/interlivre

Requirements :
None.

Organisation :
Revision of class notes. Research: Documents and methods.

Evaluation :
Two-hour written examination at the end of the semester.
Mark for project.

Target :

Artificial Intelligence	INF09-OPIA
Number of hours : 48.00 h	3.00 ECTS credit
TD : 48.00 h	
Reference Teacher(s) :	

Objectives :
* Explore algorithms for artificial intelligence through a project (rather than through the classic, class work, practical work and
lecture approach).
* Every year a different game is chosen (Othello, draughts, chess, etc).
* In small groups, students study existing algorithms with the main objective of implementing a virtual player with two or three game algorithms.
* Evaluation of the virtual players takes place during the last classes.

Content :
The programme is not established beforehand. The algorithms to be studied are chosen by the students. Nevertheless, the
algorithms are generally variations of:
* State space search. The A* algorithm.
* Min-max alpha-beta.
* Decision trees.
* Neuronal networks.
* Genetic algorithms.
* Reinforcement learning.
* Game theory.

Bibliography :
Machine Learning, Tom M. Mitchell, McGraw-Hill International editions. Reinforcement Learning, R.S. Sutton and A.G. Barto, MIT Press. Artificial Intelligence A modern approach, S. Russel and P. Norvig, Prentice Hall. Introduction to Game Theory, P. Morris, Springer.

Requirements :
None.

Organisation :
Realisation of a virtual player (Othello, draughts, chess, etc).

Evaluation :
Two-hour written examination.

Target :

Industrial conference S9	INF09-CONF
Number of hours : 15.00 h	0.50 ECTS credit
CONF : 15.00 h	
Reference Teacher(s) : COUASNON BERTRAND	

Objectives :
The purpose of this module is to complete the curriculum by knowledge, practices, industrial problems not seen in other modules. It gives students a better knowledge of business world, its internal and external ecosystem, professions. It is also a way to build links between students and companies.

Content :
The "stage dating" allows students to have several short interviews of 10mn with different companies.

Conferences are done by industrial contributors, on different subjects like:

- Virtual community and Web 2.0
    - In the depths of a networked system
    - Conception user-oriented
    - Panel discussion on mobility

Conferences can be 2 hours long, several modules of 2 hours or organized on a whole day.

Bibliography :

Requirements :

Organisation :
A group of student volunteers, with the teacher in charge of the module, define and organize the different conferences.

Evaluation :
Validation on the presence of the student

Target :

Modeling and Engineering for Biology and Health	INF09-OPMIV
Number of hours : 48.00 h	3.00 ECTS credit
TD : 48.00 h	
Reference Teacher(s) : MARCHAL MAUD	

Objectives :
From gene to human body: Computer Science for Biology and Health applications Overview The course sets out to introduce an extensive range of computing facilities vital for Biology and Health Applications. Computer Science tools are naturally used for data storage or data management but also for data analysis. From gene to human body, biological and medical applications become more and more present in our everyday life. The course is composed of two parts:
* a first part is dedicated to bioinformatics and tries to answer to the following questions: what are the links between Biology and Computer
Science? How can algorithms answer to biological problems and inversely how can biological mechanisms answer to computer science problems?
* the second part deals with modeling and instruments developed for Health applications: what are the current instruments and models applied to human body? How to develop tools for Health domain?

Content :
Part 1: Genomic and Bioinformatics
* Genetic data modeling
* Biological sequences alignment
* Phylogenie and study of species evolution
* Genetic algorithms and data analysis
* Population genetics and association studies
Part 2: Models and Instruments for Health applications
* Medical image analysis
* Computer-assisted medical interventions
* Human body modeling and physical simulation (Biomechanical models, interactive simulators, etc)
* Brain-Computer Interactions
Course schedule:
* A new topic for each course
* Presentation-course (1h-2h), Practical exercises with applications to real data (2h-3h)

Bibliography :

Requirements :
Basic understanding of algorithms and skills in programming languages. No particular Biology and Physics expertise will be assumed.

Organisation :

Evaluation :
Assignment:
* Assignment on practical exercises for each course (50%)
* Small project (50%)

Target :

Image Processing and Pattern Recognition	INF09-OPIRF
Number of hours : 48.00 h	3.00 ECTS credit
TD : 48.00 h	
Reference Teacher(s) : RICQUEBOURG YANN	

Objectives :
Image Processing and Pattern Recognition is a largely studied domain of Computer Science with various applications. The lectures aims at giving a summary of this subject focused on the main line of recognizing symbols in images. Therefore, the main knowledge leading to this end are exposed: from early vision given by basic digital processing, via features extraction from images, to final recignnition performed by classifiers.

Content :
The documents are in English. The lecture may be in English or in French.
Part 1: Image processing

I. Basics of Digital Images
* What is a digital image? Human visual system
* Color, Histograms
* Pyramids and quad-trees
* Spectral representations
II. Image pre-processing
* Geometric transforms
* Noise reduction,
* Morphologic filters
Part 2: Features

I. Features Detection (locally, low level)
* Edges and Lines
* Keypoints and Corners
* Regions and Blobs
II. Features Extraction (globally or higher level)
* Properties of features
* Geometrical, Frequential, Scale-space Features
III. FEATURES SELECTION
* Distances, Selection
Part 3: Classification

I. Unsupervised Learning / Clustering
* C-Means, Fuzzy C-Means, Possibilistic C-Means
II. Supervised Learning
* First simple classifiers (k-Nearest-Neighbor...)
* Neural Networks
- MultiLayer Perceptron (MLP)
- Radial-Basis Function Neural Networks (RBFN)
* Evaluation: Reject option, Validation
- Fuzzy Inference System (FIS),
- Dynamic Time Warping (DTW),
- Hidden Markov Models (HMM),
- Support Vector Machine (SVM)
III. Improvement strategies
IV. Example of Pattern Recognition System

Bibliography :

Requirements :
None

Organisation :
Test some notions presented during the lectures, and search other notions just mentioned, to perform a solution for the practical
work.

Evaluation :
A practical work on a real-world data set is conducted in parallel of the lecture for the half of the time of the module. The
project tends to implement a complete recognition system, gathering 3 to 4 student groups competiting each other groups.
Results of each group is presented and evaluated at the end of this module.

Target :

Modeling and scientific computing	INF09-MODEL
Number of hours : 24.00 h	1.50 ECTS credit
CM : 12.00 h, TP : 12.00 h	
Reference Teacher(s) : GOURANTON VALERIE	

Objectives :
This course aims to show, with the aid of examples, how to modelize and simulate a physical problem and some usual algorithms.
High performance computing will be emphasized and the selected application is hydrogeology, which is the study of groundwater flow.
First, we will show the establishment of the physical equations of water flow in a porous medium; then we will explain how to discretize the equations in order to get the linear system that is to be solved. An important part of this course will be devoted to the numerical computation of large linear systems.

Content :
1. Derivation of a physical Model.
2. Discretisation schemes.
3. System equation build. Parallele algorithms on multiprocessors computers.
4. System resolution : parallel, direct algorithm.
5. System resolution : parallel, iterative algorithm.
6. Other examples of physical application.

Bibliography :
Few articles on the Interstices web site, dealing with modelisation and simulation.

Requirements :
Basic kownledge in linear algebra and differential calcul (undergraduate level)

Organisation :
Lectures alternate with tutorials. A project will be conducted in groups.

Evaluation :
One homework (laboratories) and one exam (2h)

Target :

Cryptography	INF09-CRYPT
Number of hours : 28.00 h	2.00 ECTS credit
CM : 16.00 h, CONF : 2.00 h, TD : 4.00 h, TP : 6.00 h	
Reference Teacher(s) :	

Objectives :
Presentation of the functioning of various cryptographic systems.

Content :
INTRODUCTION:
* Terminology.
* Examples of historic ciphering techniques (Caesar, Vigenere, Vernam, Hill).
* Examples of attack.

ARITHMETICS:
* Chinese theorem.
* Euler's indicator function.
* Fermat's little theorem.
* Discrete logarithm.
* Quadratic residue.

PUBLIC KEY CRYPTO-SYSTEMS:
*RSA system.
* Rabin's system.
* El Gamal's system.
* Examples of applications.
* Examples of attacks.
Digital Signatures:
* Hash functions
*Examples of signatures

SECRET KEY CRYPTO-SYSTEMS:
- Bloc CIPHERING:
* DES.
* IDEA.
* AES.

- STREAM CIPHERING:
* LFSR, Berlekamp-Massey Algorithm
* RC4.

HYBRID CRYPTO-SYSTEMS:
* PGP.

Bibliography :
Codages, cryptologie et applications ,B. MARTIN Complexity and cryptography,
J. TALBOT et D. Welsh Handbook of applied cryptography, A.J.MENEZES, P.C.Van OORSCHOT S.A.VANSTONE

Requirements :

Organisation :

Evaluation :
Two-hour written examination.

Target :

Component-based software engineering	INF09-COMP
Number of hours : 12.00 h	1.00 ECTS credit
CM : 8.00 h, TP : 4.00 h	
Reference Teacher(s) :	

Objectives :
Component-based software engineering (CBSE) has gained widespread acceptance as an effective way of building flexible and
extensible software systems. In CBSE, systems are built by assembling prefabricated components that conform to a given
component model. The goal of this course is twofold. First, the course aims to present the fundamental concepts, patterns, and
methods for building component-based systems. Second, the course aims to provide an overview of modern component
models, such as OSGi, Enterprise JavaBeans, and Service Component Architecture (SCA). At the end of the course, students
will understand the main activities, techniques, and patterns involved in CBSE, know the common features and mechanisms
underlying popular component technologies, and gain practical experience with selected technologies.

Content :
(1) Introduction to CBSE: motivation, relation to object-oriented development, basic concepts, elements of component models,
development process, patterns
(2) OSGi component technology: architecture, event patterns, declarative services
(3) Service Component Architecture (SCA): assembly, packaging and deployment, bindings and implementations
(4) Selected component models: Enterprise JavaBeans, Koala, Fractal, relation to services and service-oriented architectures
The course includes practical sessions (TPs) on developing, deploying, and assembling OSGi components and componentizing existing applications.
The course is taught in English.

Bibliography :
Component Software: Beyond Object-Oriented Programming (2nd ed), Clemens Szyperski, Addison-Wesley Professional, Boston, 2002
Component-Based Software Engineering: Putting the Pieces Together, George T. Heineman, William T. Councill, Addison-Wesley Professional, Reading, 2001

Requirements :

Organisation :

Evaluation :
Written examination of 2 hours.

Target :

Distributed Algorithms	INF09-AD
Number of hours : 16.00 h	1.00 ECTS credit
CM : 12.00 h, TP : 4.00 h	
Reference Teacher(s) :	

Objectives :
* This module presents the basic concepts of parallelism and distributed computing for programming and algorithms to
complement the presentation of the low-level mechanisms seen in the fourth year "systems" module.
* Basic concepts are studied and illustrated through examples of parallel languages like Java as well as through the use of middleware and widely used libraries of communication (Java RMI, CORBA, MPI).
* The concepts and problems associated with algorithms and synchronisation are tackled.

Content :
PARALLELISM
* Execution parallelism and parallel machine. Parallelism of expression.
COMMUNICATING PROCESS BY VARIABLE SHARING
* Java threads.
* Java semaphore. Synchronisation monitors and synchronous methods.
* Software engineering and parallelism in Java.
DISTRIBUTED PROCESS
* Remote Procedure Call: Customer-server model. N-tier.
* RMI Java programming. CORBA remote method call.
* Communicating process by message exchanges: MPI
DISTRIBUTED ALGORITHMS
* Time.
* Global state.
* Election. Consensus.
PEER-TO-PEER MODEL: JXTA.
CONCLUSION.

Bibliography :
La programmation parallèle : outils, méthodes et éléments de mise en oeuvre.J.-P. Banâtre. Eyrolles, 1991.
Algorithmes et architectures parallèles Michel Cosnard, Denis Trystram. InterEditions 1993.
Concurrent Programming in Java: Design
Principles and Patterns, Doug Lea, 2e édition Addison-Wesley, 1999.

Requirements :
Experience with C and Java languages.
Good knowledge of operating systems (process, threads, semaphores).

Organisation :
Revision of lecture notes. Preparation of practical work. Further research on the student's own initiative.

Evaluation :
Two-hour written examination.

Target :

Security	INF09-SECU
Number of hours : 22.00 h	1.50 ECTS credit
CM : 6.00 h, TD : 6.00 h, TP : 6.00 h	
Reference Teacher(s) : BERTIER MARIN	

Objectives :
* Introduction to basic theory and practice of information system security.
* A look at the security risks posed to businesses and individuals (for which organizational, legal and technical solutions are required).
* Focus on technical aspects though an overview of organisational measures.
* Key technical approaches: Access control. Network protocols. Intrusion detection and trusted hardware.
* Examination of key technical approaches in terms of effectiveness in addressing major risks (e.g., viruses, denial of service attacks, information abuse).
* Presentation of the argument that information system security requires a mixture of technical and organisational measures.

Content :
I) RISK ANALYSIS
a. Why systems fail: Distinguishing fact and fantasy.
b. The economics of computer security/insecurity.
c. Social and legal aspects of security (e.g., privacy, Sarbanes-Oxley).
d. Organisational measures for security in the enterprise.
II) ACCESS CONTROL
a. Computer system models of access control.
b. Security in Unix and Java environments.
III) MALWARE: VIRUSES & WORMS
a. Creating and thwarting viruses: Breaking and mending code.
b. Classification of risks to different systems.
IV) TRUSTED HARDWARE PLATFORMS
a. Smartcards and electronic commerce.
b. The TPM (Trusted Platform Module).
c. Windows Vista security.
d. Digital Rights Management (DRM).
V) PUBLIC KEY INFRASTRUCTURES: Identity Management.
a. Using cryptography to share secrets.
b. Electronic commerce and security.
c. Pitfalls: Why protocols fail.
d. Common protocols: SSL, IPSEC, etc.
VI) INTRUSION DETECTION SYSTEMS (IDS)
a. Protecting fixed and wireless networks.
b. IDS examples: SNORT, etc.
* This module includes practical sessions (TPs) in which a variety of subjects are addressed.
* Guest speakers present the risks they face in their companies and the solutions they adopt.
* A further practical session on the subject of watermarking techniques for multimedia content: Cryptographic techniques for
watermarking. Business models adopted by content providers that utilise watermarking.

Bibliography :
Security Engineering, Ross ANDERSON, Wiley.
Computer Security Art and Science, Matt Bishop, Addison Wesley.

Requirements :
None.

Organisation :

Evaluation :
Examination.

Target :

English S9 Conversation	HUMT1-ANGL/CONV
Number of hours : 10.00 h	1.50 ECTS credit
TD : 10.00 h	
Reference Teacher(s) : LE TINNIER ANNE	

Objectives :
- Improving communication skills in everyday life situations as well as in a professional or social context.
- Obtaining or reinforcing C1 level, strongly advised/recommended by the CTI. t.

Content :
- Learning by doing: students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
- Expressing oneself accurately and fluently: students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
1. English Grammar in Use (Cambridge University Press)
2. Dictionnaire Collins Cobuild
3. Polycopié de l' INSA

Requirements :
Having taken and passed the TOEIC test during the previous two years (800 required)
or any other B2 certification recognized by the CTI.

Organisation :
- Each class lasts one hour and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
- Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet.

Evaluation :
Continuous assessment: The final mark (out of 20) will be based on the attendance rate and the personal implication of the student during the class.

Target :

TOEIC 5th year	HUMT1-ANGL/TOEIC
Number of hours : 20.00 h	1.50 ECTS credit
TD : 20.00 h	
Reference Teacher(s) : LE VOT PHILIPPE	

Objectives :
- Improving communication skills in everyday life situations as well as in company and business context.
- Obtaining or reinforcing the B2 level requested by the CTI.
- Obtaining 800 score at the final TOEIC test.

Content :
Learning by doing : students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
Expressing oneself accurately and fluently : students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
- English grammar in Use, Intermediate Edition (CUP)
- Robert and Collins bilingual dictionary or Collins Cobuild

Requirements :
Not having already taken and passed the TOEIC test during the previous two years
B1/B2 level advised

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet. B2 level tests are also taken throughout the course.

Evaluation :
Final mark based on :
TOEIC score at final exam + attendance (more than 4 non justified absences result in 0/20 mark).

Target :
5th year students who haven't already passed their TOEIC

Economics, Law and Business Studies A (serious game)	HUMT1-PGE-A
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
-Establishing a strong, specific vocabulary base
-Understanding the main issues that industrial companies deal with (in a specific management field).
-Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Business Simulation (serious game) (24h / in English)
The business simulation ¿Global Challenge¿ (a CESIM product) has been designed to improve the understanding and knowledge of the complexity of global business operations in a dynamic, competitive environment. It focuses on strategic management, international management and business policy.
The task for the student teams is to manage a global mobile telecommunications company through technological and market evolution. Students will develop and execute strategies for their simulated company operating in the USA, Asia, and Europe.
The simulation is based on an online platform that allows students to play in their own language (many languages available: English, Spanish, Portuguese, Chinese,¿).

* Law (8h / in French)
Main principles of the French legal system

* Patents (4h / in French)

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies B (Lean six sigma)	HUMT1-PGE-B
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Lean Six Sigma (28h / in French)
Lean Six Sigma is a methodology that enables firms to make their processes more effective and efficient. It¿s the current industry standard for process improvement designed to reduce waste and enhance output quality.

* Law (8h / in French)
Main principles of the French legal system

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies C (human resource management)	HUMT1-PGE-C
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field)
- Understanding the importance of teamwork: making collective decisions and producing the expected work in time

Content :
* Human Resource Management (20h / in French)
    - Main current challenges of Human Resource Management
    - Human Resource Management¿s tools and organization
    - Focus on how team managers deal with Human Resource Management

* Law (8h / in French)
    Main principles of the French legal system

* Social legislation (8h / in French)

* Main principles of French social legislation

* Employment contract

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies D (Marketing for ICT Companies)	HUMT1-PGE-D
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This module is designed to equip students with the knowledge and analytical techniques required for effective strategic marketing management in ICT companies. Through this course, students are faced with a real case study provided by a marketing director of an international ICT company. Students are placed in a decision-making situation and should emerge with a 3 years strategic program.

ICT : Information and Communications Technology

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies E (Industrial design and innovation)	HUMT1-PGE-E
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time.

Content :
The program¿s main objective is to provide a multidisciplinary approach to the field of innovation, strategy and industrial design. This course will give an overview of the innovative process.
During this program, participants will have the opportunity to explore a business case covering the first stage of a product development project.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advice to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies F (Mangement and decision making)	HUMT1-PGE-F
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This course is about how to improve decision making as a future manager.
In addition to calling for academic insights and existing literature, this module provides practical improvement strategies to avoid costly decision making errors.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Legal Training for Engineers	INF09-DROIT
Number of hours : 14.00 h	2.00 ECTS credit
CM : 14.00 h	
Reference Teacher(s) :	

Objectives :
To give to final-year engineers, whether or not in project manager positions, the key legal concepts for understanding the protection of intellectual creations and software, the contractual mechanisms for producing software content, and the terms of software licenses.

Content :
5 independent modules CM1 to CM5

CM1: COMPUTER CREATIONS AND ACTORS

CM 2: GENERIC CONTRACTUAL STRUCTURES AND RESPONSIBILITIES

CM 3: SPECIFIC CONTRACTUAL STRUCTURES

CM 4: SOFTWARE LICENSES (INCLUDING GPL)

CM 5: CREATION AND ADMINISTRATION OF WEB SITES

Bibliography :
On the internet : http://www.legalis.net/

Books : Informatique, T_l_coms, Internet - Ed Francis Lefebvre 2012

Requirements :
passing the introductory module to general law (8H Lectures)

Organisation :
Lectures (7 x 2H)

Evaluation :
final exam

Target :

Colloquium	INF09-COLQ
Number of hours : 23.00 h	2.00 ECTS credit
CM : 23.00 h	
Reference Teacher(s) :	

Objectives :
The objective of this course unit is for the student to make a first oral presentation of scientific research results in limited time (15 mn). This course unit is mandatory for all students of the MRI curriculum. The presentation describes the research results related to its internship subject. This exercice is made of three steps: mastering of presentation techniques, rehearsal with the master thesis supervisor, and effective presentation. The presentation is evaluated by a panel. The colloquium is opened to all institutions of the Matisse doctoral school.

Content :
* Knowledge of presentation preparation software
* Knowledge of oral presentation techniques
* Knowledge of the presented research topic
* Ability to make a presentation in front of public
* Ability to make a clear and synthetic presentation of research works
* Ability to organize and give a presentation in limited time

Bibliography :

Requirements :

Organisation :

Evaluation :
A grade is attributed according to precise criterion regarding both the scientific contents and the form of the presentation.

Target :

Academic year 2013/2014

Courses offered by the programme

Systèmes et Réseaux de Communications (SRC)
Communication Systems and Networks

Semester(s) : 1-2-3-4-5-6-7-8-9

Commonly used abbreviations
CM : Lectures
TD : Tutorials
TP : Laboratory Work
CONF : Conferences
TA : Personal Work
PR : Project
ST : Internship
DIV : Miscellaneous

INSA RENNES - Systèmes et Réseaux de Communications (SRC) : 2013/2014

Semestre 5

Parcours Formation Initiale SRC

1	**SRC05-1**		**Electronics**	**6.00**
	SRC05-ELEC	O	Electronics	6.00
2	**SRC05-2**		**Signal and Waves**	**5.00**
	SRC05-TTSAD	O	Deterministic Signal Theory and Processing	3.00
	SRC05-ONDE	O	Waves	2.00
3	**SRC05-3**		**Prerequisite**	**5.00**
	SRC05-PRMAT	O	Mathematics prerequisites	2.00
	SRC05-PRLOG	O	Sequential Logic (Prerequisites)	3.00
4	**TCM05**		**Science and technology of engineer S5**	**9.00**
	TCM05-ANAL	O	Mathematical Analysis for the Engineer	2.00
	TCM05-PROBA	O	Probability Tools for Engineers	2.00
	TCM05-INFOC	C	C language	3.00
	TCM05-PROG	C	C and Matlab programming	3.00
	TCM05-RISQ	O	Risk Management	2.00
5	**SRC05-HUMAS**		**Humanities**	**5.00**
	SRC05-ANGL	O	English	2.00
	SRC05-EPS	O	Sport and Physical Education	1.00
	SRC05-PSH	O	Monographs	2.00

O = compulsary, C= in choice , F= optional

Electronics	SRC05-ELEC
Number of hours : 86.00 h	6.00 ECTS credit
CM : 2.00 h, CM : 30.00 h, PR : 14.00 h, TD : 16.00 h, TP : 16.00 h, TP : 8.00 h	
Reference Teacher(s) : LEMOINE CHRISTOPHE	

Objectives :
- To be able to apply the main methods to study typical, basic circuits,
- To be able to make measurements on those circuits (handling in electronics laboratory) and carry out simulations ("spice" simulation)
- To work autonomously on a synthetic technical project.
- To know the basics on typical semi-conductor components and how they are manufactured
- To use semi-conductor components in electronic circuits (diodes, bipolar junction and field-effect transistors)

Content :
1. To study methods for linear circuits: linear circuits, physics and mathematics in circuit modelling, active and passive fundamental elements, fundamental laws and theorems, equivalent schemes, quadripole theory.
_2. Different functioning states of a linear system: time-harmonic and phasor representations and transfer functions, Bode plot, response to any pulse excitation, study of transitory states.
_3. Physics and component technology, semi-conductor devices: junction diode and bipolar junction transistor.
_4. Bipolar junction transistor: characteristics, polarisation, equivalent scheme, class A fundamental circuits, transistor association, varied integration structures, differential amplifier, transistor in high frequencies.
_5. Synthetic technical project over the entire module programme.

Bibliography :
"ELECTRONIQUE, Fondements et applications", JP Pérez, C. Lagoutte, JY Fourniols, S. Bouhours, Dunod.
"Traité d'électricité et d'électronique, VIII" (2 vol), Chatelain, Dessoulavy, Dunod
"Introduction to semiconductor materials and Devices", Ed. J. Wiley and Sons.

Requirements :
Module on "Electricity" and STPI pre-specialiation module "Electronique 2".

Organisation :
Revision of lecture notes and practical work.
Personal input for project.

Evaluation :
Two-hour written examination
Mark for coursework
Mark for practical work
Mark for project work

Target :

Deterministic Signal Theory and Processing	SRC05-TTSAD
Number of hours : 38.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 10.00 h, TP : 6.00 h, TP : 8.00 h	
Reference Teacher(s) : MERIC STEPHANE	

Objectives :
Deterministic analog signal theory. Concept of a signal as a piece of information. Description of a signal as a usable form for
posterior processing (e.g. modulation techniques).

Content :
1 - Signal representation: development of functions in series of orthogonal polynomials, Fourier series, Fourier integral
transform.
2 - Finite energy signals: convolution, intercorrelation and autocorrelation functions, energy spectral density.
3 - Finite power signals: Fourier transform extension to distributions, case of periodic signals, power spectral density.
4 - Linear filtering: transfer functions and filter impulse response, main types of filtering, with and without distortion filtering.
5 - Analytical signal: Hilbert transform, real envelope and phase of a signal, complex envelope and narrow-band signal
representation.

Bibliography :
Théorie et traitement des signaux, F de Coulon, Dunod
Eléments de théorie du signal : les signaux déterministes, Jean-Pierre DELMAS, Ellipses

Requirements :

Organisation :
Preparation for class and feed-back about class notes and practical work. Preparation of practical work with Matlab.

Evaluation :
1 two-hour written examination. Mark for Lab-work.

Target :

Waves	SRC05-ONDE
Number of hours : 20.00 h	2.00 ECTS credit
CM : 10.00 h, TD : 10.00 h	
Reference Teacher(s) : LOISON RENAUD	

Objectives :
Understanding the fundamental concepts typical to every propagation phenomenon whatever the nature of the system or
device.

Content :
1. 1D propagation without dispersion, case of the vibrating rope: wave equations, general solutions, harmonic solutions,
characteristic impedance, reflection and transmission, standing waves, transported energy, loss and attenuation.
2. Other examples of 1D propagation without dispersion: guided acoustic wave, voltage and current waves on a coaxial cable.
3. Dispersive propagation, case of the vibrating rigid rope: wave equation, dispersion, dispersion diagram, phase and group
speed, dispersion and distortion, cut-off frequency and evanescent mode.
4. 3D waves: plane waves, reflection and refraction laws, non-dispersive wave equation.

Bibliography :
"Vibration and waves in physics", Iain G. Main, Cambridge University Press.

Requirements :
TCM05-MATHS module (complex numbers)
SRC05-PRMAT and SRC05-ELEC modules

Organisation :
Study of lecture notes and preparation of practical exercises.

Evaluation :
Two-hour written examination.

Target :

Mathematics prerequisites	SRC05-PRMAT
Number of hours : 14.00 h	2.00 ECTS credit
CM : 8.00 h, TD : 4.00 h	
Reference Teacher(s) : HELARD MARYLINE	

Objectives :
Make students get used to manipulating special functions and solving partial derivative equations which they will often need during their studies. Many examples and applications to telecommunication and electronics systems are proposed.

Content :
1. Special functions defined through integral equations: error function and its complementary function
2. Eulerian special functions: Gamma and Beta functions
3. Special functions defined through differential equations: Bessel and modified Bessel functions, Legendre polynomials, Tchebychev polynomials.

Bibliography :

Requirements :
Mathematics modules of STPI.

Organisation :
Study of class content and of practical exercises.

Evaluation :
Two-hour written examination

Target :

Sequential Logic (Prerequisites)	SRC05-PRLOG
Number of hours : 38.00 h	3.00 ECTS credit
CM : 4.00 h, CM : 10.00 h, TD : 8.00 h, TD : 6.00 h, TP : 10.00 h	
Reference Teacher(s) : UZEL FABIENNE	

Objectives :
Familiarisation with logic circuits. Conception rules and methods. Methods to introduce discrete prefabricated components in logic systems.

Content :
1- Combinatory logic (lectures: 4 hours. practical exercises: 8 hours): Fundamentals of logic. Boole's algebra. Logical functions. Simplification and minimisation. Number representation. Conception of complex logical systems: multiplexers, decoders, adders, ALU.

2- Sequential logic (lectures: 10 hours. practical exercises: 6 hours. practical work: 10 hours): Introduction to sequential systems. Structure and analysis of sequential systems. Classification of sequential systems. Flip-flops, registers, counters. Finite state machines: Synthesis, finite state minimisation, finite state coding, determination of logical expressions, violation of time parameters. Conception of Dual Systems.

Bibliography :
1. Circuits logiques - Alexandre Nketsa, Collection TechnoSup, 2000
2. Architecture de l'Ordinateur - Robert Strandh - Dunod
, 2005

Requirements :
STPI pre-specialisation module "Combinatory logic"

Organisation :
Revision of lecture notes and practical work. Preparation of practical work.

Evaluation :
Two-hour written examination. Mark for practical work.

Target :

Mathematical Analysis for the Engineer	TCM05-ANAL
Number of hours : 28.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : BRIANE MARC	

Objectives :
Integration, Fourier transform, complex variables

Content :
1. Integration
Convergence theorems
Integrals with a parameter
Integrable functions
Fubini's theorems and convolution
Change of variables
2. Fourier transform
Fourier transform of a integrable function
Inversion theorem
Fourier transform of a square-integrable function
Plancherel theorem
Fourier transform and convolution
3. Complex variables
Holomorphic functions
Entire functions
Exponential and logarithmic functions
Cauchy's formula
Residues method

Bibliography :
G. GASQUET, P. WITOMSKI : « Analyse de Fourier et applications ». Masson, 1990.

Requirements :
Mathematical analysis of first and second year

Organisation :
30h

Evaluation :
1 written examination

Target :

Probability Tools for Engineers	TCM05-PROBA
Number of hours : 28.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : HERVE LOIC	

Objectives :
Probability calculus
- Large-samples
- Elements of statistics

Content :
1. Probability distributions. Examples.
2. Gaussian models.
3. Characteristic functions.
4. Limit theorems for Large-samples. Statistical applications.

Bibliography :
Modélisation probabiliste et statistique- Bernard Garel - Collection POLYTECH des éditions CEPADUES

Requirements :
Bases of analysis and linear algebra. Elements of probability theory of STP03-PROBA « Introduction aux probabilités »

Organisation :
30h

Evaluation :
One two hours written examination.

Target :

C language	TCM05-INFOC
Number of hours : 42.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 8.00 h, TP : 20.00 h	
Reference Teacher(s) : LEPLUMEY IVAN	

Objectives :
Basic understanding of the C programming language.
Ability to resolve all common problems.
Find the minimal intersection of needs / C. language.
Writing and comprehension of the code. Syntax and associated semantic.

Content :
1. Introduction to C programming language:
   Introduction.
   Chain of production, from the code source to the executable.

2. Basic C:
   Lexical entities.
   Language syntax.
   Variable declaration.
   Predefined types.
   Operators and expressions.
   General structure of a program.
   Basic input/output.
   Control structures and instructions.
   Fields: 1st form.
   Functions and pass-by-value parameter passing.

3. Advanced C:
   Pointers.
   Functions and pass-by-address parameter passing.
   Standard library functions.
   Memory models for functions and pointers.
   Fields : 2nd form.
   New types and types constructor.
   Explicit type conversion.
   File input/output.
   Allocation class.
   Dynamic Allocation.
   Pointers to functions.

Bibliography :
J.P. BRAQUELAIRE. Méthodologie de la programmation en langage C - Principes et applications. Manuels Informatiques Masson. Masson, 1993.
J.P. BRAQUELAIRE. Méthodologie de la programmation en langage C - Norme C99 - API POSIX. Sciences Sup. Dunod, 2005.
C. DELANOY. Programmer en langage C, avec exercices corrigés. Eyrolles, 1997.
B.W. KERNIGHAN and D.M. RITCHIE. Le langage C. Manuels Informatiques Masson. Masson, 1990.
J.L NEBUT. Le langage C - définition de la norme ANSI. Technical Report Cours C81, IFSIC -Université de Rennes 1, juillet 1989.

Requirements :
Understanding of Algorithms Foundations

Organisation :
Revision of the lecture notes.
Preparation for the practical work.
14hours of course, 8 hours of directed work and 20 hours of practical work

Evaluation :

2-hour written examination at the end of the semester (documents allowed).

Target :

C and Matlab programming	TCM05-PROG
Number of hours : 35.00 h	3.00 ECTS credit
CM : 9.00 h, TD : 8.00 h, TP : 18.00 h	
Reference Teacher(s) : MORIN LUCE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Risk Management	TCM05-RISQ
Number of hours : 21.00 h	2.00 ECTS credit
CM : 21.00 h	
Reference Teacher(s) : GALL PHILIPPE	

Objectives :
The engineer must always remain master of his choices and his actions within the limits defined by acceptable risk.

Content :
I- THE PRINCIPAL CONCEPTS OF RISK ANALYSIS: Dangerous situations. The five dimensions: facts, models, objectives, norms, values. The dissonances between players in a network. The deficits that affect dimensions. Options for
preventative action.
II. DANGER: AN INTRINSIC REALITY. WHEN AND WHERE TO EXPECT DANGER. Danger inherent to the natural
environment. Climate-related uncertainties. Terrestrial uncertainties. Fire as a man-made danger: facilities, production,
creation, etc. Sources of danger in the workplace: electrical, mechanical, chemical, toxicological, radiation, etc.
III - RISK: A LIKELY EVENT WHICH INDUCES DANGER: Characterisation of risk or estimation of danger: probability
and gravity. Natural or man-made danger. Error or approximation. Economic and financial risk. Complexity of the models.
Sport-related risk. Information-related risk. Alarm-related risk. Numerical treatment of problems. Risk; chemical-related risk.
IV. SECURITY: Development of a secure environment. Regulations: logic, criticism and use; technical regulations.
V. PREVENTION AND ASSUMING RESPONSIBILITY: JURIDICAL ASPECTS.

Bibliography :
Risque et Génie Civil - AFGC - 8 -10 nov 2000, Presse des Ponts et Chaussées Konstantin PROTASSOV, 1999,
""Probabilités et Incertitudes"", PUG Michèle NEUILLY - CETAMA
""Modélisation e estimation des erreurs de mesure"" GIS - MR-GenCi J.A. CALGARO, 1996,
- Introduction aux Eurocodes, Presse de l'ENPC Peter G. NEUMANN, 1995,
Computer-Related Risks, Addison-Wesley/ACM Press, ISBN 0-201-55805-X, 384pp

Requirements :

Organisation :

Evaluation :
Two-hour written examination in French.

Target :

English	SRC05-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : LE VOT PHILIPPE	

Objectives :
Improving expression, understanding and interaction skills in everyday life as well as social and professional environments.
Language objectives :
Acquiring or reinforcing B2 level (as requested by the CEFR for languages) and C1 level for the most advanced students.

Content :
Doing-by-learning approach
Listening, speaking, writing in a motivating environment and approach to help and guide students in their analysing, experimenting, implementing process.
Acquiring the right vocabulary and grammar to deal with professional and social situations in an autonomous way.
In addition to the English course, a 90-minute remedial course takes place every week (over 10 weeks), in which students can update their various skills (listening and reading, writing, speaking and interacting) in small groups.
Remedial classes are compulsory for all students that did poorly in their start-of-term placement test - and optional for those who feel they need to attend. There is no specific assessment for this course."

Bibliography :
Robert et Collins bilingual dictionary or Collins Cobuild
English Grammar in Use (Cambridge University Press)

Requirements :
B1/B2 level and a good handling of the first two post-baccalaureate program required.

Organisation :
Creativity and personal involvement-based activities such as rôle plays, debates, oral presentations, graph and diagrams analysis, radio programs recordings, video creation, subtitling and dubbing, CV/resume writing
Most of these activities cover the professional scope of the speciality of the student's department in a multicultural environment.
Resources: press article, video and audio documents from the international press and television chanels.
Each course lasts 2 hours. 56 hours a year. The classes take place in fully equipped rooms -video, audio material as well as multimedia lab- which enables the students to make the best of their time in an adapted and stimulating environment.

Evaluation :
Writing / reading test at the end of the semester: 2hrs

Target :

Sport and Physical Education	SRC05-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : LE LAGADEC PIERRE	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O. or
Kayak or golf.

Bibliography :
Several specialized books are available to the students at the library. Links to internet sites are given on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Monographs	SRC05-PSH
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
The aim of this module is to broaden the students' knowledge of their chosen professional field and of the prevailing social and managerial environment. Students must structure their thinking to argue their point and make sense of the various sources of information studied.

Content :
Students choose and plan an appropriate project in accordance with the objectives. They carry out a rigorous research on the theme and interview specialists. A special emphasis is placed on the use of project management tools and teamwork.
The methodological tools required for searching reliable information are applied, resulting in well-written documents and improved public-speaking skills. Proper writing style and editing technique are essential. The main rules of editing a quality document are studied.

6) An insight into Work rights; job placement rights; the work contract; special clauses; the rights of companies.

Bibliography :
Provided during the courseNone

Requirements :
None

Organisation :
2 hours per week

Evaluation :
Continuous assessment (collective work)

Target :

Semestre 6

Parcours Formation Initiale SRC

1	**SRC06-1**		**Electronic Linear Systems**	**5.50**
	SRC06-SL	O	Linear Systems 1	5.50
2	**SRC06-2**		**Signal and Propagation**	**7.50**
	SRC06-PROPA	O	EM propagation and radiation	2.50
	SRC06-TTSAA	O	Random Signal Theory and Processing	2.50
	SRC06-TSCA	O	Signal processing for analogue communications	2.50
3	**SRC06-3**		**Computer science and programmable logic**	**7.00**
	SRC06-INFO	O	Computer science	2.00
	SRC06-ARCHI	O	Computer Architecture	2.50
	SRC06-LPROG	O	Programmable Circuits	2.50
4	**TCM06**		**Science and technology of engineer S6**	**4.00**
	TCM06-CAPT	C	Introduction to SENSORS	1.00
	TCM06-ENRG	C	Energy	1.00
	TCM06-IMO	O	Introduction to Production and quality Management	1.00
	TCM06-SHES1	O	Science Humaine Economique et Sociale 1	1.00
	TCM06-SHES2	O	Science Humaine Economique et Sociale 2	1.00
5	**SRC06-HUMAS**		**Humanities**	**6.00**
	SRC06-ANGL	O	English	2.00
	SRC06-EPS	O	Sport and physical Education	1.00
	SRC06-PSH	O	Monographs	2.00
	SRC06-PPI	O	Professional Project	1.00
6	**HUMT2-SAM(2)**		**SAM : APES Responsabilités Associatives**	**2.00**
	HUMT2-APES ASSO	F	Association membership & responsabilities 2 credits	2.00
7	**HUMT2-SAM(3)**		**SAM : APES Responsabilités Associatives**	**3.00**
	HUMT2-APES RESP	F	Association membership & responsabilities 3 credits	3.00
8	**HUMT2-SAM(1)**		**"SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility)**	**1.00**
	HUMT2-APES	F	APES	1.00

O = compulsary, C= in choice , F= optional

Linear Systems 1	SRC06-SL
Number of hours : 80.00 h	5.50 ECTS credit
CM : 12.00 h, CM : 12.00 h, PR : 20.00 h, PR : 2.00 h, TD : 2.00 h, TD : 16.00 h, TP : 6.00 h, TP : 10.00 h	
Reference Teacher(s) : LEMOINE CHRISTOPHE	

Objectives :
- To be able to conceive and use simple and closed-loop linear systems essentially dedicated to filtering and/or signal transmission functions
_- To know the main useful methods for analyzing the stability of a linear system

- To know how to conceive and study an electronic oscillator

Content :
1- Linear systems : integrated amplifiers. Perfect and real amplifiers. Matrix representation of amplifier characteristics.
_2- Main transfer functions in linear filtering. Interest and applications of filtering in the domain of communications. Optimal filter for signal transmission. Butterworth, Bessel and Chebyshev norms. Approximation functions.
_3- Closed-loop linear systems. Changes in the matrix characteristics of a linear system. Change in the functionalities. Performance improvement in terms of transmission and interchangeability.
_4- Synthetic technical project over the entire module programme.

Bibliography :
J. Blot, électronique linéaire, cours avec exercices et travaux pratiques, Dunod.

Requirements :
Linear electric circuit analysis, SRC05-ELEC module.
Special functions, SRC05-PRMAT module.

Organisation :
Revision of lecture notes. Revision and preparation of practical work.

Evaluation :
Two-hour written examination
Mark for coursework
Mark for practical work
Mark for project work

Target :

EM propagation and radiation	SRC06-PROPA
Number of hours : 34.00 h	2.50 ECTS credit
CM : 20.00 h, TD : 14.00 h	
Reference Teacher(s) : GILLARD RAPHAEL	

Objectives :
The basics of electromagnetism from Maxwell's equations. Development of study methods for propagation and electromagnetic radiation in a homogeneous environment. Analysis of reflection and refraction.

Content :
1. Maxwell's equations in free space and in material media.
2. Propagation of electromagnetic waves with and without loss; skin depth.
3. The plane wave and its properties. Wave polarisation.
4. Electromagnetic energy. Poynting's theorem.
5. Boundary conditions. Reflection and refraction at the interface between two media. Fresnel's formulas.
6. Unicity principle. Huygens' principle. Image theory.
7. Radiation from simple sources (dipole and aperture).

Bibliography :
Electromagnetic fields Energy and waves (Chap II,IV,VII,VIII,IX,XI), Leonard M.Magid, John Wiley Editor
Advanced engineering electromagnetics, C. A. Balanis, John Wiley Editor.

Requirements :
SRC06-ONDE Module.

Organisation :
Study of lecture notes. Revision of practical work.

Evaluation :
two-hour written examination.
Mark for coursework

Target :

Random Signal Theory and Processing	SRC06-TTSAA
Number of hours : 34.00 h	2.50 ECTS credit
CM : 16.00 h, TD : 10.00 h, TP : 8.00 h	
Reference Teacher(s) : MARY PHILIPPE	

Objectives :
Introduce the fundamentals of the random signal theory as well as the main mathematical tools for studying random signals.

Content :
1- Review: probability, random signal terminology and representation.
2- Statistical model: random processes, autocorrelation and autocovariance functions.
3- Random signal properties: steadiness, ergodicity, power spectral density, Wiener-Khintchine theorem, Gaussian process, cyclostationarity.
4- Linear filtering: energetic considerations.
5- Noise: white Gaussian noise, white noise filtering, basic knowledge of signal-to-noise ratio and its use.

Bibliography :
Maurice Charbit, "Eléments de théorie du signal : les signaux aléatoires", Ellipses.
Athanasios Papoulis, "Probability, Random Variables and Stochastic Processes"

Requirements :
TCM05-MATHS (Probability part) and SRC05-TTSAD courses

Organisation :
Preparation for class and feed-back about class notes and practical work. Preparation of practical work with Matlab.

Evaluation :
one two-hour written examination. 1 written examination on the Labworks (1 hour).

Target :

Signal processing for analogue communications	SRC06-TSCA
Number of hours : 34.00 h	2.50 ECTS credit
CM : 14.00 h, TD : 10.00 h, TP : 10.00 h	
Reference Teacher(s) : CRUSSIERE MATTHIEU	

Objectives :
Complete the SRC05-TTSAD and SRC06-TTSAA modules through the application of signal processing tools to analogue communication techniques, including modulation, multiplexing, sampling and heterodyne schemes.

Content :
1. Presentation and modelisation of a generic communication système, channel concept, frequency transposition, modulation/demodulation operations.
2. Analogue modulations: principles of the different types of carrier wave modulations, classification and choice criteria.
3. Complete analysis: amplitude modulation AM, DSB, SSB, VSB, angular modulations PM, FM. Others: impulse wave modulations such as PAM, PPM, PWM.
4. Demodulation functions: coherent and non-coherent detection, envelop detection, phase lock loop, discriminator.
5. Performance in front of white noise, SNR gain, spectral efficiency, complexity.
6. Concept of heterodyne receiver, frequency transposition, concept of intermediate frequency. Concept of signal multiplexing: time and frequency multiplexing.
7. Extension to the definition of digital communications : signal sampling, quantification.

Many applications and examples are proposed from exercices to simulations with Matlab, dealing with spectral efficiency and performance of the systems with additive noise. One session lab is dedicated to the use of a spectrum analyzer.

Bibliography :
A. BRUCE CARLSON, Communication systems, MGRAW - HILL 1975
J.A. BETTS, Processing Signal, modulation and noise, UNIBOOKS 1981
D. BENSOUSSAN, modulation, principles and modes, DUNOD

Requirements :
TCM05-MATHS (Probabilities part)
SRC05-PRMAT, SRC05-TTSAD and SRC06-TTSAA

Organisation :
Study of class content, of practical exercises. Preparation of practical work with Matlab.

Evaluation :
1 two-hour written examinations.
1 mark for lab work.

Target :

Computer science	SRC06-INFO
Number of hours : 19.00 h	2.00 ECTS credit
CM : 2.00 h, PR : 9.00 h, TP : 8.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
Training in the use of UNIX/LINUX operating systems. Intensifying the practice of C language through an autonomous IT project.

Content :
Lectures:
(a) Presentation of UNIX/LINUX operating systems (2h).
(b) Advice on the implementation of an IT project (2h).
Practical Work: Linux: Overview of the file system: internal organisation, link notion, protection. Interactive use of Shell commands. Shell script language. The efficiency of this computer programming language for tasks on level system (12h). IT project: implementation of a C language project (12h). Delivery of source code, executable file, documentation, report, and oral presentation.

Bibliography :
Previous year's project reports.

Requirements :
TCM05-INFOC modules: basic knowledge of C language.

Organisation :
Preparation for practical work. IT project teamwork.

Evaluation :
- Practical work (operating systems).
- IT project (realisation/report/oral exposé - same coefficient).

Target :

Computer Architecture	SRC06-ARCHI
Number of hours : 28.00 h	2.50 ECTS credit
CM : 10.00 h, CM : 8.00 h, TP : 10.00 h	
Reference Teacher(s) : UZEL FABIENNE	

Objectives :
Analysis of the internal organisation of processors. Study of different architectures and associated peripherals. Application on
the 8051 microcontroller.

Content :
1. General architecture (10H lessons). Analysis of the internal organisation of digital processors: CPU, ALU, Registers,
Memories, Harvard and Von Neumann Architecture buses, Peripherals, Evolved Architecture Interruptions: cache memory,
MMU, pipeline, RISC/CISC, DSP, Micro-controllers.
2. Application to the MSP430 family embedded microcontroller (8H lessons, 10H practical).
Study of the MSP430 architecture.
Particular study of IT management, timers, ports. Application analysis including a MSP430 and various peripherals (memories, LCD, ADC, etc). Hardware and software link. Study of circuit boards. Use of Resonance software with C and assembly programming.

Bibliography :
"Architecture de l'ordinateur", Robert Strandh- Dunod
"Microcontrôleurs MSP430", Moodle course, Texas Instrument Website

Requirements :
SRC05-PRLOG and TCM05-INFOC Modules.

Organisation :
Revision of lecture notes. Preparation for practical work.

Evaluation :
2-hour written examination. Mark for practical work.

Target :

Programmable Circuits	SRC06-LPROG
Number of hours : 30.00 h	2.50 ECTS credit
CM : 10.00 h, TD : 4.00 h, TP : 16.00 h	
Reference Teacher(s) : UZEL FABIENNE	

Objectives :
Designing with programmable digital devices from CPLD to FPGA. Impact of architecture on design. Resource management. I/0 control.

Content :
Introduction to programmable circuits: from PAL to FPGA. Interest and comparison with discrete circuits. Classification of thedifferent architectures : CPLD and FPGA. Design manner: functional analysis, application coding, functional simulation and timing. Analysis, placement and routing, programming, test.Use of component libraries. Application on the circuits ALTERA - Quartus tools - DE1 et DE2 cards.

Bibliography :
1. Circuits logiques Programmables- Alexandre NKETSA, Collection TechnoSup, 2000
2. Digital systems design and prototyping - Zoran Salcic- Kluwer academic Publishers

Requirements :
SRC05-PRLOG Module.

Organisation :
Preparation for lectures and practical work (5 sessions - the equivalent of a small project).

Evaluation :
Two-hour written examination.
Mark for practical work.

Target :

Introduction to SENSORS	TCM06-CAPT
Number of hours : 35.00 h	1.00 ECTS credit
CM : 21.00 h, TD : 14.00 h	
Reference Teacher(s) : DURAND OLIVIER	

Objectives :
In Europe, the sensors market has been estimated to 10 billions Euros in 2007, corresponding to 28% of the glogal world
market, with an estimated growth more than 6% per year and sustained by the security systems, the automotive, aeronautics
and defence. Nowadays, the sensors market swipes to the electronic instrument mass market. Such a market generates a large
amount of employment in a wide range of industries. The aim of this course is a general overview of the properties and the
applications of sensors, with a global understanding, as general knowledge, of the different phenomena used for the sensors
elaboration.

Content :
General introduction to sensors. Active and passive sensor conditioners. Basics of semiconductor physics. Optical sensors.
Notions on the photovoltaic cells. Temperature sensors. Position and displacement sensors. Magnetic sensors. Mechanical
sensors. Introduction to microsensors.

Bibliography :
Les capteurs en instrumentation industrielle (G. Asch et collaborateurs), Dunod Handbook of Modern Sensors 2nd edition (J. Fraden), AIP Presss, Woodbury, New York Principe généraux des capteurs, cours CNAM (F. Lepoutre) Cours capteurs (M. Hubin) : http://perso.orange.fr/michel.hubin/capteurs/instrum.htm

Requirements :
No prerequisite.

Organisation :
Homework.

Evaluation :
Written examination on work covered during lectures and tutorials.

Target :

Energy	TCM06-ENRG
Number of hours : 42.00 h	1.00 ECTS credit
TD : 12.00 h	
Reference Teacher(s) : CORNET CHARLES	

Objectives :
Impact of the choice energy sources of the 21st century. Photovoltaic cells and the thermal efficiency of buildings in terms of
cost, efficiency and environmental impact. Inventory of the energy sources currently in use. Thermodynamic tools. Overview
of the different methods of energy production including combustion engines, boilers, nuclear energy, renewable energies, etc.
Presentation of the different means of transport and energy transfer; thermal isolation or conduction, convection, material
transfer, inverted cycle machines, etc.

Content :
24 hours of lectures, 12 hours of tutorials and 6 hours of practical training.
Introduction to energy management and analysis of the current energy situation. The tools of energy engineering: Fick's laws
of diffusion, black body, thermal machines and basic reminders of thermodynamics. Production of energy: nuclear, thermal
combustion, boiler. Renewable energies: wind power, solar, geothermic energy, etc. Delivery of energy: insulation, conduction, convection, electricity and gas transport, etc.
Chapter I: Introduction to energy engineering.
(I) The energy context
1/ Definitions
2/ Overview of the current energy situation
(II) Energy prospects
1/ Supply and demand
2/ Technological orientation
3/ Conclusions
(III) Energy
1/ The different forms of energy
2/ Energy conversion
3/ Stocking and transport of energy.
Chapter II: Engineering tools for Energy
(I) - Transport phenomena
1/ Particle diffusion
2/ Thermal diffusion
3/ Fourier/Ohm/Fick Analogy
4/ Convection
(II) Energy transfer by radiation: black body model
1/ classic description
2/ quantum description - Planck's law
3/ Spectral characteristics of radiation
4/ Interest of the model
(III) Thermodynamics (Reminder)
1/ Thermal machines and cycles
2/ Energetic and entropic outcomes
3/ Diathermy machines
4/ Performance and efficiency.
Chapter III: The production of energy
(I) Nuclear energy
1/ Principle
2/ Fission and nuclear power
3/ Perspectives : toward thermonuclear fusion
(II) Combustion and combustion engines
1/ Combustion and fuels
2/ Ovens and boilers
3/ Combustion engines
(III) Renewable energies : solar, wind power, etc.
1/ Renewable energies

2/ Geothermic and ocean energy
3/ The thermal conversion of solar energy
4/ Photovoltaic solar energy
5/ Wind power
6/ Other energies.
Chapter IV: Transport and transfer of energy
(I) Heat transfer
1/ Heat transfer by thermal conduction: Applications to insulation
2/ Heat transfer by convection: heat exchangers
(II) Material transfers
1/ Pressure or load losses
2/ Turbo machines
(III) Transport of electricity: three-phase current.

Bibliography :
Energétique : concept et applications : Michel Feidt Systèmes énergétiques : (2004) (bibliothèque insa rennes)
Energies renouvelables : (2006) (bibliothèque insa rennes)

Requirements :
Mathematics: differential equations, complex numbers.
Other: Thermodynamics of diffusion and thermodynamic potentials , entropy, efficiency. Fluid mechanism (Bernoulli's
principle), understanding of semiconductors.

Organisation :
Preparation for tutorials, conferences. Internet research.

Evaluation :
2-hour examination based on the lectures and tutorials.

Target :

Introduction to Production and quality Management	TCM06-IMO
Number of hours : 28.00 h	1.00 ECTS credit
CM : 14.00 h, TD : 10.00 h, TP : 4.00 h	
Reference Teacher(s) : SORRE FREDERIC	

Objectives :
Introduction to production management and quality issues: Nowadays, companies must adopt methods associated with tools,
which will allow them to manage production effectively. Overview of the organisation of a factory.

Content :
PART ONE: Production management
(I) Introduction: definition of production management, classification of production systems.
(II) Scheduling in specialised workshops: scheduling on a machine, scheduling with two or three production centres.
(III) Stock management: stock management policies, associated costs, fixed interval order system for stock with a turnover of
zero, re-order point-management.
(IV) Production planning: Planning of the number of components required, basic principles of MRP2, load adjustment, capacity.
(V) "Just-in-time" techniques: origin and principle of JIT, key factors, the Kanban method.
PART TWO: Quality:
(I) Quality of industrial products: the concepts, Quality function, and the international norms for quality control management.
(II) Quality tools: 5S, SMED, TPM, control system and reception control system.
PART THREE: Case study - A presentation by representatives of manufacturers.

Bibliography :
Gestion de la production - Blondel - DUNOD\ n
La gestion de production - Bénassy - HERMES
Contrôle de la qualité - Jaupi - DUNOD
Industrialisation des produits mécanique (Tome 1) - Linarès-Marty - HERMES

Requirements :

Organisation :

Evaluation :
Two-hour written examination. Continuous assessment of Practical work.

Target :

Science Humaine Economique et Sociale 1	TCM06-SHES1
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Science Humaine Economique et Sociale 2	TCM06-SHES2
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

English	SRC06-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : LE VOT PHILIPPE	

Objectives :
Improving expression, understanding and interaction skills in everyday life as well as social and professional environments.
Acquiring or reinforcing B2 level (as requested by the CEFR for languages) and C1 level for the most advanced students.

Content :
Doing-by-learning approach
Listening, speaking, writing in a motivating environment and approach to help and guide students in their analysing, experimenting, implementing process.
Acquiring the right vocabulary and grammar to deal with professional and social situations in an autonomous way.
In addition to the English course, a 90-minute remedial course takes place every week (over 10 weeks), in which students can update their various skills (listening and reading, writing, speaking and interacting) in small groups. Remedial classes are compulsory for all students that did poorly in their start-of-term placement test - and optional for those who feel they need to attend. There is no specific assessment for this course."

Bibliography :
Robert et Collins bilingual dictionary or Collins Cobuild
English Grammar in Use (Cambridge University Press)

Requirements :
B1/B2 level and a good handling of the first two post-baccalaureate program required.

Organisation :
Each course lasts 2 hours. 56 hours a year. The classes take place in fully equipped rooms -video, audio material as well as multimedia lab- which enables the students to make the best of their time in an adapted and stimulating environment.

Evaluation :
Writing / reading test at the end of the semester: 2hrs
individual oral (face-to-face) : 15 mn

Target :

Sport and physical Education	SRC06-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : LE LAGADEC PIERRE	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O. or
Kayak or golf.

Bibliography :
Several specialized books are available to the students at the library. Links to internet sites are given on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Monographs	SRC06-PSH
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
The aim of this module is to broaden the students' knowledge of their chosen professional field and of the prevailing social and managerial environment. Students must structure their thinking to argue their point and make sense of the various sources of information studied.

Content :
Students choose and plan an appropriate project in accordance with the objectives. They carry out a rigorous research on the theme and interview specialists. A special emphasis is placed on the use of project management tools and teamwork.
The methodological tools required for searching reliable information are applied, resulting in well-written documents and improved public-speaking skills. Proper writing style and editing technique are essential. The main rules of editing a quality document are studied.

Bibliography :
Provided during the course

Requirements :
None

Organisation :
2 hours per week

Evaluation :
Continuous assessment (collective work)

Target :

Professional Project	SRC06-PPI
Number of hours : 6.00 h	1.00 ECTS credit
TD : 6.00 h	
Reference Teacher(s) : LE BAIL SYLVIE	

Objectives :
Bringing the student to consider his professional future

Content :
- Conferences.
- Working with consultants and company directors.
- The ability to explain one's choices.
- Exploitation of knowledge.
- Outlining one's potential professional future.
- Defining motivation.
- Preparation and communication of one's "credentials"

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Association membership & responsabilities 2 credits	HUMT2-APES ASSO
Number of hours : 14.00 h	2.00 ECTS credit
DIV : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Association membership & responsabilities 3 credits	HUMT2-APES RESP
Number of hours : 20.00 h	3.00 ECTS credit
DIV : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

APES	HUMT2-APES
Number of hours : 30.00 h	1.00 ECTS credit
DIV : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

INSA RENNES - Systèmes et Réseaux de Communications (SRC) : 2013/2014

Semestre 7

Parcours Formation Initiale SRC

1	**SRC07-1**		**Electronic and Systems**	**6.50**
	SRC07-ESNL	O	Non-Linear Electronic Systems	3.00
	SRC07-DSP	O	Digital Signal Processing	2.00
	SRC07-CDC	O	CDC Project	1.50
2	**SRC07-2**		**Signal Processing**	**6.00**
	SRC07-DESTI	O	Detection and estimation / Information Theory	3.00
	SRC07-SINUM	O	Digital Signal Processing	3.00
3	**SRC07-3**		**Communications**	**5.00**
	SRC07-LGUID	O	Transmission lines and Waveguides	2.00
	SRC07-CNUM1	O	Digital Communications I	3.00
4	**SRC07-4**		**Design Tools**	**7.50**
	SRC07-VHDL	O	VHDL	2.50
	SRC07-INFO	O	C++ Object Oriented Programming	2.00
	SRC07-MNUM	O	Digital Resolution Techniques	3.00
5	**SRC07-HUMAS**		**Humanities**	**5.00**
	SRC07-ANGL	O	English	2.00
	SRC07-ECOGE	O	Economy and Management	2.00
	SRC07-EPS	O	Sport and physical education	1.00
9	**HUMT1-SAM STSRC**		**SAM : Stages Complémentaires de 3ème année**	**4.00**
	SRC07-STA3	C	Stages 3SRC	4.00

O = compulsary, C= in choice , F= optional

Non-Linear Electronic Systems	SRC07-ESNL
Number of hours : 54.00 h	3.00 ECTS credit
CM : 22.00 h, TD : 10.00 h, TP : 18.00 h, TP : 4.00 h	
Reference Teacher(s) : MERIC STEPHANE	

Objectives :
Useful methods for the study of non-linear systems. How to comprehend phenomenon occurring in non-linear systems.
Application - examples.

Content :
1. Fundamentals for non-linear systems. General behaviour of non-linear systems according to initial conditions. Signal distortion, distortion rate calculation.
2. First harmonic operating approximation method: scattered characteristics case, common method for some characteristics.
3. Non-linear looped systems, Nyquist and critical points method, auto-stabilisation of oscillations in a looped system.
4. Global study method in phase plane: singular points, limit cycles, cartography in phase plane, influence of initial conditions on system behaviour.
5. Study of some non-linear systems, multiplication circuits, frequency multipliers, modulation and demodulation circuits.
6. Description and study of a Phase Locked-Loop: Introduction and description of the different parts of the PLL, methods for designing the loop-filter, the phase detector and the voltage control oscillator, study of different applications (frequency demodulation, asynchronous amplitude demodulation, frequency synthesis).
7. Description of the ADC and DAC characteristics: Gain, transfert function, quantum, conversion errors. Description of the different technologies for ADC (flash, parallel, ramp technics, Delta-Sigma) and for DAC (weighted resistances, R-2R network, inversed network R-2R, weighted currents).

Bibliography :
Analyse numérique et équations différentielles, Jean-Pierre Demailly, Presses Universitaires de Grenoble
Systèmes non linéaires, A. FOSSARD, Publication de cours SUPAERO, Toulouse
Electronique : fonctions principales et systèmes intégrés, Jean-Marc POITEVIN, Dunod.
Principes de conversion : analogique-numérique et numérique-analogique, Jean-Paul TROADEC, Dunod

Requirements :
Resolution methods for second order differential equations with constant coefficients, SRC06-PRER module.
Looped systems analysis (stability and oscillations), SRC06-SL module.

Organisation :
Revision of class notes and practical exercises. Problem solving.

Evaluation :
2 two-hour written examinations.
Mark for practical work.

Target :

Digital Signal Processing	SRC07-DSP
Number of hours : 22.00 h	2.00 ECTS credit
CM : 8.00 h, TD : 6.00 h, TP : 8.00 h	
Reference Teacher(s) : UZEL FABIENNE	

Objectives :
Digital signal processing. Used of Texas C6X family C6416X

Content :
1- Introduction to DSP
2- Architecture VLIW and others parallelism
3- Pipeline and spatial parallelism
4- DMA transfer
5- Interruption mechanism

Bibliography :
Texas instrument data book,
Texas Instrument Web site and on line courses
Chayssing digital signal processing

Requirements :
SRC06-ARCHI, SRC05-LANGC

Organisation :
homework

Evaluation :
Practice and 1 examination of 1H

Target :

CDC Project	SRC07-CDC
Number of hours : 20.00 h	1.50 ECTS credit
TP : 20.00 h	
Reference Teacher(s) :	

Objectives :
Definition of the electronic student project

Content :
THe students are organized in group (6 students). They have to propose to work on a subject in electronic field. during this first semestria, they have to :
- analyse the existing solutions if already in use
- propose technical solutions
- propose a schedule of the projet realized during 2nd semestria
- analyse the cost (human and material costs)
- analyse the possible difficulties and alternative solutions

Bibliography :
Previous students projects since 2002

Requirements :
3 and 4 SRC lessons

Organisation :
Home work

Evaluation :
report and presentation

Target :

Detection and estimation / Information Theory	SRC07-DESTI
Number of hours : 42.00 h	3.00 ECTS credit
CM : 18.00 h, CM : 12.00 h, TD : 12.00 h	
Reference Teacher(s) : ZAHARIA GHEORGHE	

Objectives :
Introduction to detection, estimation and information theory techniques and their applications.

Content :
1. Detection and Estimation: Bayes method, min-max criterion, maximum a posteriori criterion: Fundamentals of binary
detection statistical theory: scalar and vector cases. Statistical hypothesis testing, Neyman-Pearson method. Receiver operating
characteristic. Case of multiple hypotheses. Case of band-limited signals. Estimation of deterministic parameters (scalar or
vector). Maximum likelihood criterion. Estimation of random parameters. Estimator quality Cramer-Rao criterion, efficient
estimator.
2. Information theory. Introduction to information theory. Entropy and mutual information. Information sources with and
without memory: examples of Markovian sources. Entropy of a stationary source with and without memory. Source coding:
presentation of source coding fundamental theorem, Huffman coding. Transmission channel capacity and channel coding
theorem Capacity of a stationary channel, without memory, with discrete input and analog output.

Bibliography :
1. H. van Trees, "Detection, Estimation and Modulation Theory", Part I, Dover, 1994
2. H. Urkowitz, "Signal theory and random processes", Artech House, 1983
3. A. Spataru, "Théorie de la transmission de l'information", Presses polytechniques et universitaires romandes, 1987

Requirements :
ESC05-PRER and ESC05-TTSIA modules.

Organisation :
Revision of lecture and practical work notes.

Evaluation :
2 two-hour written examinations.

Target :

Digital Signal Processing	SRC07-SINUM
Number of hours : 50.00 h	3.00 ECTS credit
CM : 24.00 h, TD : 14.00 h, TP : 12.00 h	
Reference Teacher(s) : CRUSSIERE MATTHIEU	

Objectives :
The fundamentals of Digital Signal Processing.

Content :
1. Discrete-time signals and systems.
- Analogical/digital conversion: sampling, quantification.
- Discrete sequence: sequence spectrum, operations on sequences.
- Discrete-time system: definition, LIT systems, feasible systems, discrete systems and difference equations.
- Discrete-time random signals: random processes, characterisation of discrete-time random signals, random signal sampling,
- Sampling frequency change : resampling principles, decimation, interpolation.
2. Discrete signals transforms.
- Fourier transform for sequences : definition, existence condition, inverse Fourier transform, case of periodic sequences,
Fourier transform properties for a sequence, usual transforms.
- Z-transform: definition, existence, convergence domain and poles. Inverse Z-transform: calculation method, use for the study
of discrete-time systems.
- Discrete Fourier transform: definition, properties, case of non-periodic signals, apodisation window, Discrete Fourier
transform calculation algorithm, fast Fourier transform (FFT).
- Overview of the different transforms and their links.
3. Digital filtering.
- Digital filters, definition, formalism, stability criteria, linear phase fileters, minimal phase filter, all-pass filters, implementation structures, filter decomposition
- Finite impulse response filters (FIR), definition, properties, frequency response caracteristics, synthesis methods
- Infinite impulse response filters (IIR): definition, properties, first and second order cells response, synthesis and structures.

Bibliography :
1. A. Van Den Enden, N. Verhoeckx, "Traitement numérique du signal", Masson, 1992
2. M. Bellanger, "Traitement numérique du signal", Dunod, 1996

Requirements :
ESC05-TTSIA and ESC06-TSIA modules.

Organisation :
Study of class content. Practical exercises and lab work.

Evaluation :
2 two-hour written examinations
Mark for Practical Work.

Target :

Transmission lines and Waveguides	SRC07-LGUID
Number of hours : 30.00 h	2.00 ECTS credit
CM : 18.00 h, TD : 12.00 h	
Reference Teacher(s) : FOURN ERWAN	

Objectives :
This module aims to complete and give concrete expression to the student's theoretical knowledge of electromagnetism
through the study of transmission lines and waveguides.

Content :
1. Introduction: Maxwell's equations, electromagnetic theory, boundary conditions.
2. Waveguides: Definitions, calculation hypothesis, waveguide classification (open/closed, homogeneous, non-homogeneous,
guide/line, etc.) Propagation equations. Propagation modes: notion of modes, propagation study in a guide, mode classification
(TE, TM, TEM, hybrid), mode characteristics (dispersion diagram, impedance, power, currents, etc.). Perturbation method.
Study of usual guides: rectangular and circular wave guides, coaxial and planar lines: mono-mode and multi-mode
3. Transmission lines: Line theory: Telegrapher's equation, line characteristics (characteristic impedance, propagation constant,
phase velocity, group velocity, etc.). Loaded lines: Travelling waves and standing waves, reflection coefficient, standing wave
ratio, quarter-wavelength lines, half-wavelength lines, Smith chart, serial and parallel stub impedance matching . Introduction
to high frequency metrology: detection, split guide, reflectometry, SWR, phase angle and reflection coefficient measurements.
Vector network analyser.
4. Cavity resonators: Definition, resonance mode and frequency. Study of a cavity resonator: electromagnetic analysis, electric
equivalent circuit, coupling.

Bibliography :
1. P.F. COMBES, ""Micro-ondes"", DUNOD 1997
2. D.M. POZAR, ""Microwave engineering"", WILEY, 2nd edition, 1997

Requirements :
SRC06-ONDE and SRC06-PROPA modules.

Organisation :
Revision of lecture notes and practical exercises.

Evaluation :
Two Two-hour written examinations.

Target :

Digital Communications I	SRC07-CNUM1
Number of hours : 36.00 h	3.00 ECTS credit
CM : 20.00 h, TD : 10.00 h, TP : 6.00 h	
Reference Teacher(s) : HELARD MARYLINE	

Objectives :
An overview of the principles of digital communication.

Content :
1. History and principles of digital communications. Properties of digital communications.
2. From analog to digital communications. Classification of digital modulations Pulse modulation.
3. Details of a digital communication chain. Rate and spectral efficiency. Capacity.
4. Power spectral density of digital signal. Application to line codes and linear dogital modulations.
5. Optimal receiver and performance for illimited bandwidth base band signal transmission.
6 Digital modulations. Optimal receiver and performance for modulated signal transmission. (ASK, PSK, FSK, MSK, QAM, etc).
7. 6h Lab work: study of a digital transmission channel using Ptolemy.

Bibliography :
J. G. Proakis., ""Digital communications"", 6th J. G. Proakis., ""Digital communications"", 6th Edition, Mc Graw-Hill Int. Editions, 2003.
S. Beneddeto, E. Biglieri, V. Castellani, "Digital transmission theory", Prentice Hall International Editions
Communications numériques, M. Hélard, document polycopié.

Requirements :
SRC05-PRER ,SRC06-TSIA, SRC07-DESTI and SRC07-SINUM modules.

Organisation :
Revision of lecture notes and practical exercises.

Evaluation :
2 two-hour written examinations. Mark for practical work and continuous control.

Target :

VHDL	SRC07-VHDL
Number of hours : 24.00 h	2.50 ECTS credit
CM : 10.00 h, TD : 6.00 h, TP : 8.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
Design of digital circuits in VHDL: design, simulation, logic synthesis and test.

Content :
VHDL language syntax; behaviour, data flow and structural domains. Modelling of digital circuits. Simulation (notion of
test-bench), circuit synthesis, test. Design flow applied to programmable logic circuits. Practical work on FPGA circuits
(circuit design).

Bibliography :
La langage VHDL -Jacques Weber, Maurice Meaudre - Dunod Initiation au langage VHDL - Michel Aumiaux - Dunod.

Requirements :
ESC06-LPROG.

Organisation :
Revision of lecture notes. Preparation of practical work.

Evaluation :
Written examination. Mark for practical work.

Target :

C++ Object Oriented Programming	SRC07-INFO
Number of hours : 28.00 h	2.00 ECTS credit
CM : 14.00 h, TP : 14.00 h	
Reference Teacher(s) : ANQUETIL ERIC	

Objectives :
Object-oriented programming is a powerful tool in the design and development of "real software applications". It provides a
more reliable means of defining substantial projects while ensuring efficient follow-up of the different stages in their
development. It highlights the fundamental principles associated with C++ object-oriented programming.

Content :
Basic knowledge of C++ object and class: object construction, interface, encapsulation, etc. Memory management mechanisms: dynamic memory allocation, destructor, allocation, copy construction. I/O management. C++ object-oriented
design: inheritance, polymorphism, access controls, etc. Multiple inheritance, template. STL. Exception management. Internal
class. Frameworks programming and use.

Bibliography :
Conception oriented objects and applications- G. Booch - Addison-Wesley The C++ programming language (third edition) - B. Stroustrup - Addison-Wesley

Requirements :
4-49SPROB pre-specialisation module (Java object oriented programming), ESC06-INFO module.

Organisation :
Revision of lecture notes and preparation of laboratory work.

Evaluation :
Mark for laboratory work.

Target :

Digital Resolution Techniques	SRC07-MNUM
Number of hours : 38.00 h	3.00 ECTS credit
CM : 18.00 h, TD : 20.00 h	
Reference Teacher(s) : ZAHARIA GHEORGHE	

Objectives :
Digital resolution techniques (mathematics). Theoretical basics for modelling, analysis and optimisation problems. Implementation of numeric methods with calculators. Algorithm design using the MATLAB language.

Content :
1. Linear regression analysis - theory, implementation, modelling quality. Application in radio communications and electronics. Upper rank regression analysis.
2. Polynomial modelling. Lagrange and Newton bases. Modelling quality. C1 and C2-class cubic spline modelling using Bernstein base. Natural cubic splines. Application to electronics.
3. Mathematical tools for the simulation of a simple chain of digital communications. Modeling of the transmission channel. Independence of noise samples of the Gaussian transmission channel. Simulation of the source of data transmitted with known probabilities. Using the degree of confience and the error between the bit error rate (BER) and error probability p to determine the number of observed bits for a given signal-to-noise ratio (SNR).
4. Numeric integration. Lagrange base, quadrature formula order. Rectangle, trapezium methods. Simpson, Gauss-Lagrange methods. Application to probability and signal theory (link between Fourier Transform and Fast Fourier Transform (FFT), analog and digital convolution product, accuracy of numeric calculation. Applications.
5. Differential equations. Choice of discretisation step. Progressive, retrograde, centred differences. Link with the Z-transform.
Transfer function associated with a discretisation method, stability. Comparison with before-discretisation results using the bilinear transform and analogic method.

Bibliography :
1. J. Rappens, M. Picasso "" Introduction à l'analyse numérique "", Presses polytechniques et universitaires romandes, 1998
2. H. R. Schwartz "" Numerical Analysis - A comprehensive Introduction "", Wiley, 1989
3. H. Urkowitz "" Signal theory and random processes "", Artech House, 1983

Requirements :
ESC05-PRER module.

Organisation :
Study of course content and practical exercises.

Evaluation :
Two-hour written examination.

Target :

English	SRC07-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : LE TINNIER ANNE	

Objectives :
Acquiring the required skills for working in a firm as an engineer. Reaching the required level (B2) is compulsory in order to graduate.

Content :
-Learning by doing:
The student will have to be able to talk and listen, write documents while showing he/she can solve problems, reason, convince and demonstrate in an articulate manner.
-Expressing oneself accurately and fluently.
The student will engage in activities requiring creative and reactive skills (such as debates, role-plays, individual oral presentations using PowerPoint, projects), which will be based on scientific topics and current events.
-Writing CVs and cover letters
-Scientific English
-Discovering the professional world in an international context
-Preparing for the TOEIC (during the second semester, a specific "Toeic Booster" course will be available)

Bibliography :
- Robert and Collins Dictionary (bilingual edition), Collins Cobuild (English only)
- English Grammar in Use (Cambridge University Press)

Requirements :
1st, 2nd and 3rd year English courses (or equivalent)

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia language lab and computer rooms are also available and make it possible for the students to work in a stimulating environment. Our teaching resources include press articles, audio and video documents (TV reports, extracts from films and series). We also use the Internet.
Regular personal work is obviously required. The student must be curious and practise English outside the classroom as well.

Evaluation :
One two-hour written exam.

Target :

Economy and Management	SRC07-ECOGE
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course focuses on the complexity of the decision-making process in a company.
Main learning outcomes:
- Understanding information relative to marketing and finance
- The ability to use specific tools and vocabulary in the field of management
- Understanding the importance of teamwork: making collective decisions and producing the expected work in time

Content :
The course is mainly focused around a Business simulation game called Simbrand, which empowers participants to run their own virtual businesses. Just like in real life, the teams compete against each other in order to gain market shares. The right decisions lead to success while the wrong ones engender invaluable problem solving experiences. The learning process becomes efficient and fun, and allows ¿learning by doing¿ as well as ¿learning from mistakes¿.
As an outcome of the simulation exercise, participants will fully comprehend the different aspects of the marketing decision making process, their relationship with each other, and their impact on the company¿s overall results. In addition, participants will gain invaluable experience in teamwork and problem solving.
The simulation is based on an online platform that allows students to play in their own language (many languages available: English, Spanish, Portuguese, Chinese ¿).

Bibliography :
Provided during the course

Requirements :
none.

Organisation :
2 hours per week

Evaluation :
Each team produces a written report in French and makes an oral presentation in English

Target :

Sport and physical education	SRC07-EPS
Number of hours : 26.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : VAILLANT GERARD	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O. or
Kayak or golf.

Bibliography :
Several books are available to the students at the library. Links to internet sites are given on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Stages 3SRC	SRC07-STA3
Number of hours : 240.00 h	4.00 ECTS credit
DIV : 0.00 h	
Reference Teacher(s) : MERIC STEPHANE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Semestre 8

Parcours Formation Initiale SRC

1	**SRC08-1**		**Microwaves circuits and antennas**	**4.50**
	SRC08-CIRHF	O	Microwaves circuits	2.50
	SRC08-ANTEN	O	Antennas	2.00
2	**SRC08-2**		**Radar Systems and project**	**6.50**
	SRC08-SYRAD	O	Radar Systems	2.00
	SRC08-TSRS	O	Radar and Sonar Signal Processing	2.00
	SRC08-PROJ	O	Electronic Students projects	2.50
3	**SRC08-3**		**Communication Networks**	**6.00**
	SRC08-RES	O	Réseaux de base	1.00
	SRC08-CNUM2	O	Digital Communications 2	3.00
	SRC08-RADIO	O	Radiocommunications	2.00
4	**SRC08-HUMAS**		**Humanities**	**5.00**
	SRC08-ANGL	O	English	2.00
	SRC08-ECOGE	O	Economy and Management	2.00
	SRC08-EPS	O	Sport and Physical Education	1.00
5	**SRC08-STAGE**		**Work placement**	**8.00**
	SRC08-STAGE	O	Work Placement	8.00
6	**HUMT2-SAM(2)**		**SAM : APES Responsabilités Associatives**	**2.00**
	HUMT2-APES ASSO	F	Association membership & responsabilities 2 credits	2.00
7	**HUMT2-SAM(3)**		**SAM : APES Responsabilités Associatives**	**3.00**
	HUMT2-APES RESP	F	Association membership & responsabilities 3 credits	3.00
8	**HUMT2-ELSA ES**		**High Level Sport with Studies / Sports Management MODULE**	**1.00**
	HUMT2-ES	F	High-Level sport with studies	1.00
9	**HUMT2-SAM(1)**		**"SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility)**	**1.00**
	HUMT2-APES	F	APES	1.00

O = compulsary, C= in choice , F= optional

Microwaves circuits	SRC08-CIRHF
Number of hours : 54.00 h	2.50 ECTS credit
CM : 26.00 h, TD : 16.00 h, TP : 12.00 h	
Reference Teacher(s) : GILLARD RAPHAEL	

Objectives :
Techniques for analysing, designing and measuring electronic circuits in microwaves.

Content :
1. Representation and analysing methods for microwave circuits: S matrix, Signal flow graphs, even and odd modes method.
2. Coupled lines.
3. Study of passive circuits: elementary discontinuities, power splitter (directive couplers, junctions, power dividers), examples
of filters in planar technology, nonreciprocal passive circuits (isolators, circulators).
4. Study of active circuits: linear amplification (stability, power matching, gain, noise study); complete study of a narrow band
amplifier with one transistor; amplifier topologies: balanced amplifier, distributed amplifier.
5. Non linear analysis and Power amplifiers.
6. Practical work: Characterisation of microwave circuits with a network analyzer (calibration methods, complete characterisation of a 2-port circuit). CAD of microwave circuits (simulation and optimisation with the ADS simulator).

Bibliography :
Microwave Engineering, D.M. POZAR, Addison Wesley.

Requirements :
SRC06-ONDE, SRC06-PROPA, SRC07-LGUID modules.

Organisation :
Revision of lecture and practical work notes. Preparation of practical work.

Evaluation :
2 Two-hour written examinations.

Target :

Antennas	SRC08-ANTEN
Number of hours : 44.00 h	2.00 ECTS credit
CM : 16.00 h, TD : 10.00 h, TP : 17.00 h	
Reference Teacher(s) : LOISON RENAUD	

Objectives :
The study of antennas in order to support and complete studies on electromagnetism (theory).

Content :
1. Properties of radiation: radiation pattern, directivity, efficiency, radiation impedance. Transmission and reception.
2. Wire antennas : dipoles, loop antennas, Yagi antennas, log-periodic, feeding techniques.
3. Aperture radiation: electric and magnetic sources, equivalence principle, rectangular and circular apertures, uniform and
non-uniform lighting.
4. Microwave antennas: corners, reflector antennas.

Bibliography :
C. A. BALANIS, "Antenna theory, Analysis and design", John Wiley 1997
R.E. COLLIN, "Antenna theory" McGraw-Hill 1969

Requirements :
Completion of the following modules; SRC06-ONDE, SRC06-PROPA, SRC07-LGUID.

Organisation :
Revision of lecture and practical work notes. Preparation of practical work.

Evaluation :
Two-hour written examination. Mark for practical work.

Target :

Radar Systems	SRC08-SYRAD
Number of hours : 28.50 h	2.00 ECTS credit
CM : 16.00 h, TD : 8.00 h, TP : 4.50 h	
Reference Teacher(s) : MERIC STEPHANE	

Objectives :
Overview of pulse and continuous-wave Radar systems.

Content :
Radar systems, measurement of speed, measurement of speed and distance combined. Pulse Doppler Radar: principles, distance ambiguity, blind speed, fixed-echo elimination. Correlation Radar systems, pseudo-random code, other coding techniques. Applications.
Half-day practical session: installation of an outdoor pulse Radar, calibration with tetrahedral measurements on fixed obstacles (buildings, vegetation) and moving obstacles (vehicles), target fluctuation, Doppler effect.

Bibliography :
Principes de traitement des signaux radar et sonar - F. LE CHEVALIER - Masson Editeur
Radars - Bases modernes - M. CARPENTIER - Masson Editeur
Physique et théorie du radar - J. DARRICAU - Editions PGI Bagneux
Technique du radar classique - R. BENTEJAC - Masson Editeur
Initiation aux techniques modernes des radars - L. THOUREL - CEPADUES Editions

Requirements :
SRC06-ONDE, SRC06-PROPA and SRC07-ESNL.

Organisation :
Revision of lecture and practical exercise notes. Preparation of the half-day session.

Evaluation :
Two-hour written examination.

Target :

Radar and Sonar Signal Processing	SRC08-TSRS
Number of hours : 26.50 h	2.00 ECTS credit
CM : 16.00 h, TD : 6.00 h, TP : 4.50 h	
Reference Teacher(s) : MERIC STEPHANE	

Objectives :
The importance of the choice of radar signal to reduce uncertainties in the measurement of speed and distance. Measurement techniques (anechoic room). Basics of side-looking airborne radar (SLAR) and sonar systems.

Content :
1. Uncertainties in distance and speed measurements, ambiguity functions in distance and speed, generalised ambiguity function, uncertainty principle. Properties of ambiguity functions associated with the pulse signal with and without frequency shift-keying, finding the ideal radar signal for a given application. Pseudorandom sequence radar and pulse compression radar.
2. Principles of measurement in an anechoic chamber, structure and qualities of anechoic chambers, ultra high frequency absorbers, scalar and vectorial measures, influence of polarisation, Fraunhofer area, measurement of impulse responses, windowing, holographic measurements, localisation of stationary phase centres. Introduction to electromagnetic imaging.
3. Practical half-day : measurements of RCS (Radar Cross Section) in anechoic chamber.
4. Seminar on radar remote sensing separated into two large-scale subjects: (a) physical (propagation, wave-matter interaction, and polarisation) and (b) processing (radar image design, pulse compression and synthetic aperture).
5. Principle of active and passive sonar, notions of submarine acoustics, propagation, reverberation. Characteristics of a sonar signal, carrier noise and transmission environment. Sonar equations.

Bibliography :
""Traitement des images de RSO"" (sous la direction de Henri Maître), Traité IC2, collection Hermès, 2001

Requirements :
SRC06-ONDE, SRC06-PROPA, SRC07-ESNL, SRC07-SYRAD.

Organisation :
Revision of lecture and practical work notes. Preparation of the practical "half-day".

Evaluation :
Two-hour written examination.

Target :

Electronic Students projects	SRC08-PROJ
Number of hours : 30.00 h	2.50 ECTS credit
PR : 30.00 h	
Reference Teacher(s) : LEMOINE CHRISTOPHE	

Objectives :
Realization of the project defined during the first semestria. Achivement of the solutions. demonstrations

Content :
during this semestria, students have to realized what they have proposed during the first semestria (SRC07-CDC):
- test on unitary part
- integration
- analyse of the schedule

For each group, a legacy professor assists them in order to help to find solutions, to give contacts, to analyse the problems, to
propose additionnal tests

Bibliography :
Previous projects, lessons from teachers, internet

Requirements :

Organisation :
home work,

Evaluation :
3 evaluations :
- the report
- the presentation
- the demonstration

students have to give a CD containing all the materials (codes, schemes, references, images, video, reports of tests). All the
projects are saved

Target :

Réseaux de base	SRC08-RES
Number of hours : 20.00 h	1.00 ECTS credit
CM : 20.00 h	
Reference Teacher(s) : UZEL FABIENNE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Digital Communications 2	SRC08-CNUM2
Number of hours : 70.00 h	3.00 ECTS credit
CM : 36.00 h, TD : 12.00 h, TP : 22.00 h	
Reference Teacher(s) : HELARD MARYLINE	

Objectives :
This second session of digital communications follows the first session SRC07-CNUM1 and deals with digital transmissions over band-limited channels, the design of the associated receivers and taking into account various transmission impairments. Furthermore, the basis techniques in channel coding and multicarrier modulation (OFDM) technics are presented within this session.

Content :
Digital communications (18h de cours, 8 heures de TD)

1. Band limited transmission : intersymbol interference (ISI), Nyquist criterion, eye diagram and constellations, throughput and spectral efficiency.
2. Discrete equivalent channel and various types of channels (Rice, Rayleigh)
3. Receiver optimisation : matched filter concept, optimal receiver, MAP criterion, linear filter receivers. Introduction to equalization.
4. Synchronisation : carrier frequency and sampling frequency recovery. Digital PLL.
5. Digital modulation choice criteria: noise immunity, non linearities, interchannel interferences, multipaths channels, spectral efficiency/Shannon limit

Introduction to channel coding : (10 heures de cours, 2 heures de TD)
Introduction to channel coding. Capacity of a transmission channel. Channel coding theorem.

Bloc codes. Definition. General properties of linear block codes. Generator and parity check matrices. Detection and correction of transmission errors. Minimum distance and performance of bloc codes. Some examples of linear block codes. Cyclic bloc codes. Définition. Some examples. Decoding technics. Error probability of block codes. Performance and coding gain.

Convolutional codes. Main principles of the convolutional codes. Tree, trellis and state diagrams. Decoding of convolutional codes. The Viterbi algorithm. Performance of the convolutional codes. Punctured convolutional codes. Exemples and applications of the convolutional codes.

Introduction to multicarrier modulations (8 heures de cours, 2 heures de TD)
The radio mobile channel. Frequency selectivity and time selectivity. Main principles of multicarrier modulations (Orthogonal Frequency Division multiplex ¿ OFDM). FFT algorithm implementation of OFDM systems. Association to channel coding technics : Coded OFDM. Differential demodulation Channel estimation technics and coherent demodulation. Performance of COFDM systems. Application to Digital Audio Broadcasting (DAB) and to Terrestrial Digital video Broadcasting (DVB-T, DVB-T2).

Bibliography :
S. Beneddeto, E. Biglieri, V. Castellani, "Digital transmission theory", Prentice Hall International Editions H. Meyr , M. Moeneclaey , "Digital communication receivers, volume 2 : synchronization, channel estimation and signal processing"
J. G. Proakis., "Digital communications", 6th Edition, Mc Graw-Hill Int. Editions, 2003.
Communication systems, S. Haykin, John Wiley & Sons, 2001 Éléments de communications numériques, J. C. Bic, D. Duponteil, J. C. Imbeaux , Dunod. CNET ENST,1987
Communications numériques, A. Glavieux, M. Joindot, Collection pédagogiques des Télécommunications,
S. Beneddeto, E. Biglieri, V. Castellani, "Digital transmission theory", Prentice Hall International Editions H. Meyr , M. Moeneclaey , "Digital communication receivers, volume 2 : synchronization, channel estimation and signal processing"
J. G. Proakis., "Digital communications", 6th Edition, Mc Graw-Hill Int. Editions, 2003.
Communication systems, S. Haykin, John Wiley & Sons, 2001 Éléments de communications numériques, J. C. Bic, D. Duponteil, J. C. Imbeaux , Dunod. CNET ENST,1987
Communications numériques, A. Glavieux, M. Joindot, Collection pédagogiques des Télécommunications,
Masson, 1996.
Signal et communication numérique. Egalisation et synchronisation, Jean-Marc Brossier, Collection Traitement du signal, Hermès, Paris, 1997.

Requirements :

SRC07-CNUM1 SRC07-SINUM

Organisation :
Study of class content. Practical exercises and lab work.

Evaluation :
2 two-hour written examinations including questions about lab exercises.

Target :

Radiocommunications	SRC08-RADIO
Number of hours : 39.00 h	2.00 ECTS credit
CM : 20.00 h, TD : 10.00 h, TP : 9.00 h	
Reference Teacher(s) : EL ZEIN GHAIS	

Objectives :
Study of different kinds of propagation and radio links. Characterisation and modelling of radioelectric channels.

Content :
1. Introduction to radio communications: free space propagation, receiving power, characteristics of antennas, link power
budget, interference.
2. Modelling the environment: ground waves, ground reflections, atmospheric refraction, tropospheric scattering, diffraction,
rain and vegetation effects, depolarisation, multipath and fading, prediction models.
3. Radio links: ionospheric, tropospheric, satellite and mobile radio links.
4. Characterisation of nonstationary transmission channels: time, frequency and time-frequency domains, Doppler delay.
5. Diversity reception techniques: space, frequency, time, polarisation, multipath and arrival angle diversities.

Bibliography :
L. Boithias, ""Propagation des ondes radioélectriques dans l'environnement terrestre"", Dunod 84.
Introduction aux radiocommunications, G. El Zein, document polycopié.

Requirements :
ESC05-TTSIA, ESC06-ONDE, ESC06-PROPA, ESC07-CNUM, ESC08-ANTEN.

Organisation :
Revision of lecture and practical work notes. Preparation of practical work.

Evaluation :
2 two-hour written examinations.

Target :

English	SRC08-ANGL
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : LE TINNIER ANNE	

Objectives :
Acquiring the required skills for working in a firm as an engineer. Reaching the required level (B2) is compulsory in order to graduate.

Content :
-Learning by doing:
The student will have to be able to talk and listen, write documents while showing he/she can solve problems, reason, convince and demonstrate in an articulate manner.
-Expressing oneself accurately and fluently.
The student will engage in activities requiring creative and reactive skills (such as debates, role-plays, individual oral presentations using PowerPoint, projects), which will be based on scientific topics and current events.
-Writing CVs and cover letters
-Scientific English
-Discovering the professional world in an international context
-Preparing for the TOEIC (during the second semester, a specific "Toeic Booster" course will be available)
-Presentations based on projects using CESIM, a game used in the Business Management class.

Bibliography :
- Robert and Collins Dictionary (bilingual edition), Collins Cobuild (English only)
- English Grammar in Use (Cambridge University Press)

Requirements :
1st, 2nd and 3rd year English courses (or equivalent)

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia language lab and computer rooms are also available and make it possible for the students to work in a stimulating environment. Our teaching resources include press articles, audio and video documents (TV reports, extracts from films and series). We also use the Internet.
Regular personal work is obviously required. The student must be curious and practise English outside the classroom as well.

Evaluation :
TOEIC test (end of semester)
An individual oral presentation

Target :

Economy and Management	SRC08-ECOGE
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course focuses on economic, legal and social matters. Students are encouraged to develop their curiosity and their ability to analyse topics related to the general environment of a company.
Main learning outcomes:
- Understanding key concepts related to a firm¿s environment and strategies
- The accumulation of high-quality information on these topics
- Establishing a strong, specific- vocabulary base
- Understanding how different stakeholders act

Content :
- Economics: How markets operate. Growth, financing and regulation of the economy
- Law: Corporate law. Industrial and intellectual property rights
- Management: Project management. Corporate social responsibility

Bibliography :
Provided during the course

Requirements :
None.

Organisation :
2 hours per week

Evaluation :
Continuous assessment (collective work) + final examination (2 hours)

Target :

Sport and Physical Education	SRC08-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : VAILLANT GERARD	

Objectives :
Team work, discovery of one's capabilities, communication, invention, autonomy, self-discovery and management responsibilities

Content :
Whole class: "role of the coach, role of the referee, management" (knowledge of the rules, getting involved, leading, decision
making and communicating). Practice and knowledge of the sociomotive roles involved in the strategies of team attack and
team defence. Finding one's place in a group and awareness of your team-mates and their responsibilities.

Bibliography :
Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Work Placement	SRC08-STAGE
Number of hours : 28.50 h	8.00 ECTS credit
TD : 1.00 h	
Reference Teacher(s) : MERIC STEPHANE	

Objectives :
This summer work placement must allow the student to acquire practical experience in a professional environment. The
student will aim to develop his teamwork, communication and observation skills, and improve his capacity to integrate a
business environment.

Content :
- Work placement with agreement (assistant engineer level).
- At least 8 weeks duration.
- In France or abroad.
- Can be carried out in the interim between the 3rd and 4th year or between the 4th and 5th year of studies.

Bibliography :

Requirements :

Organisation :
Writing of a training report.

Evaluation :
The training report is reviewed and evaluated thanks to an assessment form.

Target :

Association membership & responsabilities 2 credits	HUMT2-APES ASSO
Number of hours : 14.00 h	2.00 ECTS credit
DIV : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Association membership & responsabilities 3 credits	HUMT2-APES RESP
Number of hours : 20.00 h	3.00 ECTS credit
DIV : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

High-Level sport with studies	HUMT2-ES
Number of hours : 6.00 h	1.00 ECTS credit
CM : 6.00 h	
Reference Teacher(s) : VAILLANT GERARD	

Objectives :
Students must set out and structure a personal project to establish the best possible coherence between engineering studies at
INSA and a career as a high-level athlete. Acquisition of specific knowledge and know-how.

Content :
- Lessons and conferences on the tools of project management.
- Guided work on project building (personal career).
- Stress management. Relaxation therapy. Action type profiling. Mental preparation. Athletic traumatology. Motivation.
Dietetics. Physical preparation.
Organisation : Lessons, and evening conferences.

Bibliography :
Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education website.

Requirements :

Organisation :

Evaluation :
Production of a personal-career dossier. Oral presentation (30 minutes).
The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :
Maximum 4 semestrial registrations throughout the whole cursus.

APES	HUMT2-APES
Number of hours : 30.00 h	1.00 ECTS credit
DIV : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Semestre 9

Parcours Formation Initiale SRC

1	**SRC09-1**		**Communication techniques**	**9.50**
	SRC09-TCCOMP	O	Multicarrier modulations	1.50
	SRC09-TCMIMO	O	MIMO	1.00
	SRC09-TCETA	O	Spread Spectrum Techniques	1.00
	SRC09-TCFIBRES	O	Multicarrier modulations	1.50
	SRC09-TCRECA	O	Channel Equalization	1.50
	SRC09-TCANT	O	Network antennas	1.50
	SRC09-TCCEM	O	Electromagnetic compatibility (EMC). Electromagnetic compatibility (EMC). Electromagnetic compatibility (EMC).	1.50
2	**SRC09-2**		**Networks, digital systems and project**	**8.50**
	SRC09-TCRCBASE	O	Communication Networks basics	1.50
	SRC09-TCRCCROSS	O	Cross Layer	1.00
	SRC09-TCBE	O	Design Office Project and Conferences	2.50
	SRC09-TCSN-EMB	O	Introduction to Embedded Systems	1.00
	SRC09-TCSNREAL	O	Real Time Processing	1.50
	SRC09-CONF	O	Conference	1.00
3	**SRC09-3**		**Elective modules**	**6.50**
	SRC09-MOCRIP	C	Advanced IP Networks	2.50
	SRC09-MOCRIWIRELESS	C	Wireless Networks	1.50
	SRC09-MOCREMB	C	Réseaux Embarqués	1.00
	SRC09-MOCRPROJ	C	Projet Tutoré	1.50
	SRC09-MOCNPROJ	C	Digital Design Project	1.50
	SRC09-MOIRHINT	C	Integration and reconfigurability	2.50
	SRC09-MOIRHPL	C	Deterministic tools for planning and optimizing wireless networks	2.50
	SRC09-MOIRHPROJ	C	Project	1.50
	SRC09-MOCNSYSC	C	Introduction to SystemC	1.50
4	**SRC09-HUMAS**		**Humanities**	**5.50**
	SRC09-SPEC	O	Project Management	2.00
	HUMT1-PGE-A	C	Economics, Law and Business Studies A (serious game)	2.00
	HUMT1-PGE-B	C	Economics, Law and Business Studies B (Lean six sigma)	2.00
	HUMT1-PGE-C	C	Economics, Law and Business Studies C (human resource management)	2.00
	HUMT1-PGE-D	C	Economics, Law and Business Studies D (Marketing for ICT Companies)	2.00
	HUMT1-PGE-E	C	Economics, Law and Business Studies E (Industrial design and innovation)	2.00
	HUMT1-PGE-F	C	Economics, Law and Business Studies F (Mangement and decision making)	2.00
	HUMT1-ANGL/CONV	C	English S9 Conversation	1.50
	HUMT1-ANGL/TOEIC	C	TOEIC 5th year	1.50

O = compulsary, C= in choice , F= optional

Multicarrier modulations	SRC09-TCCOMP
Number of hours : 20.00 h	1.50 ECTS credit
CM : 8.00 h, CM : 12.00 h	
Reference Teacher(s) : HELARD MARYLINE	

Objectives :
To provide an overview of the channel coding techniques and multicarriers

Content :
Channel coding: Introduction to channel coding. Capacity of a transmission channel,
Shannon's theorem. Presentation of block codes, Galois fields, Cyclic block codes, Convolutional codes

Multi-carriers :
Multicarrier modulations. Characteristics of the radio channel. Principle of multicarrier modulations and their applications to the mobile radio channel. Association of channel coding techniques and multicarrier modulations: COFDM system.
Reception techniques, channel estimation and time and frequency synchronization. COFDM system performance. Implementation of multicarrier modulation in digital audio broadcasting (DAB -Digital Audio Broadcasting and DRM) Digital Television Terrestrial (DVB-T, DVB-T), wireless local area networks (WLAN) access networks (BWA), wireless personal area networks (WPAN), ... multicarrier spread spectrum techniques and their applications in B3G and 4G cellular networks.

Bibliography :
A. Glavieux, "Codage de canal, des bases théoriques aux turbo-codes", Hermès, 2005
B. Vucetic, J. Yuan , "Turbo-codes, principes et applications", Kluwer, 2001
K. Fazel, S. Kaiser "Multi-Carrier ans Spread Spectrum systems", Wiley, 2003

Requirements :
SRC08-CNUM2

Organisation :

Evaluation :
1 hour exam

Target :

MIMO	SRC09-TCMIMO
Number of hours : 16.00 h	1.00 ECTS credit
CM : 16.00 h	
Reference Teacher(s) : HELARD MARYLINE	

Objectives :
To Present multi-antenna techniques and their respective applications.

Content :
MIMO/ Presentation of the different time space schemes: spatial multiplexing, space-time coding, orthogonal and non-orthogonal beamforming. Associated receivers: optimal linear, iterative

Bibliography :

Requirements :

Organisation :

Evaluation :
1 hour exam

Target :

Spread Spectrum Techniques	SRC09-TCETA
Number of hours : 24.00 h	1.00 ECTS credit
CM : 18.00 h, TP : 6.00 h	
Reference Teacher(s) : EL ZEIN GHAIS	

Objectives :
To present the spread spectrum techniques, the multicarrier modulations, the multi-antenna technology and their respective applications.

Content :
Spread spectrum techniques. History of spread spectrum and basic principles.
Direct sequence, frequency hopping, time slots, frequency sweep.
Coding: maximum length codes, Gold codes, Kasami of, Hadamard, Barker codes, JPL.

Synchronisation: acquisition and maintenance of synchronization. Study of performance in the presence of white noise, of jammers. Multiple accesses in a multipath context.

Applications of spread spectrum: Addressing selective division multiple access codes, low interference to other emissions, low probability of intercept, difficulty listening, interference rejection, suppression of multiple discharges, high resolution radiolocation.

Examples of applications:
cellular networks (UMTS), Wireless Local Area Networks son (WiFi, Bluetooth), satellite (Globalstar), radiolocation (GPS), automotive and home automation.

spatial multiplexing, space-time coding orthogonal and non-orthogonal beamforming. Associated receivers: optimal linear, iterative.

Bibliography :
R. C. Dixon, "Spread Spectrum systems", Wiley, 1984

Requirements :
SRC07-CNUM and SRC09-TCEC

Organisation :

Evaluation :
1 hour exam

Target :

Multicarrier modulations	SRC09-TCFIBRES
Number of hours : 20.00 h	1.50 ECTS credit
CM : 20.00 h	
Reference Teacher(s) : HELARD JEAN FRANCOIS	

Objectives :
To provide an overview of the communication using optic fibers

Content :
Technology : multimode step-index and graded index. Guiding mechanism, analysis and definition of the guided modes. Dispersion of multimode fibers. Attenuation of the optical fibers and nonlinear effects.
Transmitters and couplers and the optoelectronic transmission: light emitting diodes and laser diodes.
Receiver : PIN photodiodes and avalanche photodiodes. Direct detection: performance optimization of the preamplifier
Wavelength multiplexing, amplification and optical heterodyne reception, external modulators. Digital transmission over fiber. Optimization of the link: choice of codes and modulation, link budget
Applications : Transmission over fiber telecommunications networks: digital hierarchy, optical fiber network in the international, long distance terrestrial network, the distribution network.

Bibliography :
Les fibres optiques, Notions fondamentales (Câbles, Connectique, Composants, Protocoles, Réseaux...), J.M. MUR

Requirements :
SRC07-CNUM and SRC09-TCCO

Organisation :

Evaluation :
1 hour exam

Target :

Channel Equalization	SRC09-TCRECA
Number of hours : 24.00 h	1.50 ECTS credit
CM : 12.00 h, TD : 6.00 h, TP : 6.00 h	
Reference Teacher(s) : HELARD MARYLINE	

Objectives :
To provide a large overview of receive and equalization techniques

Content :
1. Transmission over frequency selective channel.
2. MAP criterion. Optimal and sub optimal receivers.
3. Adaptive equalization techniques. Different existing algorithms. Adjustment coefficients (LMS, RLS, CMA, ...), main structures and filtering modes and operating phases (acquisition, tracking, blind equalization, sequences learning).
4. Structures and recursive transversal equalizer. Nonlinear equalizer decision feedback (DFE).
5. Advanced Receiver Techniques: iterative reception.
Presentation of many examples.

Bibliography :
J. G. Proakis ,« Digital Communications », ,McGraw-Hill International Editions
B. Widrow, S. D. Stearns, « « Adaptive Signal processing », Prentice Hall International Editions. Signal processing series
S. Benedetto, E. Biglieri, V. Castellani, "Digital transmission theory",Prentice Hall International Editions
S. Haykin, "Adaptive Filter Theory", Prentice Hall International Editions
F. Michaux, « Méthodes adaptatives pour le signal. Outils mathématiques et mise en oeuvre des algorithmes »,Hermès

Requirements :
SRC07-CNUM and SRC07-DESTI

Organisation :
Study of courses and tutorials. Preparation of the practical sessions.

Evaluation :
1 hour exam

Target :

Network antennas	SRC09-TCANT
Number of hours : 28.00 h	1.50 ECTS credit
CM : 14.00 h, TD : 8.00 h, TP : 6.00 h	
Reference Teacher(s) : GILLARD RAPHAEL	

Objectives :
To present the principles of antennas' arrays

Content :
Antenna arrays: array factor, uniform linear array and regular phased arrays, planar arrays.
Introduction to synthesis techniques. Coupling in networks. Distribution circuits (application to planar technology).
Introduction to multi-beam antennas and adaptive antennas.

Bibliography :
Antenna theory : analysis and design, C.A. BALANIS, ed. J.Wiley
IMC analysis and computational models, F. TESCHE, M. IANOZ, T. KARLSSON, ed. J. Wiley

Requirements :
SRC08-ANTEN, SRC08-CIRHF

Organisation :
Study courses and literature.
A part of the course is provided with a e-learning platform containing tutorials.

Evaluation :

Target :

Electromagnetic compatibility (EMC). Electromagnetic compatibility (EMC). Electromagnetic compatibility (EMC).	SRC09-TCCEM
Number of hours : 20.00 h	1.50 ECTS credit
CM : 14.00 h, TP : 6.00 h	
Reference Teacher(s) : BESNIER PHILIPPE	

Objectives :
To present the concepts of electromagnetic compatibility (EMC)

Content :
Electromagnetic compatibility (EMC). Physical phenomena related to EMC, electromagnetic coupling modes. Electromagnetic effects on victims (disturbances in conduction and radiation). Ground and masses : design of earth networks, mass signals (analog cards, digital and mixed). Network design mass of an electronic card. European directives, CISPR recommendations, classification, standardized tests, measurements conditions, EMC measures, standards' contents.
Means of protection: electromagnetic shielding, shielding effects and mechanism, conduction protection (filters, limiters, protective components), power protection, ...

Bibliography :

Requirements :

Organisation :

Evaluation :
2 hours exam

Target :

Communication Networks basics	SRC09-TCRCBASE
Number of hours : 26.00 h	1.50 ECTS credit
CM : 22.00 h, TP : 4.00 h	
Reference Teacher(s) : UZEL FABIENNE	

Objectives :
Acquisition of the fundamentals of networking through a description of the main techniques and their applications. Basic concepts of network security.

Content :
Telecommunication networks [6 HC]: Cellular Network: 3G, others (DCS 1800, CDMA). Architecture, radio interface protocol. Global satellite network type star, Eridium, INMARSAT.

Wired networks [12 HC]: IP / TCP / UDP / RIP X25/Frame Relay / ATM, ADSL / xDSL, PLC. Hybridization techniques and wireless communication.

Network security [4HC]

Bibliography :
Gilbert MARTINEAU, Laurent TOUTAIN, Alain LEROY, édition Hermes.
Wireless Ad Hoc and Sensor Networks, Raja Jurdak, Springer.

Requirements :
SRC08-FIBRES, SRC07-CNUM1,SRC08-CNUM2, SRC06-INFO, SRC08-RADIO

Organisation :

Evaluation :
2 hours exam

Target :

Cross Layer	SRC09-TCRCCROSS
Number of hours : 10.00 h	1.00 ECTS credit
CM : 10.00 h, TP : 0.00 h	
Reference Teacher(s) : MARY PHILIPPE	

Objectives :
Introduce new ways to optimize the wireless communication systems by studying the dependence between layers in the OSI model. The course focuses on the lowest layers, i.e. PHY, MAC and Network.

Content :
1 - Remind on the different layers of the OSI and TCP / IP models. Relevant criteria for the conception of PHY / MAC layers.
2 - Capacity region, achievable data rate.
3 - Convex optimization tools for resource allocation problems in wireless communications: water-filling, best user scheduling.
4 - MAC / Link spectral efficiency ; packet error rate.
5 - Cross-layer conception criteria: instantaneous delay, average delay, jitter.
6 - Impact of non-reliable radio links on the network graph connectivity.
7 - A cautionary approach of cross-layer design.

Bibliography :
Ana I. Pérez-Neira, Marc Realp Campalans, "Cross-layer Resource Allocation in Wireless Communications", Elsevier.

Marvin K. Simon, Mohamed Slim-Alouini, "Digital Communication Over Fading Channels", Wiley.
David Tse, Pramod Viswanath, "Fundamentals of Wireless Communications".

Requirements :
The courses : TCM05-MATHS (Probability), SRC06 - TTSAA, SRC07 - DESTI, SRC07-CNUM1 and 2, SRC08 - basics of network, SRC08 - Radiocom.

Organisation :
Lectures of 2 hours with exercises.

Evaluation :
2 hours exam.

Target :

Design Office Project and Conferences	SRC09-TCBE
Number of hours : 32.00 h	2.50 ECTS credit
PR : 20.00 h	
Reference Teacher(s) : HELARD MARYLINE	

Objectives :
Carry out a technical project team and applying concrete scientific methods of project management. Enhance training through technical conferences.

Content :
1. The main objectives of these projects are to carry out scientific work requiring specific organizational efforts. The proposed topics involve reflection, literature and theoretical studies, experimental developments in the form of actions or concrete achievements. Students work in dedicated time slots and have free access to experimental resources including those of the IETR research laboratory "Institute of Electronics and Telecommunications of Rennes
The work of each group leads to a report and to an oral presentation. The idea of these projects relies in putting the students in a situation as close as possible to the industrial reality. They are sometimes carried out in the framework of collaborations with industry.

2. Each year, a number of conferences are offered to students on specific topics. They are provided by external experts from the scientific, industrial and academic world.

Bibliography :
Previous year's design office reports.

Requirements :

Organisation :
This module involves a great deal of personal input.

Evaluation :
3 marks corresponding to the report evaluation, the oral presentation evaluation and the work that has been performed

Target :

Introduction to Embedded Systems	SRC09-TCSN-EMB
Number of hours : 10.00 h	1.00 ECTS credit
CM : 4.00 h, TP : 6.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
Introduction to embedded systems (technology, management, hardware/software co-design). Case study on a SOPC platform (Altera FPGA).

Content :
Technology of embedded systems: ASIC, FPGA, Study of different reconfigurable circuits (Xilinx, Altera, ...). Introduction to rapid prototyping tools from system to physical level.

Bibliography :

Requirements :
SRC07-LPROG

Organisation :

Evaluation :
Practical training session

Target :

Real Time Processing	SRC09-TCSNREAL
Number of hours : 16.00 h	1.50 ECTS credit
CM : 10.00 h, TP : 6.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
Study of real time operating systems and application examples.

Content :
Various fields of applications, embedded systems, kernel architecture, Kernel services (tasks, synchronizations, communications), multi-processes/multi-processors programming, scheduling policies, memory management.

Applications: embedded systems for signal processing (telecommunication, image / video) in automotive, avionics, etc. ....
Systems with strong real time constraints, system management / supervision.

Practical work on MicroC-OSII.

Bibliography :

Requirements :

Organisation :

Evaluation :
2 hours exam

Target :

Conference	SRC09-CONF
Number of hours : 20.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
To provide an overview on different telecommunication domain for the engineers.

Content :
It includes the conferences organised during the « Semaine des télécommunications » , 3 days
Areas covered :
LTE/4G, PLC (power line communication), RFID , security in networks, smart grids, green radio, ¿

Conferences are driven by industry like OBS, RENESAS, THALES, or small businesses

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Advanced IP Networks	SRC09-MOCRIP
Number of hours : 24.00 h	2.50 ECTS credit
CM : 10.00 h, CM : 8.00 h, TD : 6.00 h	
Reference Teacher(s) : UZEL FABIENNE	

Objectives :
Extensions and new applications of high-speed networks, wireless, wired and embedded. Study of the routing mechanisms and quality of service.

Content :
IP techniques [10HC]: ipv4 to ipv6 Evolutions, ipv4 and ipv6 compatibility, quality of service. Routing inside and between networks (MPLS, BGP)

Wired networks [8HC, 6HTD]: VOIP, IPTV, routing, security VLAN, VPN

Bibliography :
Gilbert MARTINEAU, Laurent TOUTAIN, Alain LEROY, édition Hermes
Réseaux haut débit (2ème édition) (Coll. réseaux et télécommunications) [e-book] , ROLIN Pierre

Requirements :
SRC08-FIBRES, SRC07-CNUM1, SRC08-CNUM2, SRC09-TCRC

Organisation :

Evaluation :
2 hours exam

Target :

Wireless Networks	SRC09-MOCRIWIRELESS
Number of hours : 10.00 h	1.50 ECTS credit
CM : 6.00 h, TD : 4.00 h	
Reference Teacher(s) : EL ZEIN GHAIS	

Objectives :
Review of data wireless protocols, applications.

Content :
Wireless data networks overview: Wimax, 802.11, Bluetooth, ZigBee. Architecture of the networks, signalisation, data flow. Data and voice convergence. PHY , MAC and application layers.

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Réseaux Embarqués	SRC09-MOCREMB
Number of hours : 6.00 h	1.00 ECTS credit
CM : 6.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Projet Tutoré	SRC09-MOCRPROJ
Number of hours : 24.00 h	1.50 ECTS credit
TP : 24.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Digital Design Project	SRC09-MOCNPROJ
Number of hours : 24.00 h	1.50 ECTS credit
TP : 24.00 h	
Reference Teacher(s) :	

Objectives :
The role of this project is to apply all the concepts of Digital Design on a real application.

Content :
This 24 hours project aims to implement all the concepts learned in the SRC09-MOCNVHD and SRC09-SYSC module.
It starts with a SystemC modeling of a complex digital communication circuit (software and hardware blocks) for system simulation and platform sizing.
It ends up with the implementation of the circuit onto a real FPGA platform composed of software and hardware parts.

Bibliography :

Requirements :
SRC09-MOCNVHD and SRC09-SYSC

Organisation :

Evaluation :
Project evaluation

Target :

Integration and reconfigurability	SRC09-MOIRHINT
Number of hours : 26.00 h	2.50 ECTS credit
CM : 18.00 h, TD : 8.00 h	
Reference Teacher(s) : FOURN ERWAN	

Objectives :
To study the concepts of microwave circuits and systems

Content :
Presentation of the technologies that are used in integrated radio front-ends (MMICs, MEMS, printed antennas, Systems in Package SiP-, ...);
study of architectures and topologies used in reconfigurable devices ("smart antennas" , reconfigurable active networks, ...)

Bibliography :

Requirements :
SRC08-CIRHF, SRC08-ANTEN, SRC05-PRER, SRC08-SYRAD

Organisation :

Evaluation :
1 hour exam

Target :

Deterministic tools for planning and optimizing wireless networks	SRC09-MOIRHPL
Number of hours : 16.00 h	2.50 ECTS credit
CM : 16.00 h	
Reference Teacher(s) :	

Objectives :
The main objective of this lecture is to present the theoretical tools describing the diffraction phenomena. These descriptions make possible to establish the deterministic radio channel response. Thus, this lecture is useful to get a basic background to understand the planning and optimizing wireless network tools.

Content :
Radio planning tools (deterministic model of the propagation channel), propagation prediction in urban areas by using the concepts of diffraction and scattering of electromagnetic waves on buildings, Analysis methods related to physical optics (assumptions of PO, limitations of PO, stationnary phase formulation), to geometrical optics (`formulation of Sommerfeld-Runge, reflection and refraction rays, ray-tracing method), the geometrical theory of diffraction (edges and discontinuities) and the uniform theory of diffraction (surface diffraction and creeping waves).

Bibliography :

Requirements :
SRC08-CIRHF, SRC08-ANTEN, SRC05-PRER, SRC08-SYRAD

Organisation :

Evaluation :
1 hour exam

Target :

Project	SRC09-MOIRHPROJ
Number of hours : 24.00 h	1.50 ECTS credit
PR : 24.00 h	
Reference Teacher(s) :	

Objectives :
Study the concepts of circuits and microwave subsystems on radio planning techniques. Become familiar with corresponding characterization and design tools.

Content :
Design of a head RF transceiver (power amplifier, mixer, filter, ...). Simulation using commercial tools circuits, antennas and systems (Agilent ADS and Momentum, HFSS, ...) additional metrology on network analyzers.

Bibliography :

Requirements :
SRC08-CIRHF, SRC08-ANTEN, SRC05-PRER, SRC08-SYRAD

Organisation :

Evaluation :
Project evaluation

Target :

Introduction to SystemC	SRC09-MOCNSYSC
Number of hours : 14.00 h	1.50 ECTS credit
CM : 8.00 h, TP : 6.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
This lecture aims at presenting the System Design languages (SystemC) for complex system designing. Special emphasis will be given on modelling across different levels of abstraction from untimed via timed transaction level models down to register transfer models including the needed refinement steps.

Content :
1. Requirements for a system methodology in order to design a system. Overview of existing methodologies
2. Presentation of the System C language syntax. :
   -Programming environment.
   -Concepts of module, port, channel, interface.
   Channels, ports, interfaces, Module constructor
   Events, Event queue
   Thread processes, Method processes
   Module instantiation (in modules)
3. Simulation of complex systems with System C.
4. Labs on a transmission system. Simulation of the system and implementation on an embedded SOC.

Bibliography :

Requirements :

Organisation :

Evaluation :
1 hour exam

Target :

Project Management	SRC09-SPEC
Number of hours : 12.00 h	2.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) :	

Objectives :
Teaching students the fundamentals of Project Management and practice within specific projects.

Content :
Project's Organization
Planning, analysis and formalization of individual and team goals.
Methodological tools for project management
Analysis of deviations from the specifications
Risk Management
All the concepts covered in this course will be applied to a specific case study within dedicated projects (SRC09 TCBE
module).

Bibliography :

Requirements :

Organisation :

Evaluation :
Oral defense of the project (Implementation of the lecture's concepts)

Target :

Economics, Law and Business Studies A (serious game)	HUMT1-PGE-A
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
-Establishing a strong, specific vocabulary base
-Understanding the main issues that industrial companies deal with (in a specific management field).
-Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Business Simulation (serious game) (24h / in English)
The business simulation ¿Global Challenge¿ (a CESIM product) has been designed to improve the understanding and knowledge of the complexity of global business operations in a dynamic, competitive environment. It focuses on strategic management, international management and business policy.
The task for the student teams is to manage a global mobile telecommunications company through technological and market evolution. Students will develop and execute strategies for their simulated company operating in the USA, Asia, and Europe.
The simulation is based on an online platform that allows students to play in their own language (many languages available: English, Spanish, Portuguese, Chinese,¿).

* Law (8h / in French)
Main principles of the French legal system

* Patents (4h / in French)

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies B (Lean six sigma)	HUMT1-PGE-B
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Lean Six Sigma (28h / in French)
Lean Six Sigma is a methodology that enables firms to make their processes more effective and efficient. It¿s the current industry standard for process improvement designed to reduce waste and enhance output quality.

* Law (8h / in French)
Main principles of the French legal system

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies C (human resource management)	HUMT1-PGE-C
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field)
- Understanding the importance of teamwork: making collective decisions and producing the expected work in time

Content :
* Human Resource Management (20h / in French)
    - Main current challenges of Human Resource Management
    - Human Resource Management¿s tools and organization
    - Focus on how team managers deal with Human Resource Management

* Law (8h / in French)
    Main principles of the French legal system

* Social legislation (8h / in French)

* Main principles of French social legislation

* Employment contract

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies D (Marketing for ICT Companies)	HUMT1-PGE-D
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This module is designed to equip students with the knowledge and analytical techniques required for effective strategic marketing management in ICT companies. Through this course, students are faced with a real case study provided by a marketing director of an international ICT company. Students are placed in a decision-making situation and should emerge with a 3 years strategic program.

ICT : Information and Communications Technology

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies E (Industrial design and innovation)	HUMT1-PGE-E
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time.

Content :
The program¿s main objective is to provide a multidisciplinary approach to the field of innovation, strategy and industrial design. This course will give an overview of the innovative process.
During this program, participants will have the opportunity to explore a business case covering the first stage of a product development project.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advice to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies F (Mangement and decision making)	HUMT1-PGE-F
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This course is about how to improve decision making as a future manager.
In addition to calling for academic insights and existing literature, this module provides practical improvement strategies to avoid costly decision making errors.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

English S9 Conversation	HUMT1-ANGL/CONV
Number of hours : 10.00 h	1.50 ECTS credit
TD : 10.00 h	
Reference Teacher(s) : LE TINNIER ANNE	

Objectives :
- Improving communication skills in everyday life situations as well as in a professional or social context.
- Obtaining or reinforcing C1 level, strongly advised/recommended by the CTI. t.

Content :
- Learning by doing: students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
- Expressing oneself accurately and fluently: students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
1. English Grammar in Use (Cambridge University Press)
2. Dictionnaire Collins Cobuild
3. Polycopié de l' INSA

Requirements :
Having taken and passed the TOEIC test during the previous two years (800 required)
or any other B2 certification recognized by the CTI.

Organisation :
- Each class lasts one hour and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
- Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet.

Evaluation :
Continuous assessment: The final mark (out of 20) will be based on the attendance rate and the personal implication of the student during the class.

Target :

TOEIC 5th year	HUMT1-ANGL/TOEIC
Number of hours : 20.00 h	1.50 ECTS credit
TD : 20.00 h	
Reference Teacher(s) : LE VOT PHILIPPE	

Objectives :
- Improving communication skills in everyday life situations as well as in company and business context.
- Obtaining or reinforcing the B2 level requested by the CTI.
- Obtaining 800 score at the final TOEIC test.

Content :
Learning by doing : students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
Expressing oneself accurately and fluently : students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
- English grammar in Use, Intermediate Edition (CUP)
- Robert and Collins bilingual dictionary or Collins Cobuild

Requirements :
Not having already taken and passed the TOEIC test during the previous two years
B1/B2 level advised

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet. B2 level tests are also taken throughout the course.

Evaluation :
Final mark based on :
TOEIC score at final exam + attendance (more than 4 non justified absences result in 0/20 mark).

Target :
5th year students who haven't already passed their TOEIC

Semestre 9

Parcours Média & Networks

1	**M&N09-SEIR**		**Systèmes embarqués - Images- Réseaux**	**18.50**
	EII09-DSP	C	Digital Signal Processor	2.00
	EII09-MDSP	C	Multicore Digital Signal ProcessingMulticore Digital Signal Processing Multicore Digital Signal Processing	3.00
	EII09-COAV	C	Advanced Design Methods	1.00
	SRC09-MOCNSYSC	C	Introduction to SystemC	1.50
	SRC09-TCSN-EMB	C	Introduction to Embedded Systems	1.00
	SRC09-TCSNREAL	C	Real Time Processing	1.50
	SRC09-MOCNPROJ	C	Digital Design Project	1.50
	EII09-CIV	C	Image and Video Compression	2.50
	EII09-VO	C	Computer Vision	2.00
	INF09-OPIRF	C	Image Processing and Pattern Recognition	3.00
	INF09-OPMIV	C	Modeling and Engineering for Biology and Health	3.00
	SRC09-TCRCBASE	C	Communication Networks basics	1.50
	SRC09-PRCNUM	C	Digital communications pre-requisite	1.50
	SRC09-MOCRIP	C	Advanced IP Networks	2.50
	SRC09-MOCRPROJ	C	Projet Tutoré	1.50
	SRC09-MOCRIWIRELESS	C	Wireless Networks	1.50
2	**M&N09-Projet**		**Projet technologique**	**8.00**
	M&N09-PROJ	O	Technical project	8.00
3	**M&N09-HUMAS**		**HUMANITES - M&N**	**3.50**
	HUMT1-ANGL/CONV	C	English S9 Conversation	1.50
	HUMT1-ANGL/TOEIC	C	TOEIC 5th year	1.50
	HUMT1-PGE-A	C	Economics, Law and Business Studies A (serious game)	2.00
	HUMT1-PGE-B	C	Economics, Law and Business Studies B (Lean six sigma)	2.00
	HUMT1-PGE-C	C	Economics, Law and Business Studies C (human resource management)	2.00
	HUMT1-PGE-D	C	Economics, Law and Business Studies D (Marketing for ICT Companies)	2.00
	HUMT1-PGE-E	C	Economics, Law and Business Studies E (Industrial design and innovation)	2.00
	HUMT1-PGE-F	C	Economics, Law and Business Studies F (Mangement and decision making)	2.00

O = compulsary, C= in choice , F= optional

Digital Signal Processor	EII09-DSP
Number of hours : 28.00 h	2.00 ECTS credit
CM : 10.00 h, TA : 4.00 h, TP : 14.00 h	
Reference Teacher(s) : MENARD DANIEL	

Objectives :
Implement digital signal processing applications on fixed-point DSP

Targeted main competences are:
- Fixed-point conversion of digital signal processing systems
- Develop C code for fixed-point DSP

Content :
- Fixed-point arithmetic
- Fixed-point conversion (dynamic range evaluation, fixed-point coding, numerical accuracy evaluation)

Bibliography :
[1] MADISETTI V., "VLSI Digital Signal Processors", IEEE Press, 1995;
[2] LAPSLEY P. & al., "DSP Processor Fondamentals", IEEE Press, 1995;
[3] BAUDOUIN G. & VIROLLEAU F., "DSP : les processeurs de traitement du signal", Dunod, 1996.

Requirements :
EII07-II1 : Computer Architecture II ;
EII07-A2 : Signal Processing II

Organisation :
- pedagogy based on project.

Evaluation :
- Attendance at lectures and project sessions

Target :
5EII

Multicore Digital Signal ProcessingMulticore Digital Signal Processing Multicore Digital Signal Processing	EII09-MDSP
Number of hours : 30.00 h	3.00 ECTS credit
CM : 8.00 h, PR : 16.00 h, TP : 6.00 h	
Reference Teacher(s) :	

Objectives :
Systems implementing modern Digital Signal Processing (DSP) applications such as telecommunication standard 3GPP Long Term Evolution (LTE) and video compression standard MPEG High Efficiency Video Coding (HEVC) require high execution speed, low power consumption and run-time adaptivity.

To meet these requirements, high performance Systems-on-Chip for DSP such as the 8-core Texas Instruments TMS320TCI6678 or the 256-core Kalray MPPA combine multiple signal processing oriented cores.

Adaptivity, memory limitation and load balancing between cores are hard to obtain. This course intends to give an overview of distributed high performance DSP solutions and of the new challenges brought by latest applications and architectures. Solutions for programming such architectures will be discussed. The focus of the course will be put on software-based solutions using dataflow Models of Computation.

Targeted competences are:
- To program multicore DSPs while understanding their internal mechanisms
- To choose a multicore programming method while understanding its limitations
- To design a high performance digital processing system using available resources efficiently

Content :
- High Performance DSP Applications
- Models of Computation
- Multicore DSP Architectures
- Architecture Models
- Assignment and Ordering Problem
- Multicore Programming Tools

Bibliography :
J Karam, I. AlKamal, A. Gatherer, G. A Frantz, D. V Anderson, and B. L Evans, "Trends in multicore DSP platforms, IEEE SPM, 2009
Hae-woo Park, Hyunok Oh, and Soonhoi Ha, "Multiprocessor SoC Design Methods and Tools", IEEE SPM, 2009
S. Sriram, S. S. Bhattacharyya, "Embedded Multiprocessors : Scheduling and Synchronization - Second Edition", CRC Press, 2009
M. Pelcat, S. Aridhi, J. Piat, J-F. Nezan, "Physical Layer Multicore Prototyping: A Dataflow-Based Approach for LTE eNodeB", Springer, 2012

Requirements :
Computer Architecture I & II (EII06-II2, EII07-II1), C Language (TCM05-INFOC), Digital Signal Processing (EII09-DSP)

Organisation :
- Courses given by internal and external professors
- Practical work and project are based on the dataflow-based programming of the TMDSEVM6678L evaluation board
- The goal of practical work is for students to acquire competences for programming the platform
- The project aims at giving students some programming habits

Evaluation :
Project grading.

Target :
5EII

Advanced Design Methods	EII09-COAV
Number of hours : 22.00 h	1.00 ECTS credit
CM : 6.00 h, PR : 8.00 h, TA : 8.00 h	
Reference Teacher(s) : MENARD DANIEL	

Objectives :
- Advanced hardware design method for complex digital systems
- Study and implementation of a complete design flow, from high-level description to hardware implementation

Targeted main competences are:
- To use efficiently available resources to design a digital system (documentation, internet, supervisor)

Content :
- Advanced synthesizable VHDL, design re-use, hardware IP blocks
- Tests and validation: verification methodology, automatic verification, testbed implementation
- Development software presentation of Mentor Graphics (HDL Designer, Leonardo Spectrum, Modelsim, RTL Precision)
- Project: design, implementation and test of a data transmission system under the HDL Designer environment

Bibliography :
- ZWOLINSKI M., "Digital System Design with VHDL", Prentice Hall, 2000
- SCHNEIDER T., "VHDL - Méthodologie de design et techniques avancées", Dunod, 2001

Requirements :
- VHDL Programming (EII08-II3)
- Programmable Logic (EII07-E3)
- Methodology and Project Management (EII07-PROJ2)

Organisation :
- Active pédagogy
- Revision of lecture notes
- Preparation for project

Evaluation :
- Attendance at lectures and project sessions
- The project report

Target :
5EII, M&N

Introduction to SystemC	SRC09-MOCNSYSC
Number of hours : 14.00 h	1.50 ECTS credit
CM : 8.00 h, TP : 6.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
This lecture aims at presenting the System Design languages (SystemC) for complex system designing. Special emphasis will be given on modelling across different levels of abstraction from untimed via timed transaction level models down to register transfer models including the needed refinement steps.

Content :
1. Requirements for a system methodology in order to design a system. Overview of existing methodologies
2. Presentation of the System C language syntax. :
   -Programming environment.
   -Concepts of module, port, channel, interface.
   Channels, ports, interfaces, Module constructor
   Events, Event queue
   Thread processes, Method processes
   Module instantiation (in modules)
3. Simulation of complex systems with System C.
4. Labs on a transmission system. Simulation of the system and implementation on an embedded SOC.

Bibliography :

Requirements :

Organisation :

Evaluation :
1 hour exam

Target :

Introduction to Embedded Systems	SRC09-TCSN-EMB
Number of hours : 10.00 h	1.00 ECTS credit
CM : 4.00 h, TP : 6.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
Introduction to embedded systems (technology, management, hardware/software co-design). Case study on a SOPC platform (Altera FPGA).

Content :
Technology of embedded systems: ASIC, FPGA, Study of different reconfigurable circuits (Xilinx, Altera, ...). Introduction to rapid prototyping tools from system to physical level.

Bibliography :

Requirements :
SRC07-LPROG

Organisation :

Evaluation :
Practical training session

Target :

Real Time Processing	SRC09-TCSNREAL
Number of hours : 16.00 h	1.50 ECTS credit
CM : 10.00 h, TP : 6.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
Study of real time operating systems and application examples.

Content :
Various fields of applications, embedded systems, kernel architecture, Kernel services (tasks, synchronizations, communications), multi-processes/multi-processors programming, scheduling policies, memory management.

Applications: embedded systems for signal processing (telecommunication, image / video) in automotive, avionics, etc. ....
Systems with strong real time constraints, system management / supervision.

Practical work on MicroC-OSII.

Bibliography :

Requirements :

Organisation :

Evaluation :
2 hours exam

Target :

Digital Design Project	SRC09-MOCNPROJ
Number of hours : 24.00 h	1.50 ECTS credit
TP : 24.00 h	
Reference Teacher(s) :	

Objectives :
The role of this project is to apply all the concepts of Digital Design on a real application.

Content :
This 24 hours project aims to implement all the concepts learned in the SRC09-MOCNVHD and SRC09-SYSC module.
It starts with a SystemC modeling of a complex digital communication circuit (software and hardware blocks) for system simulation and platform sizing.
It ends up with the implementation of the circuit onto a real FPGA platform composed of software and hardware parts.

Bibliography :

Requirements :
SRC09-MOCNVHD and SRC09-SYSC

Organisation :

Evaluation :
Project evaluation

Target :

Image and Video Compression	EII09-CIV
Number of hours : 32.00 h	2.50 ECTS credit
CM : 10.00 h, CONF : 6.00 h, TP : 16.00 h	
Reference Teacher(s) : MORIN LUCE, ZHANG LU	

Objectives :
This lecture aims at presenting fundamental and advanced methods dedicated to image and video compression.

Targeted competences are:
-> To know image and video coding scheme through functionality analysis
-> To translate state-of-the-art algorithms into C or Matlab code

Content :
1. Introduction to image coding: PCM, DPCM, MIC, MICD, transform coding
2. Still image standards: JPEG, JPEG-LS, JPEG 2000, LAR
3. Video compression: motion estimation and compensation, standard video codecs: MPEG-2, MPEG-4, AVC, SVC, HEVC
4. Conferences by industrial partners ; conferences may vary each year
examples :
- Standardization, Pierrick Philippe, Orange Labs
- HEVC : High Efficiency Video Coding, The video coding standard for 2013 to 2030 , Félix Henry, Orange Labs
- Quality asssment for video coding, Jérome Fournier, Orange Labs

Bibliography :
[1] T. Ebrahimi, C. Christopoulos, "JPEG 2000 The next generation still image coding system", EUSIPCO'00, 2000
[2] Gregory K. Wallace, "The JPEG Still Picture Compression Standard" , IEEE Transactions on Consumer Electronics, Vol.38, No. 1, Février 1992
[3] Bernd Girod, "Image and Video Compression", lecture notes, Standford University, 2005
[4] Ian E Richardson, "H.264 and MPEG-4 Video Compression", John Wiley ed., 2003
[5] Vector Quantization and Signal Compression, Allen Gersho, Robert M. Gray, Springer, 1992

Requirements :
Signal Processing II (EII07-A2).
Image Processing (EII08-A3)
Statistical Signal Processing (EII09-TSS)

Organisation :
- Revision of lecture notes. Preparation of practical works.
- Labs with EIIMage and VCDemo softwares, implementation of coding algorithms in C language

Evaluation :
One-hour and half written examination (with documents).

Target :
Students in 5EII, M&N, master I-MARS

Computer Vision	EII09-VO
Number of hours : 35.00 h	2.00 ECTS credit
CM : 16.00 h, CONF : 3.00 h, TP : 16.00 h	
Reference Teacher(s) : PRESSIGOUT MURIEL	

Objectives :
This course is an introduction to computer vision techniques with a single camera or with several ones. Estimation processes used in computer vision are also studied.

The targeted skills are :
-> Solve a pose computation problem by using a Gauss-Newton minimization
-> Compute a depth map from stereoscopic images using the epipolar geometry properties
-> Estimate a 2D tranformation using a RANSAC algorithm
-> Solve a vision problem by determining the associated equations and use an existing software platform to implement the solution.

Content :
1. Monocular vision geometry (perspective projection, calibration and pose estimation)
2. Sterevision : 3D reconstruction, epipolar geometry, 2D homography, autocalibration

Pratical exercises are in C++ language.

Bibliography :
1. HORAUD R., MONGA O., ""Vision par ordinateur"", Hermès, 1993.
2. AYACHE N., ""Vision stéréoscopique et perception multi-sensorielle"", Inter-Ed. Science Info, 1988.
3. HARTLEY R., ZISSERMAN A., "Multiple View Geometry in Computer Vision", Second Edition, Cambridge University Press, March 2004.

Requirements :
Optimization (EII08-A3) and object oriented programming (EII08-II1).

Organisation :
Revision of lecture notes. Preparation of practical work.

Evaluation :
Two-hour written examination (no documents) at the end of the semester. Possible oral remedial examination at the end of the year.

Target :
5EII, Media and Networks semester

Image Processing and Pattern Recognition	INF09-OPIRF
Number of hours : 48.00 h	3.00 ECTS credit
TD : 48.00 h	
Reference Teacher(s) : RICQUEBOURG YANN	

Objectives :
Image Processing and Pattern Recognition is a largely studied domain of Computer Science with various applications. The lectures aims at giving a summary of this subject focused on the main line of recognizing symbols in images. Therefore, the main knowledge leading to this end are exposed: from early vision given by basic digital processing, via features extraction from images, to final recignnition performed by classifiers.

Content :
The documents are in English. The lecture may be in English or in French.
Part 1: Image processing

I. Basics of Digital Images
* What is a digital image? Human visual system
* Color, Histograms
* Pyramids and quad-trees
* Spectral representations
II. Image pre-processing
* Geometric transforms
* Noise reduction,
* Morphologic filters
Part 2: Features

I. Features Detection (locally, low level)
* Edges and Lines
* Keypoints and Corners
* Regions and Blobs
II. Features Extraction (globally or higher level)
* Properties of features
* Geometrical, Frequential, Scale-space Features
III. FEATURES SELECTION
* Distances, Selection
Part 3: Classification

I. Unsupervised Learning / Clustering
* C-Means, Fuzzy C-Means, Possibilistic C-Means
II. Supervised Learning
* First simple classifiers (k-Nearest-Neighbor...)
* Neural Networks
- MultiLayer Perceptron (MLP)
- Radial-Basis Function Neural Networks (RBFN)
* Evaluation: Reject option, Validation
- Fuzzy Inference System (FIS),
- Dynamic Time Warping (DTW),
- Hidden Markov Models (HMM),
- Support Vector Machine (SVM)
III. Improvement strategies
IV. Example of Pattern Recognition System

Bibliography :

Requirements :
None

Organisation :
Test some notions presented during the lectures, and search other notions just mentioned, to perform a solution for the practical
work.

Evaluation :
A practical work on a real-world data set is conducted in parallel of the lecture for the half of the time of the module. The
project tends to implement a complete recognition system, gathering 3 to 4 student groups competiting each other groups.
Results of each group is presented and evaluated at the end of this module.

Target :

Modeling and Engineering for Biology and Health	INF09-OPMIV
Number of hours : 48.00 h	3.00 ECTS credit
TD : 48.00 h	
Reference Teacher(s) : MARCHAL MAUD	

Objectives :
From gene to human body: Computer Science for Biology and Health applications Overview The course sets out to introduce an extensive range of computing facilities vital for Biology and Health Applications. Computer Science tools are naturally used for data storage or data management but also for data analysis. From gene to human body, biological and medical applications become more and more present in our everyday life. The course is composed of two parts:
* a first part is dedicated to bioinformatics and tries to answer to the following questions: what are the links between Biology and Computer
Science? How can algorithms answer to biological problems and inversely how can biological mechanisms answer to computer science problems?
* the second part deals with modeling and instruments developed for Health applications: what are the current instruments and models applied to human body? How to develop tools for Health domain?

Content :
Part 1: Genomic and Bioinformatics
* Genetic data modeling
* Biological sequences alignment
* Phylogenie and study of species evolution
* Genetic algorithms and data analysis
* Population genetics and association studies
Part 2: Models and Instruments for Health applications
* Medical image analysis
* Computer-assisted medical interventions
* Human body modeling and physical simulation (Biomechanical models, interactive simulators, etc)
* Brain-Computer Interactions
Course schedule:
* A new topic for each course
* Presentation-course (1h-2h), Practical exercises with applications to real data (2h-3h)

Bibliography :

Requirements :
Basic understanding of algorithms and skills in programming languages. No particular Biology and Physics expertise will be assumed.

Organisation :

Evaluation :
Assignment:
* Assignment on practical exercises for each course (50%)
* Small project (50%)

Target :

Communication Networks basics	SRC09-TCRCBASE
Number of hours : 26.00 h	1.50 ECTS credit
CM : 22.00 h, TP : 4.00 h	
Reference Teacher(s) : UZEL FABIENNE	

Objectives :
Acquisition of the fundamentals of networking through a description of the main techniques and their applications. Basic concepts of network security.

Content :
Telecommunication networks [6 HC]: Cellular Network: 3G, others (DCS 1800, CDMA). Architecture, radio interface protocol. Global satellite network type star, Eridium, INMARSAT.

Wired networks [12 HC]: IP / TCP / UDP / RIP X25/Frame Relay / ATM, ADSL / xDSL, PLC. Hybridization techniques and wireless communication.

Network security [4HC]

Bibliography :
Gilbert MARTINEAU, Laurent TOUTAIN, Alain LEROY, édition Hermes.
Wireless Ad Hoc and Sensor Networks, Raja Jurdak, Springer.

Requirements :
SRC08-FIBRES, SRC07-CNUM1,SRC08-CNUM2, SRC06-INFO, SRC08-RADIO

Organisation :

Evaluation :
2 hours exam

Target :

Digital communications pre-requisite	SRC09-PRCNUM
Number of hours : 24.00 h	1.50 ECTS credit
CM : 14.00 h	
Reference Teacher(s) : HELARD JEAN FRANCOIS	

Objectives :
To deal with the basis digital communication techniques as channel coding, multicarrier modulations and single carrier transmissions on limited bandwidth channel.

Content :
1. Model of a digital communication system
2. Basis channel coding techniques
Block codes and cyclic block codes. Codes construction. Decoding techniques. Performance and channel coding gain.
Convolutional codes. Representation and main principles. Decoding techniques. Performance and main applications.
3. Single carrier transmission over unlimited and limited bandwidth channels. Nyquist criterion. Equalization techniques.
4. Multicarrier modulations. Frequency and time selectivity of the radio-mobile channel. Multicarrier modulation principle (OFDM). Digital implementation of OFDM with Fast Fourier Transform Demodulation and performance. Applications to broadcast and telecommunication systems.

Bibliography :
M. Joindot, A. Glavieux, "Introductions aux communications numériques", Ed. Dunod,
S. Beneddeto, E. Biglieri, V. Castellani, "Digital transmission theory", Prentice Hall International Editions,
J. G. Proakis., "Digital communications", 6th Edition, Mc Graw-Hill Int. Editions, 2003,
C. Berrou, « Codes et turbocodes », collection IRIS, Springer,
K. Fazel, S. Kaiser, « Multi-Carrier and spread spectrum systems, Wiley.

Requirements :
Modules SRC05-PRER, SRC06-TSIA, SRC07-DESTI, SRC07-SINUM

Organisation :
Courses documents

Evaluation :
Un contrôle continu (Cours, Td, TP)
1 Devoir surveillé de 1 heure.

Target :

Advanced IP Networks	SRC09-MOCRIP
Number of hours : 24.00 h	2.50 ECTS credit
CM : 10.00 h, CM : 8.00 h, TD : 6.00 h	
Reference Teacher(s) : UZEL FABIENNE	

Objectives :
Extensions and new applications of high-speed networks, wireless, wired and embedded. Study of the routing mechanisms and quality of service.

Content :
IP techniques [10HC]: ipv4 to ipv6 Evolutions, ipv4 and ipv6 compatibility, quality of service. Routing inside and between networks (MPLS, BGP)

Wired networks [8HC, 6HTD]: VOIP, IPTV, routing, security VLAN, VPN

Bibliography :
Gilbert MARTINEAU, Laurent TOUTAIN, Alain LEROY, édition Hermes
Réseaux haut débit (2ème édition) (Coll. réseaux et télécommunications) [e-book] , ROLIN Pierre

Requirements :
SRC08-FIBRES, SRC07-CNUM1, SRC08-CNUM2, SRC09-TCRC

Organisation :

Evaluation :
2 hours exam

Target :

Projet Tutoré	SRC09-MOCRPROJ
Number of hours : 24.00 h	1.50 ECTS credit
TP : 24.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Wireless Networks	SRC09-MOCRIWIRELESS
Number of hours : 10.00 h	1.50 ECTS credit
CM : 6.00 h, TD : 4.00 h	
Reference Teacher(s) : EL ZEIN GHAIS	

Objectives :
Review of data wireless protocols, applications.

Content :
Wireless data networks overview: Wimax, 802.11, Bluetooth, ZigBee. Architecture of the networks, signalisation, data flow. Data and voice convergence. PHY , MAC and application layers.

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Technical project	M&N09-PROJ
Number of hours : 360.00 h	8.00 ECTS credit
PR : 50.00 h	
Reference Teacher(s) : MORIN LUCE	

Objectives :
-Manage a project within a team, on a technical topic proposed by an industrial partner.
-Collaborate with an industrial partner and take into account industrial requirements and organization.
-Apply technical and management skills acquired during academic courses.
-Practice report writing and oral presentation on technical topics.

Content :
1. Meet industrial partner and write project functional specifications.
2. Task scheduling and task repartition.
3. State of the art and bibliographic research.
4. Experimental development and validation ; regular meetings with project advisor.
5. Report writing, preparation of presentation slides.
6. Oral defense of the project.

Examples of project topics:
-Visual closed-loop control of an AR-Drone
-Audio bench test for mobile phones
-Calibration of a network of heterogeneous cameras
-Direct WI-FI remote control
-CPL transmission of video stream on an ETTUS card
-Optimization of a conversion of audio sampling rate library on ARM architecture
-RFID for electronic passport reading in multi-platform Windows/Linux environment
-Activity and physiologic parameters measurement with a Kinect sensor

Bibliography :

Requirements :

Organisation :
-Teams of 4 to 6 students, including a project leader
-Topics proposed by industrial partners and work at Insa research/teaching labs.
-Regular meetings with the project advisor (a professor).
-Autonomous work over the whole semester, with dedicated time shifts (6 hour/week)
-Free access to software and hardware to teaching and research labs, industrial partner might provide software/hardware if necessary for the project.

Evaluation :
The work realized by each group is subject to a written report and an oral presentation before an audience comprised of fellow students. The jury is composed of professors and industrial partners.
A final mark awarded based on the quality of the work, written report and oral presentation.

Target :
M&N students from 5EII/5SRC/5INFO

English S9 Conversation	HUMT1-ANGL/CONV
Number of hours : 10.00 h	1.50 ECTS credit
TD : 10.00 h	
Reference Teacher(s) : LE TINNIER ANNE	

Objectives :
- Improving communication skills in everyday life situations as well as in a professional or social context.
- Obtaining or reinforcing C1 level, strongly advised/recommended by the CTI. t.

Content :
- Learning by doing: students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
- Expressing oneself accurately and fluently: students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
1. English Grammar in Use (Cambridge University Press)
2. Dictionnaire Collins Cobuild
3. Polycopié de l' INSA

Requirements :
Having taken and passed the TOEIC test during the previous two years (800 required)
or any other B2 certification recognized by the CTI.

Organisation :
- Each class lasts one hour and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
- Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet.

Evaluation :
Continuous assessment: The final mark (out of 20) will be based on the attendance rate and the personal implication of the student during the class.

Target :

TOEIC 5th year	HUMT1-ANGL/TOEIC
Number of hours : 20.00 h	1.50 ECTS credit
TD : 20.00 h	
Reference Teacher(s) : LE VOT PHILIPPE	

Objectives :
- Improving communication skills in everyday life situations as well as in company and business context.
- Obtaining or reinforcing the B2 level requested by the CTI.
- Obtaining 800 score at the final TOEIC test.

Content :
Learning by doing : students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
Expressing oneself accurately and fluently : students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
- English grammar in Use, Intermediate Edition (CUP)
- Robert and Collins bilingual dictionary or Collins Cobuild

Requirements :
Not having already taken and passed the TOEIC test during the previous two years
B1/B2 level advised

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet. B2 level tests are also taken throughout the course.

Evaluation :
Final mark based on :
TOEIC score at final exam + attendance (more than 4 non justified absences result in 0/20 mark).

Target :
5th year students who haven't already passed their TOEIC

Economics, Law and Business Studies A (serious game)	HUMT1-PGE-A
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
-Establishing a strong, specific vocabulary base
-Understanding the main issues that industrial companies deal with (in a specific management field).
-Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Business Simulation (serious game) (24h / in English)
The business simulation ¿Global Challenge¿ (a CESIM product) has been designed to improve the understanding and knowledge of the complexity of global business operations in a dynamic, competitive environment. It focuses on strategic management, international management and business policy.
The task for the student teams is to manage a global mobile telecommunications company through technological and market evolution. Students will develop and execute strategies for their simulated company operating in the USA, Asia, and Europe.
The simulation is based on an online platform that allows students to play in their own language (many languages available: English, Spanish, Portuguese, Chinese,¿).

* Law (8h / in French)
Main principles of the French legal system

* Patents (4h / in French)

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies B (Lean six sigma)	HUMT1-PGE-B
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Lean Six Sigma (28h / in French)
Lean Six Sigma is a methodology that enables firms to make their processes more effective and efficient. It¿s the current industry standard for process improvement designed to reduce waste and enhance output quality.

* Law (8h / in French)
Main principles of the French legal system

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies C (human resource management)	HUMT1-PGE-C
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field)
- Understanding the importance of teamwork: making collective decisions and producing the expected work in time

Content :
* Human Resource Management (20h / in French)
    - Main current challenges of Human Resource Management
    - Human Resource Management¿s tools and organization
    - Focus on how team managers deal with Human Resource Management

* Law (8h / in French)
    Main principles of the French legal system

* Social legislation (8h / in French)

* Main principles of French social legislation

* Employment contract

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies D (Marketing for ICT Companies)	HUMT1-PGE-D
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This module is designed to equip students with the knowledge and analytical techniques required for effective strategic marketing management in ICT companies. Through this course, students are faced with a real case study provided by a marketing director of an international ICT company. Students are placed in a decision-making situation and should emerge with a 3 years strategic program.

ICT : Information and Communications Technology

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies E (Industrial design and innovation)	HUMT1-PGE-E
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time.

Content :
The program¿s main objective is to provide a multidisciplinary approach to the field of innovation, strategy and industrial design. This course will give an overview of the innovative process.
During this program, participants will have the opportunity to explore a business case covering the first stage of a product development project.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advice to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies F (Mangement and decision making)	HUMT1-PGE-F
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This course is about how to improve decision making as a future manager.
In addition to calling for academic insights and existing literature, this module provides practical improvement strategies to avoid costly decision making errors.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Academic year 2013/2014

Courses offered by the programme

Génie Civil et Urbain (GCU)
Civil Engineering and Urban Planning

Semester(s) : 1-2-3-4-5-6-7-8-9

Commonly used abbreviations
CM : Lectures
TD : Tutorials
TP : Laboratory Work
CONF : Conferences
TA : Personal Work
PR : Project
ST : Internship
DIV : Miscellaneous

Semestre 5

Parcours Formation Initiale GCU

1	**TCM05**		**Science and technology of engineer S5**	**9.00**
	TCM05-ANAL	O	Mathematical Analysis for the Engineer	2.00
	TCM05-PROBA	O	Probability Tools for Engineers	2.00
	TCM05-INFOC	C	C language	3.00
	TCM05-PROG	C	C and Matlab programming	3.00
	TCM05-RISQ	O	Risk Management	2.00
2	**GCU05-1**		**MECANIQUE DES SOLIDES ET DES STRUCTURES**	**6.50**
	GCU05-11	O	Mechanics of Elastic Solids I	2.50
	GCU05-12	O	Structural Analysis I	4.00
3	**GCU05-2**		**MATERIAUX**	**4.00**
	GCU05-21	O	Materials Science 1A	2.00
	GCU05-22	O	Sciences des Matériaux IB	2.00
4	**GCU05-3**		**GEOL-ARCHITECTURE**	**5.50**
	GCU05-31	O	Introduction à l'Architecture	2.00
	GCU05-32	O	Engineering Geology	3.50
5	**GCU-HUM05**		**HUMANITES S5**	**5.00**
	GCU05-ANGL	O	English	2.00
	GCU05-PSH	O	Monographs	2.00
	GCU05-EPS	O	Sport and physical education	1.00

O = compulsary, C= in choice , F= optional

Mathematical Analysis for the Engineer	TCM05-ANAL
Number of hours : 28.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : BRIANE MARC	

Objectives :
Integration, Fourier transform, complex variables

Content :
1. Integration
Convergence theorems
Integrals with a parameter
Integrable functions
Fubini's theorems and convolution
Change of variables
2. Fourier transform
Fourier transform of a integrable function
Inversion theorem
Fourier transform of a square-integrable function
Plancherel theorem
Fourier transform and convolution
3. Complex variables
Holomorphic functions
Entire functions
Exponential and logarithmic functions
Cauchy's formula
Residues method

Bibliography :
G. GASQUET, P. WITOMSKI : « Analyse de Fourier et applications ». Masson, 1990.

Requirements :
Mathematical analysis of first and second year

Organisation :
30h

Evaluation :
1 written examination

Target :

Probability Tools for Engineers	TCM05-PROBA
Number of hours : 28.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : HERVE LOIC	

Objectives :
Probability calculus
- Large-samples
- Elements of statistics

Content :
1. Probability distributions. Examples.
2. Gaussian models.
3. Characteristic functions.
4. Limit theorems for Large-samples. Statistical applications.

Bibliography :
Modélisation probabiliste et statistique- Bernard Garel - Collection POLYTECH des éditions CEPADUES

Requirements :
Bases of analysis and linear algebra. Elements of probability theory of STP03-PROBA « Introduction aux probabilités »

Organisation :
30h

Evaluation :
One two hours written examination.

Target :

C language	TCM05-INFOC
Number of hours : 42.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 8.00 h, TP : 20.00 h	
Reference Teacher(s) : LEPLUMEY IVAN	

Objectives :
Basic understanding of the C programming language.
Ability to resolve all common problems.
Find the minimal intersection of needs / C. language.
Writing and comprehension of the code. Syntax and associated semantic.

Content :
1. Introduction to C programming language:
   Introduction.
   Chain of production, from the code source to the executable.

2. Basic C:
   Lexical entities.
   Language syntax.
   Variable declaration.
   Predefined types.
   Operators and expressions.
   General structure of a program.
   Basic input/output.
   Control structures and instructions.
   Fields: 1st form.
   Functions and pass-by-value parameter passing.

3. Advanced C:
   Pointers.
   Functions and pass-by-address parameter passing.
   Standard library functions.
   Memory models for functions and pointers.
   Fields : 2nd form.
   New types and types constructor.
   Explicit type conversion.
   File input/output.
   Allocation class.
   Dynamic Allocation.
   Pointers to functions.

Bibliography :
J.P. BRAQUELAIRE. Méthodologie de la programmation en langage C - Principes et applications. Manuels Informatiques Masson. Masson, 1993.
J.P. BRAQUELAIRE. Méthodologie de la programmation en langage C - Norme C99 - API POSIX. Sciences Sup. Dunod, 2005.
C. DELANOY. Programmer en langage C, avec exercices corrigés. Eyrolles, 1997.
B.W. KERNIGHAN and D.M. RITCHIE. Le langage C. Manuels Informatiques Masson. Masson, 1990.
J.L NEBUT. Le langage C - définition de la norme ANSI. Technical Report Cours C81, IFSIC -Université de Rennes 1, juillet 1989.

Requirements :
Understanding of Algorithms Foundations

Organisation :
Revision of the lecture notes.
Preparation for the practical work.
14hours of course, 8 hours of directed work and 20 hours of practical work

Evaluation :

2-hour written examination at the end of the semester (documents allowed).

Target :

C and Matlab programming	TCM05-PROG
Number of hours : 35.00 h	3.00 ECTS credit
CM : 9.00 h, TD : 8.00 h, TP : 18.00 h	
Reference Teacher(s) : MORIN LUCE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Risk Management	TCM05-RISQ
Number of hours : 21.00 h	2.00 ECTS credit
CM : 21.00 h	
Reference Teacher(s) : GALL PHILIPPE	

Objectives :
The engineer must always remain master of his choices and his actions within the limits defined by acceptable risk.

Content :
I- THE PRINCIPAL CONCEPTS OF RISK ANALYSIS: Dangerous situations. The five dimensions: facts, models, objectives, norms, values. The dissonances between players in a network. The deficits that affect dimensions. Options for
preventative action.
II. DANGER: AN INTRINSIC REALITY. WHEN AND WHERE TO EXPECT DANGER. Danger inherent to the natural
environment. Climate-related uncertainties. Terrestrial uncertainties. Fire as a man-made danger: facilities, production,
creation, etc. Sources of danger in the workplace: electrical, mechanical, chemical, toxicological, radiation, etc.
III - RISK: A LIKELY EVENT WHICH INDUCES DANGER: Characterisation of risk or estimation of danger: probability
and gravity. Natural or man-made danger. Error or approximation. Economic and financial risk. Complexity of the models.
Sport-related risk. Information-related risk. Alarm-related risk. Numerical treatment of problems. Risk; chemical-related risk.
IV. SECURITY: Development of a secure environment. Regulations: logic, criticism and use; technical regulations.
V. PREVENTION AND ASSUMING RESPONSIBILITY: JURIDICAL ASPECTS.

Bibliography :
Risque et Génie Civil - AFGC - 8 -10 nov 2000, Presse des Ponts et Chaussées Konstantin PROTASSOV, 1999,
""Probabilités et Incertitudes"", PUG Michèle NEUILLY - CETAMA
""Modélisation e estimation des erreurs de mesure"" GIS - MR-GenCi J.A. CALGARO, 1996,
- Introduction aux Eurocodes, Presse de l'ENPC Peter G. NEUMANN, 1995,
Computer-Related Risks, Addison-Wesley/ACM Press, ISBN 0-201-55805-X, 384pp

Requirements :

Organisation :

Evaluation :
Two-hour written examination in French.

Target :

Mechanics of Elastic Solids I	GCU05-11
Number of hours : 32.00 h	2.50 ECTS credit
CM : 14.00 h, TD : 14.00 h, TP : 4.00 h	
Reference Teacher(s) :	

Objectives :
The course will provide a rigorous yet engineering-oriented introduction to the mechanics of elastic solids and structures. The
student will learn how to apply the fundamentals of elasticity to civil engineering problems. Practical problems will be solved
and advantages of using particular methods will be illustrated. Comparison with solutions obtained by using elementary
strength of materials in solving engineering problems will be emphasized. The course is organized in two parts. The first part
focuses on the stress concept, the kinematics, the solution strategies as well as plane problems. The second part deals with 2D
problems in polar coordinates, anti-plane problems and energy theorems.

Content :
1 Continuum theory
1.1 The continuum concept
1.2 Continuum Mechanics
2 Deformation: Displacements and Strains
2.1 General Deformations
2.2 Geometric Construction of Small Deformation Theory
2.3 Strain transformation
2.4 Principal Strains
2.5 Spherical and Deviatoric Strains
2.6 Strain Compatibility
3 Stress and Equilibrium
3.1 Body and Surface Forces
3.2 Traction Vector and Stress Tensor
3.3 Stress Transformation
3.4 Principal Stresses
3.5 Spherical and Deviatoric Stresses
3.6 Equilibrium Equations
4 Formulation and Solution Strategies
4.1 Review of Field Equations
4.2 Boundary Conditions and Fundamental Problem Classifications 84
4.3 Stress Formulation
4.4 Displacement Formulation
4.5 Principle of Superposition
4.6 Saint-Venants Principle
4.7 General Solution Strategies
5 Two-Dimensional Formulation
5.1 Plane Strain
5.2 Plane Stress
5.3 Generalized Plane Stress
5.4 Antiplane Strain
5.5 Airy Stress Function
5.6 Polar Coordinate Formulation

Bibliography :

Requirements :
Continuum Mechanics of Solids (S4), General Mechanics and Mathematical Analysis (vectorial analysis, partial derivative
problems, functions of a complex variable, etc.)

Organisation :
Review of lecture notes. Exercises: 60 hours.

Evaluation :
Two-hour written examination. Practical Work reports.

Target :

Structural Analysis I	GCU05-12
Number of hours : 64.00 h	4.00 ECTS credit
CM : 28.00 h, TD : 28.00 h, TP : 8.00 h	
Reference Teacher(s) :	

Objectives :
This module, which takes place during the first semester, provides students of Civil Engineering and Urban Planning with the
basics necessary for the calculation and dimensioning of the elements of construction by drawing upon their knowledge of
Solids Mechanics, Continuum Mechanics and the Theory of Elasticity.

Content :
1. Introduction to beam theory (hypothesis and conventions, actions and loading, equilibrium of a beam)
2. Calculation of stress due to axial force
3. Calculation of stress due to bending: simple, combined, oblique
4. Calculation of shear stress: thick sections (Jouravski's hypothesis), thin sections (open, closed, partitioned), shear centre
5. Calculation of torsional stress: thick sections (membrane analogy), thin sections: Bredt's formulas , non- uniform torsion
theory of Vlassov

Bibliography :
1. FREY F., ""Statique appliquée et Mécanique des structures"", volumes 1 et 2 Presses Polytechniques et Universitaires Romandes
2. ALBIGES M. et COIN A., ""Résistance des matériaux appliquée"", tomes I et II, Ed. Eyrolles, Paris

Requirements :
Mathematical basics and General Mechanics acquired during the first two-years of preparation in general engineering studies.
Continuum Mechanics of Solids and Mechanics of Deformable media.

Organisation :
21 hours per semester: ninety minutes per week + preparation of practical work.

Evaluation :
Three-hour written synthesis examination.

Target :

Materials Science 1A	GCU05-21
Number of hours : 28.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) :	

Objectives :
Essential links between the intrinsic characteristics of materials, their properties and usage; notably chemical, physical,
thermal, optical and mechanical properties.

Content :
Definitions: material, raw material, ore - Various classifications of materials - Life cycle of Materials. Essential differences
between solid, liquid and gas - The origin of cohesion in materials - Atomic architectures in solids (from order to disorder,
from perfect crystal to real crystal) - The fundamental role of chemical bonds and properties of materials - The fundamental
role of crystalline imperfections on the properties of materials - Incidence of microstructure on properties and usage of
materials (fragility, ductility, rigidity, hardness, tenacity, thermal conduction, electric conductivity). - Physico-chemical
methods for the study of materials (X-Ray Diffractometry, thermal analysis, X-Ray fluorescence, microscopy (optical, MEB,
PUTS), spectrophotometric methods. Materials under stress: theoretical resistance and real resistance; defects; stress
concentration coefficient. Elastic limit of ductile materials; Critical shear stress for interfacial slip; role of dislocations;
crystallinity and ductility. Tenacity of fragile materials. Mechanical characteristics.

Bibliography :
1. Introduction à la science des matériaux. Wilfried Kurz, Jean Pierre Mercier, Gérard Zambelli, Ecole Polytechnique Fédérale de Lausanne. Matériaux : Propriétés et Applications M.F. Ashby, D.R.H Jones. Edition Dunod, Paris.
Science des Matériaux. Jean Paul Baillon, Jean-Marie Dorlot. Presses internationales polytechnique.

Requirements :

Organisation :

Evaluation :
Written examination.

Target :

Sciences des Matériaux IB	GCU05-22
Number of hours : 26.00 h	2.00 ECTS credit
CM : 14.00 h, TP : 12.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Introduction à l'Architecture	GCU05-31
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Engineering Geology	GCU05-32
Number of hours : 52.00 h	3.50 ECTS credit
CM : 14.00 h, TD : 14.00 h, TP : 24.00 h	
Reference Teacher(s) :	

Objectives :
Understanding the structure of the Earth and the movement of the continents. Theoretical and practical study of rocks;
properties and usage.

Content :
1. The planet Earth: structure and important geological phenomena.
2. Igneous, metamorphic and sedimentary rock.
3. Physical and mechanical properties of rocks.
4. Exploitation of Quarries, characteristics of aggregates.
5. Identification of rocks: from visual observation to the polarising microscope.
6. X-ray Analysis (clayey rock).

Bibliography :
ARQUIE G., TOURENQ C., 1990, ""Granulats"", 717 p., Ed. Presses de l'E.N.P.C. RAUTUREAU, CAILLERE, HENINI,
""Les argiles"", Ed. Septima POMEROL, LAGABRIELLE, RENARD,
""Eléments de géologie"", Ed. Dunod HOMAND,
DUFFAUT, Manuel de Mécanique des Roches, Tome 1, Presses de l'Ecole des Mines de Paris HOMAND, DUFFAUT,
Manuel Mécanique des Roches, Tome 2, Presses de l'Ecole des Mines de Paris

Requirements :

Organisation :
Revision of lecture notes.
Preparation of the practical work and Tutorials.

Evaluation :
Two-hour written examination.
One-hour practical examination "Identification and exploitation of rocks".

Target :

English	GCU05-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) :	

Objectives :
Development of the student's knowledge of everyday English: lexicon, syntax and phonology. Development of listening and
speaking skills.

Content :
The four skills are developed through a variety of supports such as the Internet, press articles, audio and video resources
dealing with topical issues and recent trends (including extracts from movies, TV series and news reports).
- Listening and Speaking includes debates, role-plays, etc, with participation by the class as a whole or in small groups.
- Reading and Writing includes letter writing, drafting of CVs, etc. Syntactic structures associated with English for scientific
purposes.

Bibliography :
1. Dictionnaire : ROBERT et COLLINS Senior.
2. MURPHY Raymond, English Grammar in Use (with Answers), Cambridge University Press, 1999.
3. BERLAND-DELEPINE Serge, Grammaire Anglaise de l'Etudiant, Ophrys, 2000.
4. REY J., BOUSCAREN C., MOUNOLOU A., Le Mot et l'Idée 2, Ophrys 1991 (livre de vocabulaire général).
5. GUSDORF Florent, Words Universités, Médiascopie du vocabulaire anglais, Ellipses 1993.

Requirements :
A-level English.

Organisation :
Revision; with focus on grammatical detail and vocabulary building.
Students should read, watch TV series and movies or TV in general in English.

Evaluation :
Two-hour written examination at the end of the semester.
Oral Presentation.

Target :

Monographs	GCU05-PSH
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) :	

Objectives :
Write and present a synthesis report on a topic related to economic or social news, or linked to a career project. An
inter-departmental competition takes place to find the "monograph of the year".

Content :
Overview: Students choose and plan an appropriate project in accordance with the objectives. They carry out rigorous research
on the theme and interview specialists (Emphasis is placed on the use of project management tools and teamwork). A
Presentation is given in front of an invited audience. An inter-departmental competition to finish.
The aim of this module is to broaden the students' knowledge of their chosen professional field and of the prevailing social and
managerial environment. Students must structure their thinking to argue their point and make sense of the various sources of
information studied. Particular emphasis is placed on the importance of the use and quotation of trustworthy sources. The
monographs, which are archived in the library, will then represent a reliable, recent source of information.
The methodological tools required for project management (aims, organisational chart, task-delegation, work schedule) are
applied, resulting in well-written documents and improved public-speaking skills. Teamwork is particularly encouraged.
The teacher ensures that teams never lose sight of their stated objectives.
The advantages and pitfalls of research via the internet are discussed. Interviews are organised with people from within INSA
(Mr. Aubel of CEIP and various teacher-researchers), and with various engineers and managers from elsewhere. Their thoughts
are added systematically to the monograph to support the analysis. The library and the multimedia centre also prove to be
reliable sources of information.
Proper writing style and editing technique are essential; The main rules of editing a quality document are studied, including
structure of a report, style, bibliography, etc.
At least one rehearsal precedes the final oral presentation in order to give the students confidence and highlight the importance
of a well-delivered speech. Students learn how to create a Power Point presentation.
The last classes focus on the voice, gestures, and carefully communicating information in a clear and rigorous way. The oral
presentation event is open to students, teachers and those interviewed in the course of research. The formal nature of this event
is of significant importance as it underlines INSA's policy for the training of generalist engineers.
An inter-departmental competition is held to reward the three best monographs of the year. The objective is threefold:
- to promote the importance of the students' work
- to bring together those interviewed and explain to them our approach
- to promote exchange between departments.

Bibliography :
Timbal-Duclaux L.: L'Expression écriteEcrire pour communiquer. Editions ESF 1994.
Claret J. :Organiser la pensée. Editions ESF, 1989.
Quivy R. et Van Campenhoudt L. : Manuel de recherche en sciences sociales. Editions Dunod 1995.
Licette C. : La prise de parole en public. Editions Studyrama 2002.

Requirements :

Organisation :

Research. Writing of progress reports and press reviews.

Evaluation :
Two marks: (a) Monograph (b) Final presentation.

Target :

Sport and physical education	GCU05-EPS
Number of hours : 26.00 h	1.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) :	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities

Content :
Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O or
Kayak or golf

Bibliography :
Several specialized books are available to the students at the library. Links to internet sites are given on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Semestre 6

Parcours Formation Initiale GCU

1	**TCM06**		**Science and technology of engineer S6**	**4.00**
	TCM06-CAPT	C	Introduction to SENSORS	1.00
	TCM06-ENRG	C	Energy	1.00
	TCM06-IMO	O	Introduction to Production and quality Management	1.00
	TCM06-SHES1	O	Science Humaine Economique et Sociale 1	1.00
	TCM06-SHES2	O	Science Humaine Economique et Sociale 2	1.00
2	**GCU06-1**		**ANALYSE DES STRUCTURES**	**5.25**
	GCU06-11	O	structural Analysis II	1.75
	GCU06-12	O	Béton Armé I	1.50
	GCU06-13	O	Mécanique des solides Elastiques 2	2.00
3	**GCU06-2**		**SOL ET EAU**	**6.25**
	GCU06-21	O	Fluid Mechanics and Hydraulic Engineering 1A	3.00
	GCU06-22	O	Mécanique des Sols I	3.25
4	**GCU06-3**		**MATERIAUX ET TECHNIQUES DE CONSTRUCTION**	**4.50**
	GCU06-31	O	Science des Matériaux II	1.50
	GCU06-32	O	Technologie de la Construction	1.50
	GCU06-33	O	TOPO/SIG/DAO	1.50
5	**GCU-STAGE06**		**STAGE 3GCU**	**4.00**
	GCU06-STAGE	O	3rd Year Work Placement	4.00
6	**GCU-HUM06**		**HUMANITES S6**	**6.00**
	GCU06-ANGL	O	English	2.00
	GCU06-PSH	O	Monographs	2.00
	GCU06-EPS	O	Sport and Physical Education	1.00
	GCU06-PPI	O	Professional Project	1.00
7	**HUMT2-SAM(2)**		**SAM : APES Responsabilités Associatives**	**2.00**
	HUMT2-APES ASSO	F	Association membership & responsabilities 2 credits	2.00
8	**HUMT2-SAM(3)**		**SAM : APES Responsabilités Associatives**	**3.00**
	HUMT2-APES RESP	F	Association membership & responsabilities 3 credits	3.00
10	**GCU06-3 S**		**SC. DES MATERIAUX**	**1.50**
	GCU06-31	C	Science des Matériaux II	1.50
11	**HUMT2-SAM(1)**		**"SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility) "SAM" (Work Placement, Extra-Curricular Activities, Mobility)**	**1.00**
	HUMT2-APES	F	APES	1.00

O = compulsary, C= in choice , F= optional

Introduction to SENSORS	TCM06-CAPT
Number of hours : 35.00 h	1.00 ECTS credit
CM : 21.00 h, TD : 14.00 h	
Reference Teacher(s) : DURAND OLIVIER	

Objectives :
In Europe, the sensors market has been estimated to 10 billions Euros in 2007, corresponding to 28% of the glogal world
market, with an estimated growth more than 6% per year and sustained by the security systems, the automotive, aeronautics
and defence. Nowadays, the sensors market swipes to the electronic instrument mass market. Such a market generates a large
amount of employment in a wide range of industries. The aim of this course is a general overview of the properties and the
applications of sensors, with a global understanding, as general knowledge, of the different phenomena used for the sensors
elaboration.

Content :
General introduction to sensors. Active and passive sensor conditioners. Basics of semiconductor physics. Optical sensors.
Notions on the photovoltaic cells. Temperature sensors. Position and displacement sensors. Magnetic sensors. Mechanical
sensors. Introduction to microsensors.

Bibliography :
Les capteurs en instrumentation industrielle (G. Asch et collaborateurs), Dunod Handbook of Modern Sensors 2nd edition (J. Fraden), AIP Presss, Woodbury, New York Principe généraux des capteurs, cours CNAM (F. Lepoutre)
Cours capteurs (M. Hubin) : http://perso.orange.fr/michel.hubin/capteurs/instrum.htm

Requirements :
No prerequisite.

Organisation :
Homework.

Evaluation :
Written examination on work covered during lectures and tutorials.

Target :

Energy	TCM06-ENRG
Number of hours : 42.00 h	1.00 ECTS credit
TD : 12.00 h	
Reference Teacher(s) : CORNET CHARLES	

Objectives :
Impact of the choice energy sources of the 21st century. Photovoltaic cells and the thermal efficiency of buildings in terms of
cost, efficiency and environmental impact. Inventory of the energy sources currently in use. Thermodynamic tools. Overview
of the different methods of energy production including combustion engines, boilers, nuclear energy, renewable energies, etc.
Presentation of the different means of transport and energy transfer; thermal isolation or conduction, convection, material
transfer, inverted cycle machines, etc.

Content :
24 hours of lectures, 12 hours of tutorials and 6 hours of practical training.
Introduction to energy management and analysis of the current energy situation. The tools of energy engineering: Fick's laws
of diffusion, black body, thermal machines and basic reminders of thermodynamics. Production of energy: nuclear, thermal
combustion, boiler. Renewable energies: wind power, solar, geothermic energy, etc. Delivery of energy: insulation, conduction, convection, electricity and gas transport, etc.
Chapter I: Introduction to energy engineering.
(I) The energy context
1/ Definitions
2/ Overview of the current energy situation
(II) Energy prospects
1/ Supply and demand
2/ Technological orientation
3/ Conclusions
(III) Energy
1/ The different forms of energy
2/ Energy conversion
3/ Stocking and transport of energy.
Chapter II: Engineering tools for Energy
(I) - Transport phenomena
1/ Particle diffusion
2/ Thermal diffusion
3/ Fourier/Ohm/Fick Analogy
4/ Convection
(II) Energy transfer by radiation: black body model
1/ classic description
2/ quantum description - Planck's law
3/ Spectral characteristics of radiation
4/ Interest of the model
(III) Thermodynamics (Reminder)
1/ Thermal machines and cycles
2/ Energetic and entropic outcomes
3/ Diathermy machines
4/ Performance and efficiency.
Chapter III: The production of energy
(I) Nuclear energy
1/ Principle
2/ Fission and nuclear power
3/ Perspectives : toward thermonuclear fusion
(II) Combustion and combustion engines
1/ Combustion and fuels
2/ Ovens and boilers
3/ Combustion engines
(III) Renewable energies : solar, wind power, etc.
1/ Renewable energies

2/ Geothermic and ocean energy
3/ The thermal conversion of solar energy
4/ Photovoltaic solar energy
5/ Wind power
6/ Other energies.
Chapter IV: Transport and transfer of energy
(I) Heat transfer
1/ Heat transfer by thermal conduction: Applications to insulation
2/ Heat transfer by convection: heat exchangers
(II) Material transfers
1/ Pressure or load losses
2/ Turbo machines
(III) Transport of electricity: three-phase current.

Bibliography :
Energétique : concept et applications : Michel Feidt Systèmes énergétiques : (2004) (bibliothèque insa rennes)
Energies renouvelables : (2006) (bibliothèque insa rennes)

Requirements :
Mathematics: differential equations, complex numbers.
Other: Thermodynamics of diffusion and thermodynamic potentials , entropy, efficiency. Fluid mechanism (Bernoulli's
principle), understanding of semiconductors.

Organisation :
Preparation for tutorials, conferences. Internet research.

Evaluation :
2-hour examination based on the lectures and tutorials.

Target :

Introduction to Production and quality Management	TCM06-IMO
Number of hours : 28.00 h	1.00 ECTS credit
CM : 14.00 h, TD : 10.00 h, TP : 4.00 h	
Reference Teacher(s) : SORRE FREDERIC	

Objectives :
Introduction to production management and quality issues: Nowadays, companies must adopt methods associated with tools,
which will allow them to manage production effectively. Overview of the organisation of a factory.

Content :
PART ONE: Production management
(I) Introduction: definition of production management, classification of production systems.
(II) Scheduling in specialised workshops: scheduling on a machine, scheduling with two or three production centres.
(III) Stock management: stock management policies, associated costs, fixed interval order system for stock with a turnover of
zero, re-order point-management.
(IV) Production planning: Planning of the number of components required, basic principles of MRP2, load adjustment, capacity.
(V) "Just-in-time" techniques: origin and principle of JIT, key factors, the Kanban method.
PART TWO: Quality:
(I) Quality of industrial products: the concepts, Quality function, and the international norms for quality control management.
(II) Quality tools: 5S, SMED, TPM, control system and reception control system.
PART THREE: Case study - A presentation by representatives of manufacturers.

Bibliography :
Gestion de la production - Blondel - DUNOD\ n
La gestion de production - Bénassy - HERMES
Contrôle de la qualité - Jaupi - DUNOD
Industrialisation des produits mécanique (Tome 1) - Linarès-Marty - HERMES

Requirements :

Organisation :

Evaluation :
Two-hour written examination. Continuous assessment of Practical work.

Target :

Science Humaine Economique et Sociale 1	TCM06-SHES1
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Science Humaine Economique et Sociale 2	TCM06-SHES2
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

structural Analysis II	GCU06-11
Number of hours : 32.00 h	1.75 ECTS credit
CM : 14.00 h, TD : 14.00 h, TP : 4.00 h	
Reference Teacher(s) :	

Objectives :
This module maintains the same objectives as part 1 (first semester). It also prepares students for the more general module on
the theory of Structures as well as for the special modules on Reinforced concrete, Metal in Construction and Wood in
Construction.

Content :
1. General theory for the calculation of displacement and rotation of beams (Bresse's formulas, theorem of virtual work,
Castigliano-Menabrea's theorem, Maxwell-Betti's theorem)
2. General theory of resolution of beams and systems of hyperstatic beams.
3. Straight isostatic beams.
4. Straight hyperstatic beams.
5. Continuous beams: stiff, elastic, continuous elastic supports.
6. General theory of lines of influence.
7. Study of trellis.
8. Arches.

Bibliography :
1. ALBIGES M. et COIN A., ""Résistance des matériaux appliqués"", tomes I et II, Ed. Dunod, Paris
2. COURBON J.,""Résistance des matériaux"", volumes I et II, Ed. Dunod, Paris
3. ROUX J., ""Résistance des matériaux"", tomes I et II, Ed. Eyrolles, Paris
4. FREY F., ""Structures en barres et poutres"", volume 4, Presses Polytechniques et Universitaires Romandes

Requirements :
Basics of Mathematics and General Mechanics of the first two-years of general engineering studies (STPI). Mechanics of
Elastic Solids GCU3121A and GCU3121B.

Organisation :
42 hours per semester (3 hours per week).

Evaluation :
Two-hour written synthesis examination. Three practical work reports.

Target :

Béton Armé I	GCU06-12
Number of hours : 21.00 h	1.50 ECTS credit
CM : 14.00 h, TD : 7.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Mécanique des solides Elastiques 2	GCU06-13
Number of hours : 36.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 14.00 h, TP : 8.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Fluid Mechanics and Hydraulic Engineering 1A	GCU06-21
Number of hours : 54.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 28.00 h, TP : 12.00 h	
Reference Teacher(s) :	

Objectives :
Design of networks and hydraulic works. Further study of fluid mechanics. Introduction to turbulent flow.

Content :
1. Load losses.
2. Hydraulic installations.
3. Design of branched networks.
4. Dynamics of real fluids.
5. Basic concepts of turbulence.

Bibliography :
1. CARLIER H, 1998, ""Hydraulique générale et appliquée"", Ed. Eyrolles
2. MOREL M.A. et LABORDE J.P., 1992,
""Exercices de mécanique des fluides"" (2 tomes), Ed. Eyrolles
3. OUZIAUX, 1994, ""Mécanique des fluides appliquée"",
Ed. Dunod
4. COMOLET R., 1994, ""Mécanique des fluides"" (3 tomes), Ed. Masson
5. CHASSAING P., 1997, ""Mécanique des fluides"", Ed. Polytech
6. CHASSAING P., 1997, ""Turbulence en Mécanique des fluides"", Ed. Polytech
7. LESIEUR M. , 1994, ""La Turbulence ""

Requirements :
Applied Fluid Mechanics (pre-specialisation module). Global understanding of mechanics.

Organisation :
Review of lecture notes. Preparation for lectures and practical work.

Evaluation :
2 two-hour examinations.
Practical Work reports.

Target :

Mécanique des Sols I	GCU06-22
Number of hours : 61.00 h	3.25 ECTS credit
CM : 28.00 h, TD : 21.00 h, TP : 12.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Science des Matériaux II	GCU06-31
Number of hours : 26.00 h	1.50 ECTS credit
CM : 14.00 h, TP : 12.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Technologie de la Construction	GCU06-32
Number of hours : 28.00 h	1.50 ECTS credit
CM : 28.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

TOPO/SIG/DAO	GCU06-33
Number of hours : 29.00 h	1.50 ECTS credit
CM : 6.00 h, TP : 23.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

3rd Year Work Placement	GCU06-STAGE
Number of hours : 240.00 h	4.00 ECTS credit
ST : 240.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

English	GCU06-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) :	

Objectives :
Development of the students' knowledge of everyday English: lexicon, syntax and phonology. Development of listening and
speaking skills.

Content :
The four skills are developed through a variety of supports such as the Internet, press articles, audio and video resources
dealing with topical issues and recent trends (including extracts from movies, TV series and news reports).
- Listening and Speaking includes debates, role-plays, etc, with participation by the class as a whole or in small groups.
- Reading and Writing includes letter writing, drafting of CVs, etc. Syntactic structures associated with English for scientific
purposes.

Bibliography :
1. Dictionnaire : ROBERT et COLLINS Senior.
2. MURPHY Raymond, English Grammar in Use (with Answers), Cambridge University Press, 1999.
3. BERLAND-DELEPINE Serge, Grammaire Anglaise de l'Etudiant, Ophrys, 2000.
4. REY J., BOUSCAREN C., MOUNOLOU A., Le Mot et l'Idée 2, Ophrys 1991 (livre de vocabulaire général).
5. GUSDORF Florent, Words Universités, Médiascopie du vocabulaire anglais, Ellipses 1993.

Requirements :
A-level English.

Organisation :
Revision; with focus on grammatical detail and vocabulary building.
Students should read, watch TV series and movies or TV in general in English

Evaluation :
Two-hour written examination at the end of the semester.
Oral presentation.

Target :

Monographs	GCU06-PSH
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) :	

Objectives :
Write and present a synthesis report on a topic related to economic or social news, or linked to a career project. An
inter-departmental competition takes place to find the "monograph of the year".

Content :
Overview: Students choose and plan an appropriate project in accordance with the objectives. They carry out rigorous research
on the theme and interview specialists (Emphasis is placed on the use of project management tools and teamwork). A
Presentation is given in front of an invited audience. An inter-departmental competition to finish.
The aim of this module is to broaden the students' knowledge of their chosen professional field and of the prevailing social and
managerial environment. Students must structure their thinking to argue their point and make sense of the various sources of
information studied. Particular emphasis is placed on the importance of the use and quotation of trustworthy sources. The
monographs, which are archived in the library, will then represent a reliable, recent source of information.
The methodological tools required for project management (aims, organisational chart, task-delegation, work schedule) are
applied, resulting in well-written documents and improved public-speaking skills. Teamwork is particularly encouraged.
The teacher ensures that teams never lose sight of their stated objectives.
The advantages and pitfalls of research via the internet are discussed. Interviews are organised with people from within INSA
(Mr. Aubel of CEIP and various teacher-researchers), and with various engineers and managers from elsewhere. Their thoughts
are added systematically to the monograph to support the analysis. The library and the multimedia centre also prove to be
reliable sources of information.
Proper writing style and editing technique are essential; The main rules of editing a quality document are studied, including
structure of a report, style, bibliography, etc.
At least one rehearsal precedes the final oral presentation in order to give the students confidence and highlight the importance
of a well-delivered speech. Students learn how to create a Power Point presentation.
The last classes focus on the voice, gestures, and carefully communicating information in a clear and rigorous way. The oral
presentation event is open to students, teachers and those interviewed in the course of research. The formal nature of this event
is of significant importance as it underlines INSA's policy for the training of generalist engineers.
An inter-departmental competition is held to reward the three best monographs of the year. The objective is threefold:
- to promote the importance of the students' work
- to bring together those interviewed and explain to them our approach
- to promote exchange between departments.

Bibliography :
Timbal-Duclaux L.: L'Expression écriteEcrire pour communiquer. Editions ESF 1994.
Claret J. :Organiser la pensée. Editions ESF, 1989.
Quivy R. et Van Campenhoudt L. : Manuel de recherche en sciences sociales. Editions Dunod 1995.
Licette C. : La prise de parole en public. Editions Studyrama 2002.

Requirements :

Organisation :

Research. Writing of progress reports and press reviews.

Evaluation :
Monograph.
Oral Presentation.

Target :

Sport and Physical Education	GCU06-EPS
Number of hours : 26.00 h	1.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) :	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O or
Kayak or golf

Bibliography :
Several specialized books are available to the students at the library. Links to internet sites are given on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Professional Project	GCU06-PPI
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) :	

Objectives :
Students are encouraged to reflect upon their professional future.

Content :
1. Discovering companies: working for an enterprise, the relationship between "technicians" and other teams: marketing,
direction, sales, finance.
2. Analysis of professional ambition with the aid of human resource specialists and company directors.
3. Meetings: each department sets up meetings to illustrate the situations particular to their sector.
Detailed programme:
Stage 1: In groups of twelve, working alongside consultants and company directors on "how to establish and develop a
professional project".
Stage 2: Discovery of the different professions. Meeting professionals. The student is to set up meetings with two professionals
with the objective of understanding the relationship between the engineering department and the other departments of the
enterprise: marketing, sales, finance, human resources, etc.
Stage 3: Debriefing (with the human resources consultants).
The objective is to have the student to refine his professional project with respect to the enterprise. Students must prepare a
document in advance of the interview containing the following; How did you relate to your interviewee? How did you obtain a
meeting? Did you come across difficulties? How did you prepare for your interview? What were your main objectives? What
can you say about the course of your interview? Have you achieved your objectives (Give details)? And finally, what will you
do differently in future interviews?
Networking: how to use first contacts in an enterprise to achieve further goals.
In the framework of their professional project, fifth year students will attend a conference on job opportunities in their chosen
domain. Examples: High quality car production and the requirements of this sector (GMA). Images and networks (ESC-EII-Info). Setting up business in the information technology sector (EII-ESC-Info). Purchasing: the opportunities for the
engineer (GMA). The different professions open to civil engineering students (GCU). Microelectronics and nanotechnology:
job opportunities (MNT).

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Association membership & responsabilities 2 credits	HUMT2-APES ASSO
Number of hours : 14.00 h	2.00 ECTS credit
DIV : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Association membership & responsabilities 3 credits	HUMT2-APES RESP
Number of hours : 20.00 h	3.00 ECTS credit
DIV : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Science des Matériaux II	GCU06-31
Number of hours : 26.00 h	1.50 ECTS credit
CM : 14.00 h, TP : 12.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

APES	HUMT2-APES
Number of hours : 30.00 h	1.00 ECTS credit
DIV : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Semestre 7

Parcours Formation Initiale GCU

1	**GCU07-1**		**ANALYSE DES STRUCTURES**	**8.50**
	GCU07-11	O	Matrix Structural Analysis I	4.75
	GCU07-12	O	Reinforced concrete Structures I	3.75
2	**GCU07-2**		**MECANIQUE DES SOLS**	**6.25**
	GCU07-21	O	Geotechnical Engineering and road Building II	4.25
	GCU07-22	O	Mécanique des Sols III	2.00
3	**GCU07-3**		**THERMIQUE ET FLUIDE**	**6.25**
	GCU07-31	O	Thermique I	2.50
	GCU07-32	O	Open Channel Flow	3.75
4	**GCU07-4**		**PHYSIQUE DE L'HABITAT**	**4.00**
	GCU07-41	O	Acoustique	2.00
	GCU07-42	O	Lighting Design	2.00
5	**GCU-HUM07**		**HUMANITES S7**	**5.00**
	GCU07-ANGL	O	English	2.00
	GCU07-ECOG	C	Economy and Management	2.00
	HUMT1-EI	C	Entrepreneurship and Innovation 1	2.00
	GCU07-EPS	O	Sport and physical education	1.00

O = compulsary, C= in choice , F= optional

Matrix Structural Analysis I	GCU07-11
Number of hours : 68.00 h	4.75 ECTS credit
CM : 28.00 h, CM : 28.00 h, TD : 28.00 h, TD : 28.00 h, TP : 12.00 h, TP : 12.00 h	
Reference Teacher(s) :	

Objectives :
To understand the mechanical phenomena that governs the behavior of structures (redundancy, stability) and to provide useful
solution strategies such as Matrix Methods)

Content :
1 Energy Principles: An overview with applications to beams
1.1 Principle of Virtual Work
1.2 Principle of Stationary Potential Energy
1.3 Principle of Complementary Virtual Work
1.4 Principle of Stationary Complementary Energy
1.5 Reciprocal Theorems
Part 1: Matrix Analysis of Structures (Direct Stiffness Method)
2 Truss Structures
2.1 Idealization / Degree of Freedom
2.2 Local and Global Coordinate Systems
2.3 Nodal and Element Equilibrium
2.4 Element Stiffness Equations in the Local Coordinate System
2.5 Coordinate Transformation
2.6 Element Stiffness Equations in the Global Coordinate System
2.7 Assembly of the Global Stiffness Matrix
2.8 Incorporation of Boundary Equations
2.9 Static Condensation / Substructuring
2.10 Support Settlement / Elastic Support
2.11 Temperature Effects
3 Continuous Beams
3.1 Idealization / Degree of Freedom
3.2 Nodal and Element Equilibrium
3.3 Element Stiffness Equations
3.4 Assembly of the Global Stiffness Matrix
3.5 Incorporation of Boundary Equations
3.6 Static Condensation / Substructuring
3.7 Support Settlement / Elastic Support
3.8 Beam with Internal Hinge
3.9 Semi-Rigid Connection
3.10 Temperature Effects
4 Frames Structures: Beam/Column Element
4.1 Idealization / Degree of Freedom
4.2 Local and Global Coordinate Systems
4.3 Nodal and Element Equilibrium
4.4 Element Stiffness Equations in the Local Coordinate System
4.5 Coordinate Transformation
4.6 Element Stiffness Equations in the Global Coordinate System
4.7 Assembly of the Global Stiffness Matrix
4.8 Incorporation of Boundary Equations
4.9 Static Condensation / Substructuring
4.10 Support Settlement / Elastic Support
Part 2: Static Stability of Structures
5 Fundamental Concepts in Static Stability
5.1 Introduction
5.2 Bifurcation of Geometrically Perfect Systems
5.3 The Effect of Imperfection
5.4 The Role of Linearized Buckling Analysis
5.5 Systems with Multiple Degrees of Freedom
6 Elastic Buckling Of Planar Columns
6.1 Introduction
6.2 Large-Deflection Solution of an Elastic Column
6.3 Differential Equation of Planar Flexure

6.4 The Basic Case: Pin-Ended Column
6.5 Energy Methods / Ritz Approach
6.6 Five Fundamental Cases
6.7 The Effect of Imperfections
6.8 Stability of a Rigid Frame
6.9 End-Restrained Columns
7 Lateral-Torsional Buckling
7.1 Introduction
7.2 Basic Case: Beams Subjected to Uniform Moment
7.3 The Effect of Boundary Conditions
7.4 The Effect of Loading Conditions
7.5 Lateral-Torsional Buckling of Singly-Symmetric Cross-Sections

Bibliography :

Requirements :
Continuum Mechanics , Elasticity, Beam Theory.

Organisation :
Lecture Review. Personal work: 50 hours

Evaluation :
Three-hour written examination; Practical work reports.

Target :

Reinforced concrete Structures I	GCU07-12
Number of hours : 42.00 h	3.75 ECTS credit
CM : 21.00 h, TD : 21.00 h	
Reference Teacher(s) :	

Objectives :
Safety in the field of construction sciences. The importance of the suitability of building materials. Understand and apply the
results of Limit analysis. Calculations relative to limitation of normal stress for the Service Limit State. Calculations relative to
Service Limit State and Ultimate Limit State.

Content :
Reinforced concrete and safety principles
- Phenomenological and regulatory characterisation of materials. Structural modelling
- Construction law details for local properties
- General rules to justify the normal stress of prismatic pieces subjected to normal forces. Service Limit State of fissuring, deformation. Ultimate Limit State of bending.

Bibliography :
http://www.btp.equipement.gouv.fr/article.php3?id_article=224
http://www.btp.equipement.gouv.fr/article.php3?id_article=378
http://www.btp.equipement.gouv.fr/article.php3?id_article=389
http://www.btp.equipement.gouv.fr/article.php3?id_article=377
THONIER H., 2006, Conception et calcul des structures de bâtiment, l'Eurocode 2 pratique,Ed. Presses de l'ENPC CALGARO J.A., CORTADE J. et ALL, 2006,
Applications de l'Eurocode 2, Ed. Presses de l'ENPC GUILLEMONT P., 2005,
Aide-mémoire béton armé, Ed . Dunod pour Editions Le Moniteur MATANA M., 2004,
Béton armé, Ed. Alternatives Norme européenne EN 1992-1-1 :2004, Ed. AFNOR MOUGIN J.P., 2000,
""Béton armé BAEL 91 modifié 99"", Ed. Eyrolles MIEHLBRADT M., 1997,
Béton armé bases. Structure I, Ed. EPFL NICOT R., 1997, ""Béton armé, Application de l'eurocode 2"", Ed. Ellipse DAVIDOVICI V., 1995,
""Formulaire du béton armé"", Ed. Le Moniteur PERCHAT J. et ROUX A., 1994,
""Pratique du BAEL 91"", Ed. Eyrolles
LACROIX R., FUENTES A. et THONIER H., 1985,
""Traité de béton armé"", Ed. Eyrolles COIN A., 1983, ""Ossatures des bâtiments"", Ed. Eyrolles

Requirements :
Materials. Stress and strain states in a beam. Beam Theory.

Organisation :

Evaluation :
Written examination.

Target :

Geotechnical Engineering and road Building II	GCU07-21
Number of hours : 72.00 h	4.25 ECTS credit
CM : 28.00 h, TD : 28.00 h, TP : 16.00 h	
Reference Teacher(s) :	

Objectives :
Various aspects of soil mechanics. Methods for calculation and dimensioning of works. Stability and settling during the
construction phase /after the handover.

Content :
1. Resistance to drained and undrained shear. Elastoplastic behaviour.
2. Regulations and norms. Limit state calculations.
3. Stability of Slopes. Method of slices.
4. Rigid and flexible retaining structure screens. Limit equation. Reaction module.
5. Shallow and deep foundations. Carrying capacity coefficient.
6. Finite element calculation of the works.

Bibliography :
1. COSTET J., SANGLERAT G., 1985, ""Cours pratique de Mécanique des Sols"", Ed. Dunod.
2. CORDARY D, 1994, ""Mécanique des Sols"", Ed. Tec Doc.
3. LAMBE T.W. et WHITMAN R.V., 1969, ""Soil Mechanics"", J. Wiley.
4. ATKINSON J.H. et BRANSBY, 1978, ""The Mechanics of Soils : an introduction to Critical State Mechanics"", Mac Graw Hill.

Requirements :
Soil Mechanics 1 - Solids Mechanics- Resistance of Materials- Continuum Mechanics, Numeric Calculation, Finite Element.

Organisation :
Review of lecture notes. Research and writing of the project: 40 hours

Evaluation :
Project report.
Oral presentation.
Practical work reports.

Target :

Mécanique des Sols III	GCU07-22
Number of hours : 8.00 h	2.00 ECTS credit
PR : 8.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Thermique I	GCU07-31
Number of hours : 28.00 h	2.50 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Open Channel Flow	GCU07-32
Number of hours : 47.00 h	3.75 ECTS credit
CM : 14.00 h, TD : 21.00 h, TP : 12.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :
Written examination.
Practical work reports.

Target :

Acoustique	GCU07-41
Number of hours : 21.00 h	2.00 ECTS credit
CM : 10.00 h, TD : 7.00 h, TP : 4.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Lighting Design	GCU07-42
Number of hours : 26.00 h	2.00 ECTS credit
CM : 19.00 h, TD : 7.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

English	GCU07-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 0.00 h	
Reference Teacher(s) :	

Objectives :
Acquiring the required skills for working in a firm as an engineer. Reaching the required level (B2) is compulsory in order to graduate.

Content :
- Learning by doing:
The student will have to be able to talk and listen, write documents while showing he/she can solve problems, reason, convince and demonstrate in an articulate manner.
- Expressing oneself accurately and fluently.
The student will engage in activities requiring creative and reactive skills (such as debates, role-plays, individual oral presentations using PowerPoint, projects), which will be based on scientific topics and current events.
- Writing CVs and cover letters
- Scientific English
- Discovering the professional world in an international context
- Preparing for the TOEIC (during the second semester, a specific "Toeic Booster" course will be available)

Bibliography :
Robert and Collins Dictionary (bilingual edition), Collins Cobuild (English only)
English Grammar in Use (Cambridge University Press)

Requirements :
1st, 2nd and 3rd year English courses (or equivalent)

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia language lab and computer rooms are also available and make it possible for the students to work in a stimulating environment. Our teaching resources include press articles, audio and video documents (TV reports, extracts from films and series). We also use the Internet.
Regular personal work is obviously required. The student must be curious and practise English outside the classroom as well.

Evaluation :
One two-hour written exam.

Target :

Economy and Management	GCU07-ECOG
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) :	

Objectives :
- Understand the main topics of management
- Analyse financial information published by companies
- Calculate and analyse costs.
- Be aware of the relations between the different functions of a company.
- Work on a project in a team.

Content :
- Fundamentals of management: fiscal concerns
- accounting and financial management - marketing
- Business simulation for an industrial company.

Bibliography :

Requirements :
None.

Organisation :
An average of one hour a week.

Evaluation :
Continuous assessment.

Target :

Entrepreneurship and Innovation 1	HUMT1-EI
Number of hours : 30.00 h	2.00 ECTS credit
CM : 30.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
The aim of this module is to assemble a team of students with backgrounds in commercial studies and engineering studies. The
groups must learn to communicate and work in mixed teams (engineering students and students of commerce and management) and work together on a business start-up project or product development plan. (business plan)

Content :
Through conferences, interviews and lectures, students gather the information and advice necessary to set out a business plan.
Working in small groups, the students find, develop and formulate their own business start-up project or product-development plan. Progress is evaluated through progress reports in the form of oral presentations.

Groups also benefit from tutorial sessions.

Bibliography :
Given during the course

Requirements :
None

Organisation :
30 hours.

Evaluation :
Continuous assessment (collective work)

Target :

Sport and physical education	GCU07-EPS
Number of hours : 26.00 h	1.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) :	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O. or
Kayak or golf.

Bibliography :
Several specialized books are available to the students at the library. Links to internet sites are given on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Semestre 8

Parcours Formation Initiale GCU

1	**GCU08-1**		**ANALYSE DES STRUCTURES**	**5.50**
	GCU08-11	O	Dynamics of Structures	2.25
	GCU08-12	O	Plastic Analysis of Structures	1.50
	GCU08-13	O	Compunational Methods	1.75
2	**GCU08-2**		**SOLS ET ROUTES**	**4.50**
	GCU08-21	O	Pavement engineering	2.50
	GCU08-22	O	Geology and Hydrogeology	2.00
3	**GCU08-3**		**BATIMENT**	**7.00**
	GCU08-31	O	Steel structures	1.50
	GCU08-32	O	Heat Transfer Engineering II	1.50
	GCU08-33	O	Reinforced Concrete Structures II	1.75
	GCU08-34	O	Science des matériaux III	2.25
4	**GCU-STAGE08**		**STAGE 4GCU**	**8.00**
	GCU08-STAGE	O	Fourth year work placement	8.00
5	**GCU-HUM08**		**HUMANITES S8**	**5.00**
	GCU08-ANGL	O	English	2.00
	GCU08-ECOG	C	Economy and management	2.00
	HUMT2-EI	C	Entrepreneurship and innovation 2	2.00
	GCU08-EPS	O	Sport and physical education	1.00

O = compulsary, C= in choice , F= optional

Dynamics of Structures	GCU08-11
Number of hours : 49.00 h	2.25 ECTS credit
CM : 28.00 h, TD : 21.00 h	
Reference Teacher(s) :	

Objectives :
The stability of elastic structures using the functions of stability. Local buckle and discharge. Analysis of dynamic structures as
applied to earthquake-resistant engineering.

Content :
1. Elastic buckling of bars and structures
2. Calculation of critical load using the energy method
3. Calculation of critical load using the successive approximations method
4. Influence of initial curvature - phenomenon of inversion of flexion
5. Functions of stability
6. Problem Solving: for rigid-knot structures / articulated-knot structures / continuous beams
7. Classification of sections (Eurocodes) (Reminder) - Theoretical models of collapse by buckling (local - shearing) in
structural calculations
8. Understanding Discharge in structural calculations
9. Understanding Seismology
10. Simple damped oscillator
11. Response spectra
12. Multiple oscillators
13. Dimensioning of Structures
14. Potential energy
15. Earthquake-resistance
16. Applications

Bibliography :
1. TIMOSHENKO S., GERE J.M., 1966, ""Théorie de la stabilité élastique"", Dunod
2. APK (BOURRIER P. et BROZETTI J.), 1996, ""Construction métallique et mixte acier-béton"", Eyrolles
3. DAVIDOVICI V., 1980 ""Calcul dynamique des
structures en zone sismique"", Eyrolles
4. ABSI E., 1987, ""Introduction au génie parasismique"", Annales ITBTP
5. Eurocodes 3, 4 et 8

Requirements :
General Mechanics and Mathematical Analysis (vectorial analysis, Partial derivative problems, functions of a complex
variable, etc).

Organisation :
Review of lecture notes. Homework; 90 hours.

Evaluation :
Two written examinations of two and three hours respectively.

Target :

Plastic Analysis of Structures	GCU08-12
Number of hours : 21.00 h	1.50 ECTS credit
CM : 14.00 h, TD : 7.00 h	
Reference Teacher(s) :	

Objectives :
Calculations for plasticity of structures. Application in steel and wooden buildings.

Content :
1. General theory of plasticity: plastic behaviour of structures, load function and load surface, rules of plastic deformation,
metalwork, Prandtl-Reuss and Hencky equations. Elastoplastic behaviour of hyperstatic systems.
2. Limit equilibrium of beam sections: flexion, moment-rotation curve, plastic hinge, interaction with normal and shear forces,
curves of interaction.
3. Theory of Limit Analysis: Static theorem, kinematic theorem and combined theorem - Calculation of maximum loads of
reinforced structures by combination of independent mechanisms - Maximum loads of thin plates.

Bibliography :
1. PRAGER W. KIEFFER J., EPAIN R., 1958, ""Problèmes de Plasticité Théorique"", Ed. Dunod, Paris.
2. RJANITSYN A.R., 1959, ""Calcul à la Rupture et Plasticité des Constructions"", Ed. Eyrolles, Paris.
3. COURBON J., 1965, ""Résistance des Matériaux"", Tome 2, Ed. Dunod, Paris.
4. MANDEL J., 1966, ""Cours de Mécanique des Milieux Continus"", Ed.Gauthier-Villars.
5. MASSONNET Ch. et SAVE M., 1977, ""Calcul plastique des constructions"", Vol. 1, Ed. Nélissen, Liège.
6. FREY F., 2000, ""Mécanique des structures"", Vol. 2, Ed. Presses Polytechniques et Universitaires Romandes.

Requirements :
Mechanics of Elastic Solids. Structural Analysis I.

Organisation :
21 hours

Evaluation :
Two-hour written examination

Target :

Compunational Methods	GCU08-13
Number of hours : 40.00 h	1.75 ECTS credit
CM : 14.00 h, TD : 14.00 h, TP : 12.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Pavement engineering	GCU08-21
Number of hours : 54.00 h	2.50 ECTS credit
CM : 28.00 h, TD : 14.00 h, TP : 12.00 h	
Reference Teacher(s) :	

Objectives :
ROAD AND TERRACING TECHNIQUES:
Road geotechnics (soil classification, compacting, soil utilisation - subgrades and embankment), earthmoving (terracing sketch), Road design (horizontal alignment, longitudinal section, cross-section). Road design software.
ROAD MATERIALS AND ROAD STRUCTURE:
Various elements of road structure (principles, thickness of the different types of layers). Constituents and requirements of road materials - focus on bituminous mixes. Principles of the French method of road design; Quality control tests for road surfaces.

Content :
ROAD AND TERRACING TECHNIQUES:
1. GTR classification of soils. Subgrades and embankment compacting.
2. Earthmoving/ Terracing.
3. Bearing capacity and roadbed classification.
4. Soil treatments.
5. Frost and defrost phenomena: consequences and solutions.
6. Road design: horizontal alignment, longitudinal section, cross-section.
ROAD MATERIALS AND ROAD STRUCTURE:
1. Introduction.
2. Road structure.
2.1. Functional description of road layers.
2.2. Categories of road structure.
2.3. Pavement design, various structures.
3. Road materials.
3.1. Basic constituents: aggregates, hydraulic binders and hydro-carbonated binders.
3.2. Mixes: non treated materials, treated materials with hydraulic binders, treated materials with hydro-carbonated binders.
4. Surface quality.
4.1. Evenness
4.2.Pavement skid resistance

Bibliography :
SETRA-LCPC, 1992, ""Réalisation des remblais et des couches de forme - Guide Technique"", LCPC IST-Publications.
LCPC- SETRA, 2000, ""Traitement des sols à la chaux et/ou aux liants hydrauliques - Guide Technique"", LCPC IST-Publications. SETRA, 1994,
"" Aménagements des Routes Principales (ARP) "", Guide Technique. SETRA, 1985,
"" Instruction sur les Conditions Techniques d'Aménagement des Autoroutes de Liaison (ICTAAL)"", Guide Technique.SETRA-LCPC, 1994,
""Conception et dimensionnement des structures de chaussée - Guide Technique"", LCPC IST-Publications.
DI BENEDETTO. H., CORTE J.-F., Matériaux routiers bitumineux, tomes 1 2, éd. Hermes, Lavoisier, 2005.
HERSCHKORN P., Couches de roulement, Presses de l'ENPC, 1988.
PEYRONNE C., KAROFF G., Dimensionnement des chaus sées, Presses de l'ENPC, 1991.
NISSOUX J.-L., VILLEMAGNE M., Chaussées en béton de ciment, Presses de l'ENPC, 1988.

Requirements :
Soil physics. Plane geometry. Aggregates and hydraulic binders. Basic knowledge of Mechanics of elastic solids.

Organisation :
Review of lecture notes.

Evaluation :
2 two-hour written examinations. Practical Work reports.

Target :

Geology and Hydrogeology	GCU08-22
Number of hours : 40.00 h	2.00 ECTS credit
TD : 24.00 h, TP : 16.00 h	
Reference Teacher(s) :	

Objectives :
Practical and theoretical study methods for land, soil and road-building materials.

Content :
1. Using cartographic documents and aerial photos.
2. Geological structures.
3. Geotechnics.
4. Terracing.
5. Road-building techniques.

Bibliography :
FOUCAUT A. et RAOULT J.F., 1975, ""Coupes et cartes géologiques"", Ed. SEDES et DOIN

Requirements :
Third year programme.

Organisation :

Evaluation :
2 ninety-minute written examinations.
Practical Work reports.

Target :

Steel structures	GCU08-31
Number of hours : 21.00 h	1.50 ECTS credit
CM : 21.00 h	
Reference Teacher(s) :	

Objectives :
Global understanding of the behaviour of metal frame structures. Identification of the combination of actions on each element
of the structure. Basic principles of verification of; structural safety and serviceability; elasticity and plastic dimensioning of
metallic elements; assembly and stability theory.

Content :
1. History and main points.
2. The utility steels in steel construction: methods of manufacture, finished products, performances and testing.
3. Eurocodes One and Three. Different types of analysis.
4. Strength of sections.
5. Strength of elements.
6. Weld assembly, bolted joints.

Bibliography :
1. M.A. Hirt et R. Bez, 1996, Construction Métallique. Notions fondamentales et méthodes de dimensionnement, Presses Polytechniques et Universitaires Romandes
2. M.A. Hirt, A. Nussbaumer, M. Crisinel et J.P. Lebet , 2004, Construction Métallique : bases de calcul et exemples numériques adaptés aux nouvelles normes, Presses Polytechniques et Universitaires Romandes

Requirements :
Beam theory. Strength of materials. Structural mechanics. Calculation of plasticity of structures. Mechanics of elastic solids.
Stability.

Organisation :
50 hours.

Evaluation :
Three-hour written examination.

Target :

Heat Transfer Engineering II	GCU08-32
Number of hours : 28.00 h	1.50 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) :	

Objectives :
This module provides the elements necessary for a profound understanding of the technical and theoretical problems of
Thermics for Buildings. There are four objectives:
1. An extension of the third year programme to standard elements of man-made structures;
2. Global understanding of and critical attitude towards the principles and methods of thermal code RT2000;
3. Method for integrating Thermics into the design process for buildings;
4. Technical solutions for the construction of thermically-efficient buildings.

Content :
1. Problems associated with thermics in residential buildings. The Energy Challenge.
2. Opaque walls in steady and time-dependent flow.
3. Air film thermics.
4. Thermal bridges.
5. Themics of glass walls.
6. Solar thermal gain.
7. Humid air and hygrometry.
8. Energy consumption of buildings.

Bibliography :
1. Cortès H. et Blot J., ""Transferts thermiques-Application à l'habitat"", chez Ellipse, 1999
2. Croiset M., ""L'hygrothermique dans l'habitat"", chez Eyrolles Paris, 1970
3. ""Traité de physique du bâtiment, Tome 1 : connaissances de base"", edition du CSTB
4. ""RT200"", Base de données I-Reef du CSTB
5. Hernot D., Porcher G., ""Thermique appliquée aux bâtiments"", aux éditions parisiennes CFP, 1984
6. Recknagel et col., ""Manuel pratique du génie climatique- tome 1: données fondamentales"",
chez PYC, édition Paris, 1995, présent à la BU INSA

Requirements :
Thermics

Organisation :
Review of lecture notes(15 hours).

Evaluation :
Two-hour written examination.

Target :

Reinforced Concrete Structures II	GCU08-33
Number of hours : 42.00 h	1.75 ECTS credit
CM : 21.00 h, TD : 21.00 h	
Reference Teacher(s) :	

Objectives :
- Fundamental understanding of safety in construction.
- Conceptualise security methods; development of observation and evaluation skills in order to highlight the adequacy between material and work.
- Understand and apply the results of limit state analysis.
- Calculation methods for normal stress and design at serviceability limit state (SLS) and ultimate limit state (ULS).

Content :
ULS of flexion, torsion and stability. Shearing force at the ULS for beams, columns and slabs.

Bibliography :
http://www.btp.equipement.gouv.fr/article.php3?id_article=224
http://www.btp.equipement.gouv.fr/article.php3?id_article=378
http://www.btp.equipement.gouv.fr/article.php3?id_article=389
http://www.btp.equipement.gouv.fr/article.php3?id_article=377 THONIER H., 2006, Conception et calcul des structures de
bâtiment, l'Eurocode 2 pratique, Ed. Presses de l'ENPC CALGARO J.A., CORTADE J. et ALL, 2006, Applications de l'Eurocode 2, Ed. Presses de l'ENPC GUILLEMONT P.,
2005, Aide-mémoire béton armé, Ed . Dunod pour Editions Le Moniteur
MATANA M., 2004, Béton armé, Ed. Alternatives Norme européenne EN 1992-1-1 :2004, Ed. AFNOR MOUGIN J.P.,
2000, ""Béton armé BAEL 91 modifié 99"", Ed. Eyrolles MIEHLBRADT M., 1997, Béton armé bases. Structure I, Ed.
EPFL NICOT R., 1997, ""Béton armé, Application de l'eurocode 2"", Ed. Ellipse DAVIDOVICI V., 1995, ""Formulaire du béton armé"", Ed. Le Moniteur PERCHAT J. et ROUX A., 1994, ""Pratique du BAEL 91"", Ed. Eyrolles LACROIX R., FUENTES A. et THONIER H., 1985, ""Traité de béton armé"", Ed. Eyrolles COIN A., 1983, ""Ossatures des bâtiments"", Ed. Eyrolles

Requirements :
Structural Analysis I.
Reinforced Concrete I.

Organisation :

Evaluation :
Two 3-hour written examinations

Target :

Science des matériaux III	GCU08-34
Number of hours : 22.00 h	2.25 ECTS credit
CM : 14.00 h, TP : 8.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Fourth year work placement	GCU08-STAGE
Number of hours : 240.00 h	8.00 ECTS credit
ST : 240.00 h, ST : 240.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

English	GCU08-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) :	

Objectives :
Acquiring the required skills for working in a firm as an engineer. Reaching the required level (B2) is compulsory in order to graduate.

Content :
- Learning by doing:
The student will have to be able to talk and listen, write documents while showing he/she can solve problems, reason, convince and demonstrate in an articulate manner.
- Expressing oneself accurately and fluently.
The student will engage in activities requiring creative and reactive skills (such as debates, role-plays, individual oral presentations using PowerPoint, projects), which will be based on scientific topics and current events.
- Writing CVs and cover letters
- Scientific English
- Discovering the professional world in an international context
- Preparing for the TOEIC (during the second semester, a specific "Toeic Booster" course will be available)

Bibliography :
- Robert and Collins Dictionary (bilingual edition), Collins Cobuild (English only)
- English Grammar in Use (Cambridge University Press)

Requirements :
1st, 2nd and 3rd year English courses (or equivalent)

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia language lab and computer rooms are also available and make it possible for the students to work in a stimulating environment. Our teaching resources include press articles, audio and video documents (TV reports, extracts from films and series). We also use the Internet.
Regular personal work is obviously required. The student must be curious and practise English outside the classroom as well.

Evaluation :
TOEIC test (end of semester)
An individual oral presentation

Target :

Economy and management	GCU08-ECOG
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) :	

Objectives :
- To improve the understanding of economy and management topics
- To be able to work on a project in a team.

Content :
- The firm
- Introduction to industrial property
- Introduction to project management
- Accounting and Finance
- Economy

Bibliography :

Requirements :
None.

Organisation :
An average of 1 hour a week.

Evaluation :
Continuous assessment and exam.

Target :

Entrepreneurship and innovation 2	HUMT2-EI
Number of hours : 30.00 h	2.00 ECTS credit
CM : 26.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course focuses on economic, legal and social matters. Students are encouraged to develop their curiosity and their ability to analyse topics related to the general environment of a company.

Main learning outcomes:
- Understanding key concepts related to a firm¿s environment and strategies
- The accumulation of high-quality information on these topics
- Establishing a strong, specific- vocabulary base
- Understanding how different stakeholders act

Content :
- Economics: How markets operate. Growth, financing and regulation of the economy
- Law: Corporate law. Industrial and intellectual property rights
- Management: Project management. Corporate social responsibility

Bibliography :
Provided during the course

Requirements :
None

Organisation :
2 hours per week

Evaluation :
Continuous assessment (collective work) + final examination (2 hours)

Target :

Sport and physical education	GCU08-EPS
Number of hours : 26.00 h	1.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) :	

Objectives :
Team work. Discovery of one's capabilities. Communication. Invention. Autonomy. Self-discovery and Management
responsibilities.

Content :
Whole class: "role of the coach, role of the referee, management" (knowledge of the rules, getting involved, leading, decision
making and communicating). Practice and knowledge of the sociomotive roles involved in the strategies of team attack and
team defence. Finding one's place in a group and awareness of your team-mates and their responsibilities.
Organisation: two 15-hour and one 30-hour sports or physical activity programme in groups.

Bibliography :
Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education
website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Semestre 9

Parcours Formation Initiale GCU

1	**GCU09-1**		**TRONC COMMUN 1**	**10.00**
	GCU09-1C1	O	Durability	2.00
	GCU09-1C2	O	Reinforced Concrete Structures III	3.00
	GCU09-1C3	O	Prestressed Concrete Structures	2.00
	GCU09-1C4	O	Ground improvement	1.50
	GCU09-1C5	O	Maintenance and Rehabilitation of Infrastructure	1.50
2	**GCU09-2**		**TRONC COMMUN 2**	**4.00**
	GCU09-2C6	O	Construction Law and Legislation	1.00
	GCU09-2C7	O	Architecture and Urban Space Management	1.00
	GCU09-2C8	O	Urban planning	1.50
	GCU09-2C9	O	Conférences	0.50
3	**GCU09-3**		**UE A CHOIX : BATIMENT OU GENIE URBAIN OU TRAVAUX PUBLICS**	**10.50**
	GCU09-3B1	C	Wood Structures	1.00
	GCU09-3B2	C	Steel structures	2.00
	GCU09-3B3	C	Building Materials	1.00
	GCU09-3B4	C	Building Acoustics	1.00
	GCU09-3B5	C	Heat Transfer Engineering III	1.50
	GCU09-3B6	C	Thermal Conditioning	1.50
	GCU09-3B7	C	Fluids and Building Equipment	1.00
	GCU09-3U1A	C	Urban Hydrogeology and Water Ressource Management	2.00
	GCU09-3U2A	C	Design of Water Supply & Waste Conveyance Systems	1.50
	GCU09-3U3B	C	Waste Management & Contaminated Sites	1.00
	GCU09-3U4B	C	Air Quality Assessment & Sustainable Development	1.00
	GCU09-3U5B	C	Urban Acoustics	1.00
	GCU09-3U6C	C	Public Road & Transportation Infrastructure	1.50
	GCU09-3U7C	C	Sustainable Mobility in Cities	1.50
	GCU09-3U8	C	Urbanisme 2	1.00
	GCU09-3T1	C	Pavement Mechanics	1.50
	GCU09-3T2	C	Ouvrages géotechniques	2.50
	GCU09-3T3	C	Marine Hydraulic Engineering	1.00
	GCU09-3T4	C	Hydrogeology	1.00
	GCU09-3T5	C	Prestressed Concrete	1.00
	GCU09-3T6	C	Bridges and Infrastructures	2.00
	GCU09-3T7	C	Composite Steel - Concrete Structures	1.50
4	**GCU-HUM09**		**HUMANITES S9**	**5.50**
	HUMT1-ANGL/CONV	O	English S9 Conversation	1.50
	HUMT1-PGE-A	C	Economics, Law and Business Studies A (serious game)	2.00
	HUMT1-PGE-B	C	Economics, Law and Business Studies B (Lean six sigma)	2.00
	HUMT1-PGE-C	C	Economics, Law and Business Studies C (human resource management)	2.00
	HUMT1-PGE-D	C	Economics, Law and Business Studies D (Marketing for ICT Companies)	2.00
	HUMT1-PGE-E	C	Economics, Law and Business Studies E (Industrial design and innovation)	2.00

	HUMT1-PGE-F	C	Economics, Law and Business Studies F (Mangement and decision making)	2.00
	GCU09-SPEC	O	Module spécifique GCU	2.00
	HUMT1-EI	C	Entrepreneurship and Innovation 1	2.00
11	**GCU09-IGR 45**		**IGR**	**4.50**
	GCU09-IGR 4.5	C	IGR	4.50
15	**HUMT1-ELSA EI**		**Entrepreneurship**	**1.00**
	HUMT1-EI+	F	Entrepreneurship +	1.00

O = compulsary, C= in choice , F= optional

Durability	GCU09-1C1
Number of hours : 24.00 h	2.00 ECTS credit
CM : 24.00 h	
Reference Teacher(s) :	

Objectives :
Identification of and understanding the main causes of damage to building materials. Characterisation techniques. The
principles of prevention.

Content :
I. DURABILITY OF CONCRETE:
1. The physico-chemical basics of the durability of concretes: hydrates, porous network of concrete - Interfaces, surface
properties, properties of capillary transport, permeability, diffusion, migration.
2. The chemical processes of the degradation of concrete. Effect of acid, sea water, sulphates on concrete. Degradation by
alkali-silica reaction - Carbonation, Corrosion.
3. The physical processes of the degradation of concrete. Freeze - thaw cycling, Abrasion, Erosion, Cavitation.
4. Principles of prevention .
II. DURABILITY AFTER IMPLEMENTATION:
1. Factors of intrinsic alteration (effects connected to the mineralogical composition, role of hydric properties, mechanical
properties and transfer properties).
2. Factors of extrinsic alteration (freeze, effects of salts, effects of gaseous atmospheric pollution, biological colonisation).
3. Patina.

Bibliography :
1. La durabilité des bétons. Collection de l'Association Technique de l'Industrie des Liants Hydrauliques, sous la direction de Jacques Baron et Jean-Pierre Ollivier. Edition Presse de l'Ecole Nationale des Ponts et Chaussées.
2. La dégradation des bétons: couplage fissuration dégradations chimi ques. Sous la direction de Jean Michel TORRENTI, Olivier DIDRY, Jean Pierre OLLIVIER, Frederic PLAS. Edition HERMES
3. Les bétons à hautes performances : caractérisation, durabilité, applications. Sous la direction de Yves MALIER. Edition Presse de l'Ecole Nationale des Ponts et Chaussées.

Requirements :

Organisation :

Evaluation :
Written examination.
Mini-project (Report and oral presentation).

Target :

Reinforced Concrete Structures III	GCU09-1C2
Number of hours : 16.00 h	3.00 ECTS credit
CM : 16.00 h	
Reference Teacher(s) :	

Objectives :
Completion of a synthesis project on the subject of reinforced concrete.

Content :
Class time is given over to discussing and finding solutions to any problems the students may have met while preparing their
project. The group receives instructions to guide them in the next phase of their project.

Bibliography :
1. DAVIDOVICI V., 1995, ""Formulai re du béton armé"", Ed. Le Moniteur
2. RENAUD H., 1989, ""Constructeur bâtiment"", Ed. Foucher
3. DREUX G., 1981, ""Calcul pratique du béton armé"", Ed. Eyrolles
4. ""EC2"", 1992, Ed. AFNOR
5. ""BAEL 91"", 1991, Ed. Journal Officiel
6. PERCHAT J. et ROUX A., 1994, ""Pratique du BAEL 91"", Ed. Eyrolles
7.LACROIX R., FUENTES A. et THONIER H., 1985, ""Traité de béton armé"", Ed. Eyrolles
8. MOUGIN J.P., 1995, ""Béton armé, BAEL 91 et DTU associés"", Ed. Eyrolles
9. ALBIGES M. et MINGASON M., 1984, ""Théorie et pratique du béton armé aux états limites"", Ed. Eyrolles
10. COIN A., 1983, ""Ossatures des bâtiments"", Ed. Eyrolles.

Requirements :
Structural Analysis GCU0523 and GCU0624, Reinforced Concrete GCU0744; GCU0845

Organisation :
4 to 6 hours of personal work per week: 70 hours.

Evaluation :
Mini-project (100 to 150 pages).

Target :

Prestressed Concrete Structures	GCU09-1C3
Number of hours : 24.00 h	2.00 ECTS credit
CM : 24.00 h	
Reference Teacher(s) :	

Objectives :
Principles of prestressed structures. Application to concrete.

Content :
1. Main points - history.
2. Understanding of safety and regulation in construction.
3. Materials.
4. Process of prestressing concrete.
5. Phases of construction.
6. Execution and inspection.
7. Cable Tension and assessment of loss of tension.
8. Simple longitudinal flexion study (Service Limit State).
9. Simple longitudinal flexion study (Ultimate Limit State).
10. Tangent loading (Justification).
11. Tensioning cables.
12. Synthesis exercises.

Bibliography :
1. THONIER H., LE BETON PRECONTRAINT AUX ETATS LIMITES, Presse des Ponts et Chaussées, 1992.
2. CHAUSSIN R., FUENTES A., LACROIX R. , PERCHAT J. LA PRECONTRAINTE, Presse des Ponts et Chaussées 1992
3. Cours de béton précontraint INSA Document polycopié, par Jean BACOT
4. Documents techniques des fabricants de systèmes de précontrainte et des constructeurs.
5. Films, CD rom, etc ; reportages personnels sur des chantiers.

Requirements :
Modules on; General Mechanics. Resistance of Materials. Reinforced Concrete.

Organisation :
Review of lecture notes. Completion of drawings. 30 hours

Evaluation :
Mini-project (in pairs).

Target :

Ground improvement	GCU09-1C4
Number of hours : 36.00 h	1.50 ECTS credit
CM : 24.00 h	
Reference Teacher(s) :	

Objectives :
A synthesis of acquired knowledge of soil reinforcement.

Content :
General points: Grain-soil treatment. Silt-soil treatment. Physical, mechanical, chemical and special processes. Individual techniques and combinations of techniques: Soil injection. Reinforced earth and derivative procedures. Selection of
the appropriate method.

Bibliography :
Cours de Mécanique des sols. Cours de Renforcement des sols. Document polycopié par Jean BACOT

Requirements :
"Soil mechanics" module.

Organisation :
Review of lecture notes. Research. Article (synthesis).

Evaluation :
Bibliographic research project in pairs.
One Report per student.

Target :

Maintenance and Rehabilitation of Infrastructure	GCU09-1C5
Number of hours : 24.00 h	1.50 ECTS credit
CM : 24.00 h	
Reference Teacher(s) :	

Objectives :
Problems associated with works maintenance and problem diagnosis. Modern, non-destructive techniques for diagnosing
abnormalities. Principles and methods for treating degraded concrete.

Content :
1. Policy for the maintenance of classified buildings
- Implementation of maintenance policy
- Technical evaluation
- Classification of the works
- Indication of the state
- Technical priority
- Socioeconomic priority
- Strategy of intervention.
2. The problem of auscultation, evaluation and diagnosis of the works.
3. Basics and principles of the usual non-destructive physical methods of the qualification of concrete
- Non-destructive evaluation methods using ultrasound, electromagnetism (radar), thermal imagery (infrared thermography), electric and electrochemical methods (resistivity, potential and speed of corrosion), radiographic and gammagraphic methods, optical methods
- Applications: evaluation of the state of the material. Evaluation of the waterproofness of the works.
4. Reparation of concrete
- Damage to concrete
- Concepts for carrying out repairs
- Repair procedures
- Choice of materials
- Preparation of the surface to be repaired
- Implementation techniques
- Crack injection
5. Reinforcing the structure
- Strengthening
- Addition of material
- Principles of dimensioning.
6. Case studies:
- bridges
- Buildings
- Protection of steel
- Reparation with screed
- Reparation and reinforcement by sprayed concrete
- Reparation by casting or injection of concrete or mortar.

Bibliography :

Requirements :
Understanding of diagnosis abnormalities in buildings.

Organisation :
Review of lecture notes.

Evaluation :
Two-hour written examination.

Target :

Construction Law and Legislation	GCU09-2C6
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) :	

Objectives :
Understanding of law and judicial reasoning in preparation for future dealings with the legal department of a company.

Content :
1. Introduction to law (characteristics, specialisation: classification).
2. Origins and the hierarchy of standards.
3. Legal organisation (jurisdictions, law practitioners).
4. The decennial responsibility of builders and the presentation of a legal proceeding regarding construction law.
5. Employment and the employment contract (rules, sanctions).

Bibliography :
1. LYON-CAEN, ""Manuel de Droit du Travail"", Précis Dalloz
2. Dictionnaire Permanent, Droit de la Construction, Droit
social.
3. Dictionnaire des termes juridiques - Editions Dalloz

Requirements :
Knowledge of materials used in building and public works. Overview of French institutions and the separation of the three
powers of government.

Organisation :

Evaluation :
A two-hour examination (four questions linked to the topics treated in class).
Practical Case Study.

Target :

Architecture and Urban Space Management	GCU09-2C7
Number of hours : 14.00 h	1.00 ECTS credit
CM : 2.00 h, TD : 12.00 h	
Reference Teacher(s) :	

Objectives :
Technical analysis and synthesis of two aspects of the architecture of a recent construction. Engineering and Architecture
students work on a common project.

Content :
Students of the INSA and the ENSAB* cooperate on a project.
The groups are given a list of recently constructed buildings from which they must choose one as the subject of their project.
Then, working together, they first carry out the necessary research through consulting specialised reviews and the Internet, and
meeting architects or visiting design offices, etc.
Once their research has been completed they must conduct an analysis of two relevant technical aspects associated with the
building; acoustics, thermal, structure, façade composition, fire safety plan, etc.
The engineering students must present their research synthesis and their analysis on an A1 format board.
*ENSAB: Brittany Superior National School of Architecture.

Bibliography :
1. ""Le Grand Atlas de l'Architecture Mondiale"", 1988, Ed. Encyclopaedia Universalis
2. LE CORBUSIER, 1995, ""Vers une architecture"" , Ed. Flammarion
3. ACHE J.B., 1970, ""Eléments d'une histoire de l'art de bâtir"", Ed. Moniteur des Travaux Publics.
4. ZEVI BRUNO, 1959, ""Apprendre à voir l'architecture"", Ed. de Minuit
5. CHOISY A., 1987, ""Histoire de l'architecture"", 2 vol., Ed. Statkine reprints

Requirements :

Organisation :
16 hours.

Evaluation :
Mini-project: presentation board in A1 format.

Target :

Urban planning	GCU09-2C8
Number of hours : 24.00 h	1.50 ECTS credit
CM : 24.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Conférences	GCU09-2C9
Number of hours : 24.00 h	0.50 ECTS credit
CONF : 10.00 h, CONF : 10.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Wood Structures	GCU09-3B1
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) :	

Objectives :
Familiarisation with wood as a building material. An approach to the dimensioning of wooden structures.

Content :
1. Description of wood, durability, treatment, pathology.
2. Using the plan of a house: calculations for wooden elements under flexion, compression, shearing.
3. Buckling and discharge.
4. Calculation for assemblies.
5. Calculation of fire resistance.
6. Presentation of the most common types of wooden structures.

Bibliography :
1. Règles CB71 2. Règles Eurocode 5.

Requirements :
Basics of Resistance of Materials used in Civil Engineering.

Organisation :
10 hours.

Evaluation :
Two-hour written examination.

Target :

Steel structures	GCU09-3B2
Number of hours : 36.00 h	2.00 ECTS credit
CM : 36.00 h	
Reference Teacher(s) :	

Objectives :
Conception: Sensitivity dimensioning. Understanding classic calculations for steel structures. General: Overview of the various
metal technologies in building construction. Calculation techniques.

Content :
1. Introduction to the conception of structures: Main structural plans (classic constructions).
2. Analysis of structures: Classification and choice of the structural analysis methods.
3. Resistance of elements and sections: Calculation procedures.
4. Calculation of stiffened sheet steel: Buckle of a slender web.
5. Calculation under localised loads: Introduction.
6. Assemblies: Conception. Calculation of the constituent elements. Semi rigidity. Constituents method. Application:
document SPRINT
7. Resistance to fire: Introduction.
8. Introduction to the calculation of hollow profiles.
9. Introduction to the calculation of hulls
10. Introduction to the conception of earthquake-resistant steel structures.

Bibliography :
1. APK, 1996, ""construction métallique et mixte acier-béton"", tomes 1 et 2, éditions Eyrolles
2. MAQUOI R, , Cours de construction métallique, université de Liège
3. CD ROM ESDEP, leçons de construction métallique, APK, 1999
4. SPRINT, rapport de recherche RA 351 : ""L'eurocode 3 et les assemblages en acier : aides de calcul pour assemblages rigides et semi rigides""
5. HIRT, BEZ, NUSSBAUMER, 2006, ""Construction métallique : Notions fondamentales et méthodes de dimensionnement"", presses polytechniques et universitaires romandes.
6. PLUMIER A, cours de construction parasismique, université de Liège

Requirements :
Structural calculation for Metallic construction I (GCU 0842)

Organisation :
Review of lecture notes. Mini project: 90 hours.

Evaluation :
Mini project.
Oral presentation.

Target :

Building Materials	GCU09-3B3
Number of hours : 14.00 h	1.00 ECTS credit
CM : 14.00 h	
Reference Teacher(s) :	

Objectives :
Overview of all new Civil Engineering building materials including special materials and finishing materials.

Content :
The following materials are examined from the point of view of their interest, composition, manufacturing and properties:
- Glass: Composition (formative oxides, modifiers, and intermediate). Variation of the viscosity according to the temperature.
General properties (optical, thermal, mechanical properties, thermal and chemical tempering).
- Vitreous ceramics: (electric properties, tribology, dimensional stability, Impact resistance).
- Ceramics: Definition. General properties (chemical Connections, crystalline structure, microstructure).
- Various types of ceramic materials: Traditional, technical, fireproof. Domains of application.
- Plastics: Composition (monomers, polymerisation by addition, polycondensation). Various types of plastics (thermoplastic,
thermal hardening, elastomers). The atomic architecture of polymers. Other constituents and additives of plastics. Physical
properties. Mechanical properties.
- High-performance concretes: principle for obtaining, mechanics of super plastifying, composition. Properties in fresh state
and hardened state, expected durability, interest.
- Ultra-high-performance fibre-reinforced concrete.
- Self-compacting concrete. Light Concretes. Heavy Concretes. Fireproof Concretes. Casting concrete directly onto the ground.
Pulverised concrete. Lime. Plaster.

Bibliography :

Requirements :

Organisation :

Evaluation :
Mini-project (Report and Presentation).

Target :

Building Acoustics	GCU09-3B4
Number of hours : 14.00 h	1.00 ECTS credit
CM : 14.00 h	
Reference Teacher(s) :	

Objectives :
Basics of building acoustics.

Content :
1. Environmental noiseproofing.
2. Impact noiseproofing.
3. Equipment noiseproofing.
4. Regulations.
5. Understanding the acoustics of a large room.

Bibliography :
1. JOSSE R., 1977, ""Notions d'acoustique"", Ed. Eyrolles
2. JOUHANNEAU J., 1997, ""Acoustique des salles et sonorisation"", Lavoisier Tec et Doc

Requirements :
Basics of physics-acoustics.

Organisation :
Calculations from class notes: 16 hours.

Evaluation :
Mark for on-site calculations taken over a period of four hours. Building department option.

Target :

Heat Transfer Engineering III	GCU09-3B5
Number of hours : 24.00 h	1.50 ECTS credit
CM : 24.00 h	
Reference Teacher(s) :	

Objectives :
Thermal modelling of various types of buildings and energy systems. Study of models and calculation methods associated with
the problems of heat transfer.

Content :
1. Loads and thermal exchange in buildings.
2. Simplified simulation model of thermal behaviour. Application to irregularity of heating.
3. Study of convective heat transfer and thermal radiation in buildings. Modelling of thermal exchanges
4. Finite difference numerical methods. Cranck-Nicholson Implicit and explicit schemes. Mono and bi-dimensional problems.
Case studies.
5. Convolutive methods of transfer: answer factor, transfer function.
6. Principles and modelling of energy systems.
7. Phenomena of transfer of heat and flow of fluids. Finite volume method.

Bibliography :
1. Cortès H. et Blot J., « Transferts thermiques-Application à l?habitat », chez Ellipse, 1999
2. Croiset M., « L'hygrothermique dans l?habitat », chez Eyrolles Paris, 1970
3. « Traité de physique du bâtiment, Tome 1 : connaissances de base », edition du CSTB
4. « RT200 », Base de données I-Reef du CSTB
5. Hernot D., Porcher G., Thermique appliquée aux bâtiments », aux éditions parisiennes CFP, 1984
6. Recknagel et col., « Manuel pratique du génie climatique- tome 1: données fondamentales », chez PYC edition Paris, 1995, présent à la BU INSA

Requirements :

Organisation :

Evaluation :
Two-hour written examination.

Target :

Thermal Conditioning	GCU09-3B6
Number of hours : 20.00 h	1.50 ECTS credit
CM : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :
Mini-projet.

Target :

Fluids and Building Equipment	GCU09-3B7
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :
Mini-projet.

Target :

Urban Hydrogeology and Water Ressource Management	GCU09-3U1A
Number of hours : 24.00 h	2.00 ECTS credit
CM : 24.00 h	
Reference Teacher(s) :	

Objectives :
Hydrology & Water management: The problems associated with superficial and subterranean water resource management.
Water pollution criteria. Sources of pollution. Analysis of the reaction of urban bowater watersheds during precipitation.
Calculation and conception of water distribution works. Evacuation and water treatment.

Content :
Hydrology & Water management:
1. Organisation of water management in France.
2. Water resources. Treatment of drinking-water. Adduction and drinking-water distribution networks.
3. Urban zone sanitation systems and projects. Waste-water treatment.
4. Alternative techniques for urban sanitation T

Bibliography :
1. VALIRON F., 1990, ""Gestion des eaux"" (3 tomes), Presses de l'E.N.P.C.
2. DUPONT A., 1969, ""Hydraulique urbaine"" (2 tomes), Ed. Dunod
3. COSTE C et LOUDET M., 1987, ""L'assainissement en milieu urbain ou rural"", Ed. Le Moniteur
4. REMENIERAS G., 1976, ""Hydrologie de l'ingénieur, Ed. Eyrolles
5. LLAMAS J., 1993, ""Hydrologie générale - Principes et applications"", Ed. Gaëtan Morin
6. MUSY A. ""Hydrologie générale ""Ed. EPFL

Requirements :
Hydraulic engineering GCU3242. Open Channel Flow GCU4142.

Organisation :
Project: Uurban hydrology and hydraulic engineering.
Research: Technical and municipal reviews. Publications on water management and ecology.
Students are encouraged to analyse and criticise case studies.

Evaluation :
Mini-project.

Target :

Design of Water Supply & Waste Conveyance Systems	GCU09-3U2A
Number of hours : 24.00 h	1.50 ECTS credit
CM : 24.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :
Mini-project.

Target :

Waste Management & Contaminated Sites	GCU09-3U3B
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :
Mini-project.

Target :

Air Quality Assessment & Sustainable Development	GCU09-3U4B
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) :	

Objectives :
Understanding the problems associated with atmospheric pollution and its association with sustainable development.

Content :
Atmospheric state variables - Thermodynamics and state of the atmosphere equations - Relative humidity (humidity rate) -
Density & volumetric mass - Dew temperature - Wet air. Air pollution and its consequences on human health - Nitrogen
Oxides, sulphur, carbon - Volatile organic compounds - Aromatic polycyclic hydrocarbons - Hydrochloric and fluorhydric
acids - Dioxins and furans - Heavy metals - Dust in suspension - photochemical oxidisers - Odours - Microbodies, bacteria,
viruses, fungi, moulds, pollen. Quality of air in buildings. Our understanding of "comfort" in terms of air quality. Air quality
indicators - The concept of quality indicators - Indicators of environmental impact.

Bibliography :
1. Les systèmes de ventilation; Sylvain Charreyre et Julien Maratier
2. La gestion de la qualité de l'air, Javier Garcia et Joëlle
Colosio, Presses de l'Ecole des Mines de Paris

Requirements :

Organisation :

Evaluation :
Mini-project.

Target :

Urban Acoustics	GCU09-3U5B
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) :	

Objectives :
Identification of the sources of noise in urban zones. Analysis under current regulations. Main technical solutions in the fight
against the noise pollution.

Content :
1 Introduction - What is noise?
2 Acoustics (reminders); Physical acoustics. Physiological acoustics. Effects of noise on health.
3 Sources of noise. Multitude of sources. Road traffic. Air traffic. Rail traffic. Other sources
4 Models of noise distribution. Urban environment. Open field. Meteorological effects
5 Noise measurement.
6 Regulation: The law regarding
(a) road traffic noise
(b) air traffic noise
(c) rail traffic noie. European directives.
7 Technical solutions: Anti-noise walls. Earthen mounds. Road surfaces. Urban-planning.

Bibliography :

Requirements :

Organisation :

Evaluation :
Mini-project.

Target :

Public Road & Transportation Infrastructure	GCU09-3U6C
Number of hours : 24.00 h	1.50 ECTS credit
CM : 24.00 h	
Reference Teacher(s) :	

Objectives :
Geometric design and dimensioning of roads and urban crossroads with a view to conducting a study. Development a critical
attitude on urban projects: Various restrictions linked to urban environment are covered and the different aspects of road
surface deterioration in an urban environment are examined.

Content :
1. Urban roads: Geometric design and dimensioning. Deterioration.
2. Urban crossroads: Different types. Geometric design. Dimensioning.
3. Pedestrian streets and bicycle paths: Traffic development.
4. Road system for public transportation: Metro. Bus.
5. Lighting. Markings and signage on urban roads.

Bibliography :
1. "" Dimensionnement des structures des chaussées urbaines"", 2000, CERTU
2. "" Carrefours urbains : guide "", 1999, CERTU
3. "" Conception structurelle d'un giratoire en milieu urbain "", 2000, CERTU
4. "" Guide pratique de la voirie urbaine"", 1999, RGRA
5. "" Catalogue des dégradations de surface des chaussées"", 1998, LCPC

Requirements :
Basics of the French method of road design.

Organisation :
Review of lecture notes.

Evaluation :
Mini-project.

Target :

Sustainable Mobility in Cities	GCU09-3U7C
Number of hours : 24.00 h	1.50 ECTS credit
CM : 24.00 h	
Reference Teacher(s) :	

Objectives :
Traffic management in urban agglomerations taking into account all means of transportation: Urban traffic plan. A look at
various traffic models and the external effects of traffic.

Content :
1. Traffic: Stakes. Models. Data gathering. Legislation.
2. Traffic models.
3. External effects: Pollution. Noise. Traffic congestion. Safety.
4. Diagnosis. Traffic planning scenarios (traffic organisation, parking, road distribution).
5. Urban traffic plans: Examples of France's urban traffic plans.

Bibliography :
1. "" Quelle est la mobilité quotidienne des personnes dans les agglomérations : approche de la question et proposition d'indicateurs "", 2004, CERTU
2. "" Etude Méthodologique de la connaissance des déplacements des périurbains "", 2004, CERTU
3. "" PDU de Rennes 2007/2017"", 2006, Rennes Métropole.
4. COHEN S., 1990, ""Ingénierie du trafic routier - Eléments de théorie du trafic et applications "", Presses de l'Ecole Nationale des Ponts et Chaussées

Requirements :

Organisation :
Review of lecture notes. Exercises to be completed.

Evaluation :
Mini project.
Written report.
Oral presentation.

Target :

Urbanisme 2	GCU09-3U8
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Pavement Mechanics	GCU09-3T1
Number of hours : 24.00 h	1.50 ECTS credit
CM : 24.00 h	
Reference Teacher(s) :	

Objectives :
Understanding the mechanical behaviour of road materials and road structures: surface damage, fatigue, creep, etc. Mechanical
dimensioning of different types of road structures using road design software. Structural evaluation techniques for the quality
of roads and techniques for maintenance and reinforcement.

Content :
1. Functionality and classification of roads.
2. Traffic characterisation, Equivalent traffic calculation.
3. Mechanical behaviour of supporting soils and roadbeds.
4. Mechanical behaviour of road materials: laws of fatigue and creep.
5. Allowable stress and deformation: reliability.
6. Structural design: methods and practice Burminster solutions, Alizé programme.
7. Structural evaluation methods.
8. Methods and practice of structural reinforcement.

Bibliography :
1. PEYRONNE C., CAROFF G., 1984, Dimensionnement des chaussées. Presses de l'ENPC.
2. L.C.P..-SETRA, 1994, Conception et dimensionnement des structures de chaussées - Guide Technique.
3. ULLIDTZ P., 1987, Pavement analysis, Elsevier

Requirements :
Modules on "Mechanics of elastic solids, Elasticity I and II"; "Road materials and structures", "Road techniques"

Organisation :
Mini-project. Road design software calculations: 8 hours.

Evaluation :
Mini-project: 8 hours.

Target :

Ouvrages géotechniques	GCU09-3T2
Number of hours : 36.00 h	2.50 ECTS credit
CM : 36.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Marine Hydraulic Engineering	GCU09-3T3
Number of hours : 14.00 h	1.00 ECTS credit
CM : 14.00 h	
Reference Teacher(s) :	

Objectives :
- Maritime hydraulics: Modelling of swell. Effect of swell on maritime works.
- Environment option: Modelling of the phenomena of erosion and sedimentation in estuaries.
- Maritime works & coastal management: An outline of the various arrangements possible to satisfy industry and simultaneously protect the coastal environment.

Content :
1. Theory of tides.
2. Theory of swell.
3. Physics of swell - Real swell.
4. Effects of swell on maritime works.
5. River hydraulics.

Bibliography :
1. BONNEFILLE R., 1993, ""Cours d?hydraulique maritime"", Ed. Eyrolles
2. LARRAS J., 1979, ""Physique de la houle et des lames"", Ed. Eyrolles
3. GRAF W., ""Hydrodynamique"", ""Hydraulique fluviale"", Presses polytechniques et universitaires romandes
4. LEBRETON J.C., 1974, ""Dynamique fluviale"", Ed. Eyrolles

Requirements :
Physics of undulatory phenomena.
Fluid Mechanics.

Organisation :
Calculation of swell deformation in the neighbourhood of maritime works. Dimensioning of coastal protection works. Study of
the phenomena of erosion and fluvial deposits.

Evaluation :
Mini project (8 hours).

Target :

Hydrogeology	GCU09-3T4
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) :	

Objectives :
Analysis of the reaction of bowater watershed (urban or rural) during precipitation. Calculations for rain drainage system and
safety measures.

Content :
1. Characteristics of the bowater watershed.
2. Statistical analysis of the pluviometric data.
3. Rain-flow transformation.
4. Flood flow estimation: Summary methods. Correlative methods.

Bibliography :
1. REMENIERAS G., 1976, ""Hydrologie de l?ingénieur, Ed. Eyrolles
2. LLAMAS J., 1993, ""Hydrologie générale - Principes et applications"", Ed. Gaëtan Morin
3. Ministère de l?Agriculture, 1982, ""Synthèse nationale des crues de bassins versants""
4. MUSY, A., 2002, ""Hydrologie générale "", Ed. EPFL
5. ANCTIL, F., 2005, Hydrologie, Presses Internationales, Polytechnique Montréal

Requirements :
Statistics, Topography, Hydraulics.

Organisation :
Project on subjects such as:
- Application of the estimation methods of the peak flows in an urban or rural bowater watershed.
- Calculations for large hydraulic works.

Evaluation :
Mini-project.

Target :

Prestressed Concrete	GCU09-3T5
Number of hours : 16.00 h	1.00 ECTS credit
CM : 16.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Bridges and Infrastructures	GCU09-3T6
Number of hours : 36.00 h	2.00 ECTS credit
CM : 36.00 h	
Reference Teacher(s) :	

Objectives :
Principles of bridge and works design integrating the different functions of the works. Mechanical behaviour models.
Construction materials. Inherent difficulties in building works of art. Awareness of the use of the technical rules of pre-dimensioning for the various elements of basic bridges and of the principles of mechanical analysis of works with classic
or distinctive geometry (curved bridges or diagonal bridges). Introduction to characteristic calculation techniques (dynamic
calculation, calculation of stiff metallic sheets).

Content :
1. Terminology and classification of bridges.
2. Foundation design and execution. Supports: piles and abutments.
3. Concrete and prestressed bridges. SETRA typical bridges. Curved and diagonal bridges.
4. Metal bridges: Technology. Web stability. Stability of stiff sheets (orthotropic flagstone).
5. Distinctive typology: Cable-stayed bridges. Arch bridges.
6. Bridge-building equipment.
7. Fabrication. Launching. Assembly. Maintenance.
8. Behaviour under dynamic loads: TGV. Earthquakes. Footbridges.

Bibliography :
1. CREMER J.M. , ""PONTS"", notes de cours, université de Liège, 2006
2. APK, 1996, ""construction métallique et mixte acier-béton"", tomes 1 et 2, éditions Eyrolles
3. MAQUOI R, Cours de construction métallique, université de Liège
4. CDROM ESDEP, leçons de construction métallique, APK, 1999
5. CALGARO J. A., Projet et construction des ponts, presses de l'ENPC, 2000
6. BERNARD GELY A., CALGARO J. A., Conception des ponts, presses de l'ENPC, 1994

Requirements :

Organisation :
Review of lecture notes. Mini project: 45 hours.

Evaluation :
Mini-project.
Oral evaluation.

Target :

Composite Steel - Concrete Structures	GCU09-3T7
Number of hours : 24.00 h	1.50 ECTS credit
CM : 19.00 h, TD : 5.00 h	
Reference Teacher(s) :	

Objectives :
Dimensioning and design of mixed steel-concrete buildings. Advantages. Success of these methods in Europe. Utilisation of
specific calculation codes. 15 hours of lectures conducted jointly with the Building department (Group 1).

Content :
1. Design of buildings and public works. Evolution of calculation methods and regulations. Eurocode 4.
2. Study of mixed beam sections: Elasticity and plastic strength of flexion. Local warping and classification. Resistance to
shear.
3. Check for service limit state and ultimate limit state: Actions to be considered. Different global analysis. Buckling of the
compression flange. Check continuous beams.
4. Connection dimensioning: Ductile and non ductile connectors. Full connection. Partial connection. Construction steps.
5. Limit state verification: Cracks. Deflection. Vibrations.
6. Stability of mixed posts and mixed portal frames.

Bibliography :
1. Comité Européen de Normalisation, 1992, Eurocode 4 - Partie 1,1
2. JOHNSON R.P., 1994, ""Composite Structures of Steel
and Concrete"", Blackwell Scientific Publications
3. A.P.K., 1996, ""Construction Métallique et Mixte Acier-Béton"", chapitre 8, Ed. Eyrolles
4. A.F.P.C., 1997, ""Calcul des ouvrages généraux de construction"", chapitre 8, ""Modélisation des ouvrages mixtes acier- béton avec leur connexion"", Ed. Hermes

Requirements :
Theory and calculation of plasticity of structures.

Organisation :
Review of lecture notes. Personal work: 20 hours.

Evaluation :
Mini-project for each section (Building Engineering and Public Works).

Target :

English S9 Conversation	HUMT1-ANGL/CONV
Number of hours : 10.00 h	1.50 ECTS credit
TD : 10.00 h	
Reference Teacher(s) : LE TINNIER ANNE	

Objectives :
- Improving communication skills in everyday life situations as well as in a professional or social context.
- Obtaining or reinforcing C1 level, strongly advised/recommended by the CTI. t.

Content :
- Learning by doing: students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
- Expressing oneself accurately and fluently: students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
1. English Grammar in Use (Cambridge University Press)
2. Dictionnaire Collins Cobuild
3. Polycopié de l' INSA

Requirements :
Having taken and passed the TOEIC test during the previous two years (800 required)
or any other B2 certification recognized by the CTI.

Organisation :
- Each class lasts one hour and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
- Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet.

Evaluation :
Continuous assessment: The final mark (out of 20) will be based on the attendance rate and the personal implication of the student during the class.

Target :

Economics, Law and Business Studies A (serious game)	HUMT1-PGE-A
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
-Establishing a strong, specific vocabulary base
-Understanding the main issues that industrial companies deal with (in a specific management field).
-Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Business Simulation (serious game) (24h / in English)
The business simulation ¿Global Challenge¿ (a CESIM product) has been designed to improve the understanding and knowledge of the complexity of global business operations in a dynamic, competitive environment. It focuses on strategic management, international management and business policy.
The task for the student teams is to manage a global mobile telecommunications company through technological and market evolution. Students will develop and execute strategies for their simulated company operating in the USA, Asia, and Europe.
The simulation is based on an online platform that allows students to play in their own language (many languages available: English, Spanish, Portuguese, Chinese,¿).

* Law (8h / in French)
Main principles of the French legal system

* Patents (4h / in French)

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies B (Lean six sigma)	HUMT1-PGE-B
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Lean Six Sigma (28h / in French)
Lean Six Sigma is a methodology that enables firms to make their processes more effective and efficient. It¿s the current industry standard for process improvement designed to reduce waste and enhance output quality.

* Law (8h / in French)
Main principles of the French legal system

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies C (human resource management)	HUMT1-PGE-C
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field)
- Understanding the importance of teamwork: making collective decisions and producing the expected work in time

Content :
* Human Resource Management (20h / in French)
    - Main current challenges of Human Resource Management
    - Human Resource Management¿s tools and organization
    - Focus on how team managers deal with Human Resource Management

* Law (8h / in French)
    Main principles of the French legal system

* Social legislation (8h / in French)

* Main principles of French social legislation

* Employment contract

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies D (Marketing for ICT Companies)	HUMT1-PGE-D
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This module is designed to equip students with the knowledge and analytical techniques required for effective strategic marketing management in ICT companies. Through this course, students are faced with a real case study provided by a marketing director of an international ICT company. Students are placed in a decision-making situation and should emerge with a 3 years strategic program.

ICT : Information and Communications Technology

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies E (Industrial design and innovation)	HUMT1-PGE-E
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time.

Content :
The program¿s main objective is to provide a multidisciplinary approach to the field of innovation, strategy and industrial design. This course will give an overview of the innovative process.
During this program, participants will have the opportunity to explore a business case covering the first stage of a product development project.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advice to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies F (Mangement and decision making)	HUMT1-PGE-F
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This course is about how to improve decision making as a future manager.
In addition to calling for academic insights and existing literature, this module provides practical improvement strategies to avoid costly decision making errors.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Module spécifique GCU	GCU09-SPEC
Number of hours : 24.00 h	2.00 ECTS credit
CM : 24.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Entrepreneurship and Innovation 1	HUMT1-EI
Number of hours : 30.00 h	2.00 ECTS credit
CM : 30.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
The aim of this module is to assemble a team of students with backgrounds in commercial studies and engineering studies. The
groups must learn to communicate and work in mixed teams (engineering students and students of commerce and management) and work together on a business start-up project or product development plan. (business plan)

Content :
Through conferences, interviews and lectures, students gather the information and advice necessary to set out a business plan.
Working in small groups, the students find, develop and formulate their own business start-up project or product-development plan. Progress is evaluated through progress reports in the form of oral presentations.

Groups also benefit from tutorial sessions.

Bibliography :
Given during the course

Requirements :
None

Organisation :
30 hours.

Evaluation :
Continuous assessment (collective work)

Target :

IGR	GCU09-IGR 4.5
Number of hours : 78.00 h	4.50 ECTS credit
TP : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Entrepreneurship +	HUMT1-EI+
Number of hours : 20.00 h	1.00 ECTS credit
CM : 20.00 h, CM : 20.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Academic year 2013/2014

Courses offered by the programme

Génie Mécanique et Automatique (GMA)
Mechanical and Control Systems Engineering

Semester(s) : 1-2-3-4-5-6-7-8-9

Commonly used abbreviations
CM : Lectures
TD : Tutorials
TP : Laboratory Work
CONF : Conferences
TA : Personal Work
PR : Project
ST : Internship
DIV : Miscellaneous

Semestre 5

Parcours Formation Initiale GMA

1	**TCM05**		**Science and technology of engineer S5**	**9.00**
	TCM05-ANAL	O	Mathematical Analysis for the Engineer	2.00
	TCM05-PROBA	O	Probability Tools for Engineers	2.00
	TCM05-INFOC	C	C language	3.00
	TCM05-PROG	C	C and Matlab programming	3.00
	TCM05-RISQ	O	Risk Management	2.00
2	**GMA05-1**		**Mechanical engineering and materials S5**	**6.00**
	GMA05-MMC	O	Mech of Continuous and Deformable Media	3.00
	GMA05-METAG	O	Metallurgy	3.00
3	**GMA05-2**		**Design and processes S5**	**5.00**
	GMA05-PMI	O	Industrial Methods and Procedures	3.00
	GMA05-TCONS	O	Construction Technology	2.00
4	**GMA05-3**		**Automation and model-building S5**	**5.00**
	GMA05-AURES	O	Automatons and Local Industrial Networks	3.00
	GMA05-SISYS	O	Signals and Systems	2.00
5	**GMA-HUM05**		**HUMANITIES S5**	**5.00**
	GMA05-ANGL	O	English	2.00
	GMA05-PSH	O	Monographs	2.00
	GMA05-EPS	O	Sport and Physical Education	1.00

O = compulsary, C= in choice , F= optional

Mathematical Analysis for the Engineer	TCM05-ANAL
Number of hours : 28.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : BRIANE MARC	

Objectives :
Integration, Fourier transform, complex variables

Content :
1. Integration
Convergence theorems
Integrals with a parameter
Integrable functions
Fubini's theorems and convolution
Change of variables
2. Fourier transform
Fourier transform of a integrable function
Inversion theorem
Fourier transform of a square-integrable function
Plancherel theorem
Fourier transform and convolution
3. Complex variables
Holomorphic functions
Entire functions
Exponential and logarithmic functions
Cauchy's formula
Residues method

Bibliography :
G. GASQUET, P. WITOMSKI : « Analyse de Fourier et applications ». Masson, 1990.

Requirements :
Mathematical analysis of first and second year

Organisation :
30h

Evaluation :
1 written examination

Target :

Probability Tools for Engineers	TCM05-PROBA
Number of hours : 28.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : HERVE LOIC	

Objectives :
Probability calculus
- Large-samples
- Elements of statistics

Content :
1. Probability distributions. Examples.
2. Gaussian models.
3. Characteristic functions.
4. Limit theorems for Large-samples. Statistical applications.

Bibliography :
Modélisation probabiliste et statistique- Bernard Garel - Collection POLYTECH des éditions CEPADUES

Requirements :
Bases of analysis and linear algebra. Elements of probability theory of STP03-PROBA « Introduction aux probabilités »

Organisation :
30h

Evaluation :
One two hours written examination.

Target :

C language	TCM05-INFOC
Number of hours : 42.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 8.00 h, TP : 20.00 h	
Reference Teacher(s) : LEPLUMEY IVAN	

Objectives :
Basic understanding of the C programming language.
Ability to resolve all common problems.
Find the minimal intersection of needs / C. language.
Writing and comprehension of the code. Syntax and associated semantic.

Content :
1. Introduction to C programming language:
   Introduction.
   Chain of production, from the code source to the executable.

2. Basic C:
   Lexical entities.
   Language syntax.
   Variable declaration.
   Predefined types.
   Operators and expressions.
   General structure of a program.
   Basic input/output.
   Control structures and instructions.
   Fields: 1st form.
   Functions and pass-by-value parameter passing.

3. Advanced C:
   Pointers.
   Functions and pass-by-address parameter passing.
   Standard library functions.
   Memory models for functions and pointers.
   Fields : 2nd form.
   New types and types constructor.
   Explicit type conversion.
   File input/output.
   Allocation class.
   Dynamic Allocation.
   Pointers to functions.

Bibliography :
J.P. BRAQUELAIRE. Méthodologie de la programmation en langage C - Principes et applications. Manuels Informatiques Masson. Masson, 1993.
J.P. BRAQUELAIRE. Méthodologie de la programmation en langage C - Norme C99 - API POSIX. Sciences Sup. Dunod, 2005.
C. DELANOY. Programmer en langage C, avec exercices corrigés. Eyrolles, 1997.
B.W. KERNIGHAN and D.M. RITCHIE. Le langage C. Manuels Informatiques Masson. Masson, 1990.
J.L NEBUT. Le langage C - définition de la norme ANSI. Technical Report Cours C81, IFSIC -Université de Rennes 1, juillet 1989.

Requirements :
Understanding of Algorithms Foundations

Organisation :
Revision of the lecture notes.
Preparation for the practical work.
14hours of course, 8 hours of directed work and 20 hours of practical work

Evaluation :

2-hour written examination at the end of the semester (documents allowed).

Target :

C and Matlab programming	TCM05-PROG
Number of hours : 35.00 h	3.00 ECTS credit
CM : 9.00 h, TD : 8.00 h, TP : 18.00 h	
Reference Teacher(s) : MORIN LUCE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Risk Management	TCM05-RISQ
Number of hours : 21.00 h	2.00 ECTS credit
CM : 21.00 h	
Reference Teacher(s) : GALL PHILIPPE	

Objectives :
The engineer must always remain master of his choices and his actions within the limits defined by acceptable risk.

Content :
I- THE PRINCIPAL CONCEPTS OF RISK ANALYSIS: Dangerous situations. The five dimensions: facts, models, objectives, norms, values. The dissonances between players in a network. The deficits that affect dimensions. Options for
preventative action.
II. DANGER: AN INTRINSIC REALITY. WHEN AND WHERE TO EXPECT DANGER. Danger inherent to the natural
environment. Climate-related uncertainties. Terrestrial uncertainties. Fire as a man-made danger: facilities, production,
creation, etc. Sources of danger in the workplace: electrical, mechanical, chemical, toxicological, radiation, etc.
III - RISK: A LIKELY EVENT WHICH INDUCES DANGER: Characterisation of risk or estimation of danger: probability
and gravity. Natural or man-made danger. Error or approximation. Economic and financial risk. Complexity of the models.
Sport-related risk. Information-related risk. Alarm-related risk. Numerical treatment of problems. Risk; chemical-related risk.
IV. SECURITY: Development of a secure environment. Regulations: logic, criticism and use; technical regulations.
V. PREVENTION AND ASSUMING RESPONSIBILITY: JURIDICAL ASPECTS.

Bibliography :
Risque et Génie Civil - AFGC - 8 -10 nov 2000, Presse des Ponts et Chaussées Konstantin PROTASSOV, 1999,
""Probabilités et Incertitudes"", PUG Michèle NEUILLY - CETAMA
""Modélisation e estimation des erreurs de mesure"" GIS - MR-GenCi J.A. CALGARO, 1996,
- Introduction aux Eurocodes, Presse de l'ENPC Peter G. NEUMANN, 1995,
Computer-Related Risks, Addison-Wesley/ACM Press, ISBN 0-201-55805-X, 384pp

Requirements :

Organisation :

Evaluation :
Two-hour written examination in French.

Target :

Mech of Continuous and Deformable Media	GMA05-MMC
Number of hours : 42.00 h	3.00 ECTS credit
CM : 20.00 h, TD : 14.00 h, TP : 8.00 h	
Reference Teacher(s) : RAGNEAU ERIC	

Objectives :
-Understanding the fundamental laws of deformable and continuous media.
-A modern presentation of the general concepts: (kinematics of deformations, laws of conservation and of reciprocal action).
-Classic applications of thermoelasiticity and stiffness of materials (In preparation for the "Résistance des Matériaux" module of the second semester).
-More complex models of the Thermomechanics of large deformations.

Content :
I Geometry of deformations.
II Dynamics.
III General laws of conservation.
VI Balance of energy and entropy.
V General laws of thermomechanical behaviour.
Detailed description: Geometry of deformations. Intuitive understanding of deformation. Transformation gradient. Convective
transport. Lagrangian and Eulerian tensors of dilation and deformation. Decomposition of displacements. Theories on
linearisation (theory of small deformations). Compatibility equations. Theory of small deformations.
Dynamics: Concept of the particular derivative of tensor and vector functions.
Particular derivatives of elements: linear, surface, volume. Particular derivatives of integrals. Introduction of the rate of
deformation in Lagrangian and Eulerian form. The exceptional case of isochoric movement. General laws of the conservation
of mass (in local and integral form). Introduction to the kinetic and dynamic principles of torque. Fundamental laws of
dynamics. Existence of the Cauchy stress tensor. Consequences of the laws of reciprocal movement and of the moment of the
quantity of movement. Tensor of Lagrangian stress. Theory of kinetic energy. Concept of virtual power.
Accounting for energy and entropy: Integral and local form of the first law of thermodynamics. Balance. Concept of deformation energy.
Second law of thermodynamics: Localised form. Concept of dissipation. General laws of thermomechanical behaviour.
Classing of unknowns. Use of the second principle. Laws governing state of matter. The Gibbs relation and the transformation
of Legendre and Frenchel. Introduction of dissipation. Examples: hyperelastic environments, linear thermoelasticity.

Bibliography :
Jean COIRIER : Mécanique des Milieux Continus - Concepts de base. DUNOD (1997).
Georges DUVAUT : Mécanique des Milieux Continus. DUNOD (1998).
Paul GERMAIN : Cours de Mécanique des Milieux Continus. MASSON (1973).
D.S. DUGDALE et C. RUIZ : Elasticité à l'usage des Ingénieurs et Physiciens. Edisciences (1973).

Requirements :
Mathematics: Analysis (vector mathematics, application of particular derivatives, Concepts of tensor calculation, etc).
Other disciplines: General knowledge of Mechanics and Plane Elasticity.

Organisation :

Evaluation :
Three-hour written examination. Practical work.

Target :

Metallurgy	GMA05-METAG
Number of hours : 42.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 12.00 h, TP : 16.00 h	
Reference Teacher(s) : GUILLOU ANNIE	

Objectives :
In depth look at the relationship between microstructure and properties in the common alloy families.
Understanding diffusion
mechanisms.

Content :
I. DIFFUSION IN SOLIDS:
1. Flick's law, Diffusion equation and solutions for simple cases.
2. Diffusion coefficient. the problems of diffusion: carburation, evaporation. Arrhenius's Law.
3. Diffusion: carburetion, evaporation.
II. PHASE TRANSFORMATIONS:
1. Solidification: the influence of conditions on properties (germination, separation, unbalanced phases.)
2. Solubility limits and precipitation: Coherent and Incoherent Precipitates. Inter and intragranular preciptation. Effect on properties. Examples of stainless steel and of alloys with structural or precipitate hardening.
3. Martensitic and Baintic transformations and their applications to the shape memory of alloys and steel.
III. THERMAL TREATMENT:
Influence on mechanical properties. Examples from the family of steel alloys, aluminium alloys, copper alloys and titanium
alloys.
1. Reheating for homogenisation, dissolution of precipitations.
2. Restoration-recrystallisation after work-hardening.
3. quenching, quenching and return (structural hardening). Comparison between the structural hardening of steels and alloys.
4. Superficial martenisitic quenching and superficial thermal treatments.
IV. GEOMETRICAL CRYSTALLOGRAPHY:
1. Crystal networks, knots, nets and motifs. Miller indices, reciprocal network.
2. Metals and crystal structures. Cubic and hexagonal structures. Understanding schematics and compact directions. Sliding mechanisms.
V. USE OF X-RAYS in the characterisation of materials:
1. X-ray generation, application of chemical material analysis to emmision spectrometry (electronic micro-sensor).
2. Absorption: application of radiography (detection of flaws), for qualitative and quantitative analysis.
3. Fluouresence: definition, use and material analysis
4. Diff ratio: a basic approach to a characterisation of crystal structures. Practical work: (4 Practical Work Sessionss of 4 hours each) - metallography - thermal analysis (ATS- ATD) - Jominy's test on two steel samples. Structural hardening on (aluminium and copper).

Bibliography :
C.S. BARRETT, Structure des Métaux, Dunod, Paris (1957).
TAYLOR, X-Ray Metallography, J. Wiley and Sons Inc., New-York, London (1961)
J.P. EBERHART, Analyse structurale et chimique des matériaux, Dunod , Paris (1997).
A. DE SY, J. VIDTS, Traité de métallurgie structurale théorique et appliquée, Dunod, Paris (1968).
J. PHILIBERT, A. VIGNES, Y. BRECHET, P. COMBRADE, Métallurgie du minerai au matériau, Masson, Paris (1997) J. BARRALIS, G MAEDER, Précis de métallurgie, Elaboration, structures, propriétés, AFNOR-NATHAN(1997)
Y.ADDA, J. PHILIBERT, La diffusion dans les solides, INSTN (1966)

Requirements :
Global understanding of phase diagrams. Preferably a prespecialisation course in materials.

Organisation :

Evaluation :
Three-hour written examination. Mark for practical work.

Target :

Industrial Methods and Procedures	GMA05-PMI
Number of hours : 42.00 h	3.00 ECTS credit
CM : 20.00 h, TD : 22.00 h	
Reference Teacher(s) : SORRE FREDERIC	

Objectives :
This module aims to equip the future engineer with a knowledge of industrial methods and procedures in order to successfully
integrate the workplace and to communicate and interact with new colleagues and collaborators.

Content :
(I) Methodology: Geometrical errors in products (dimension, position, form, surface condition). Specification of the geometry
of products (Interpretation and verification). Geometrically identifying a surface. Isostatism (rules and symbology). Fabrication
documents. Vector models of machines (basing milling centres SMED). Architecture of computer-controlled machines.
(II) Proceses: Moulding techniques. Forging techniques. Pressing metals. Milling and turning techniques (geometry, materials,
tool wear, parameters). Means of measuring and checking geometric specifications.

Bibliography :

Requirements :

Organisation :

Evaluation :
Three-hour written examination.

Target :

Construction Technology	GMA05-TCONS
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : GUINES DOMINIQUE	

Objectives :
Familiarisation with components and basic technological functions as a conceptual aid in mechanical design.

Content :
1- Assembling and fixing parts
1.1 Threads and Screws
1.2 Elastic supports
1.3 Riveting, circlips.
2- Connecting systems
2.1
2.2 Splines
2.3 Conical assemblies.
3- Study of the dimensioning of rotation guides
3.1
3.2 Ball bearings.
4- Study of the guides of translation
4.1 Ballscrews, ball dowels
4.2 Sliding connections.
5- Elastic connections
5.1 Springs.
6- Geometry and technology of flexible link transmissions
6.1 Belts and chains: comparable elements
6.2 Flat, trapezodial and toothed belts
6.3 Wheels and chains.
7- Gears: Overview
7.1 Gears with straight cut teeth
7.2 Gears with heliocoidal teeth
7.3 Gears with conical teeth
7.4 Gears with multiple screws and wheels
7.5 Study of epicycloidal transmissions.
8- Couplings, clutches and gears.
8.1 Rigid and flexible couplings
8.2 Cardans
8.3 Clutches, Brakes
8.4 Coupling converters.
9- Lubrication and greasing
9.1 Basics of tribology: lubrication solutions
9.2 Lubricants
9.3 Lubrication systems.
10- Leakproofing
10.1 Useful principles in leakproofing: leakproofing by direct contact, indirect, controlled fluid debit, deformable elements
10.2 Technology of leak-proof systems.

Bibliography :
Construction mécanique : Aublin, Cahuzac, Ferrza, Vernhères Guide of industrial science and technology : Fanchon

Requirements :

Organisation :
45h

Evaluation :
Two-hour written examination

Target :

Automatons and Local Industrial Networks	GMA05-AURES
Number of hours : 42.00 h	3.00 ECTS credit
CM : 16.00 h, TD : 10.00 h, TP : 16.00 h	
Reference Teacher(s) : MAURINE PATRICK	

Objectives :
Creation of sequentially commanded automatic production systems using appropriate tools. Industrial networks and
automatons.

Content :
1. Synthesis and optimisation of sequential logic systems. Mealy and Moore machines. Representing sequential systems.
Flipflops. Synthesis of synchronised sequential systems. The Huffman-Mealy method.
2. Industrial Programmable machines (IPM): Placement and role of an IPM at the core of an automated industrial production
system. Specific structure and functionality of an IPM. Connection and peripherals of the automaton. IPM programming
languages. Connection to networks.
3. Grafcet: Definitions and normalisation. Basic elements; Syntax and evolution of the system. Basic and special structures.
Extension of the representations. Marco-stages using Grafcet. Algorithms and equivalent equations. Partition and placement of
a Grafcet. Forcing situations.
4. Local industrial systems: Functional architecture of local industrial networks. SIM and three-axis modelling. Field networks.
Architecture, reduced OSI model. FIP, ASI and PROBUS networks.

Bibliography :
1. GREPA, "" Le Grafcet "", 2ème édition, 1995, Cépadues 2. CIAME, "" Réseaux de terrain "", 1998, Hermès

Requirements :
1. Combinational logic.
2. Study and optimisation of combinational logic systems.

Organisation :

Evaluation :
Two-hour examination. Mark for practical work.

Target :

Signals and Systems	GMA05-SISYS
Number of hours : 28.00 h	2.00 ECTS credit
CM : 10.00 h, TD : 10.00 h	
Reference Teacher(s) : GUEGAN SYLVAIN	

Objectives :
Modelling of analog, digital, pulsed and noise signals. Use of mathematical tools: Fourier transforms, Laplace transforms and
Z transforms. Representation of linear and stationary systems by means of a transfer function. Frequential representation and
stability. Simple electronic and mechanical applications. Functional schematics. Signal flow graph.

Content :
(I). Continuous time analog signals or deterministic signals, Dirac impulsions, single pulse, unit ramp and exponential signals.
Serial development of a periodical function with a Fourier series. Fourier transforms, Laplace transforms and their main
properties. - Use of the Laplace transform to resolve differential linear equations.
(II). Z transform of discrete time digital or deterministic signals and their main properties - application of Z transform to
resolve differential linear equations. (Fourier transform and its main properties - discrete Fourier transform - quick Fourier
transform).
(III). Pulsed signals: Pulsing - Reconstitution - Qualification - Transforming pulsed signals (Fourier, Laplace) - Study of zero
order blockers - response to a pulsed signal of a linear system equipped with a zero order blocker.
(IV). Noise signals: Statistical characteristics - Stationarity - Ergodicity - Correlation functions - Spectral power density - white
and coloured noise - study of the quantification error of a pulsed signal.
(V). Linear deterministic and stationary systems - Mathematical models (transfer functions, state equations) - Functional
schematics and signal flow graphs - Stability (Routh-Hurwithz criterium for analog systems and the Jury criterion for the
digital systems) - Models of pulsed systems - temporal and frequential responses of simple systems.

Bibliography :
MARET L., 1987, "" Régulation automatique "", Presses polytechniques romandes.
GILLE J.-Ch., DECAULNE P., PELEGRI N M., 1990, " Théorie et calcul des asservissements linéaires ", Dunod.
RIVOIRE M., FERRIER J.-L., 1992, "" Cours d'automatique - tome 1 : signaux et systèmes "", Eyrolles.
THOMAS Y., 1992, "" Signaux et systèmes linéaires "", Masson.

Requirements :
Mathematics:
- Fourier transform and distributions;
- Differential systems with initial conditions;
- Basics and functions of electronics;
- Mechanical modelling.

Organisation :
30 hours.

Evaluation :
Two-hour written examination.
Mark for practical work

Target :

English	GMA05-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h, TD : 28.00 h	
Reference Teacher(s) : WEST ANN	

Objectives :
Development of the student's knowledge of everyday English: lexicon, syntax and phonology. Development of listening and
speaking skills.

Content :
The four skills are developed through a variety of supports such as the Internet, press articles, audio and video resources
dealing with topical issues and recent trends (including extracts from movies, TV series and news reports).
- Listening and Speaking includes debates, role-plays, etc, with participation by the class as a whole or in small groups.
- Reading and Writing includes letter writing, drafting of CVs, etc. Syntactic structures associated with English for scientific
purposes.

Bibliography :
1. English Grammar in Use (Cambridge University Press)
2. Dictionnaire Collins Cobuild
3. Polycopié de l' INSA.

Requirements :
A-level English.

Organisation :
Revision of class notes with focus on grammatical detail and vocabulary building.
Students should read, watch TV series and movies or TV in general in English.

Evaluation :
Two-hour written examination.

Target :

Monographs	GMA05-PSH
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h, TD : 26.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
Overview: Students choose and plan an appropriate project in accordance with the objectives. They carry out rigorous research
on the theme and interview specialists (Emphasis is placed on the use of project management tools and teamwork). A
Presentation is given in front of an invited audience. An inter-departmental competition to finish.

Content :
The aim of this module is to broaden the students' knowledge of their chosen professional field and of the prevailing social and
managerial environment. Students must structure their thinking to argue their point and make sense of the various sources of
information studied. Particular emphasis is placed on the importance of the use and quotation of trustworthy sources. The
monographs, which are archived in the library, will then represent a reliable, recent source of information.
The methodological tools required for project management (aims, organisational chart, task-delegation, work schedule) are
applied, resulting in well-written documents and improved public-speaking skills. Teamwork is particularly encouraged.
The teacher ensures that teams never lose sight of their stated objectives.
The advantages and pitfalls of research via the internet are discussed. Interviews are organised with people from within INSA
(Mr. Aubel of CEIP and various teacher-researchers), and with various engineers and managers from elsewhere. Their thoughts
are added systematically to the monograph to support the analysis. The library and the multimedia centre also prove to be
reliable sources of information.
Proper writing style and editing technique are essential; The main rules of editing a quality document are studied, including
structure of a report, style, bibliography, etc.
At least one rehearsal precedes the final oral presentation in order to give the students confidence and highlight the importance
of a well-delivered speech. Students learn how to create a Power Point presentation.
The last classes focus on the voice, gestures, and carefully communicating information in a clear and rigorous way. The oral
presentation event is open to students, teachers and those interviewed in the course of research. The formal nature of this event
is of significant importance as it underlines INSA's policy for the training of generalist engineers.
An inter-departmental competition is held to reward the three best monographs of the year. The objective is threefold:
- to promote the importance of the students' work
- to bring together those interviewed and explain to them our approach
- to promote exchange between departments.

Bibliography :
Timbal-Duclaux L.: L'Expression écriteEcrire pour communiquer. Editions ESF 1994.
Claret J. :Organiser la pensée. Editions ESF, 1989.
Quivy R. et Van Campenhoudt L. : Manuel de recherche en sciences sociales. Editions Dunod 1995.
Licette C. : La prise de parole en public. Editions Studyrama 2002.

Requirements :

Organisation :
Research, writing of progress reports and press reviews.

Evaluation :
Monograph.
Oral Presentation.

Target :

Sport and Physical Education	GMA05-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h, TD : 24.00 h	
Reference Teacher(s) : VAILLANT GERARD	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O or
Kayak or golf.

Bibliography :
Several specialized books are available to the students at the library. Links to internet sites are given on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Semestre 6

Parcours Formation Initiale GMA

1	**TCM06**		**Science and technology of engineer S6**	**4.00**
	TCM06-CAPT	C	Introduction to SENSORS	1.00
	TCM06-ENRG	C	Energy	1.00
	TCM06-IMO	O	Introduction to Production and quality Management	1.00
	TCM06-SHES1	O	Science Humaine Economique et Sociale 1	1.00
	TCM06-SHES2	O	Science Humaine Economique et Sociale 2	1.00
2	**GMA06-1**		**Mechanical engineering and materials S6**	**7.00**
	GMA06-RDM	O	Resistance of Materials	4.00
	GMA06-CDM	O	Kinematics and Dynamics of Mechanisms	3.00
3	**GMA06-2**		**Design and processes S6**	**6.00**
	GMA06-CMAO1	O	Computer-aided Mechanical Design	3.00
	GMA06-MOPI	O	Industrial Methods and Processes	3.00
4	**GMA06-3**		**Automation and model-building S6**	**7.00**
	GMA06-AUT1	O	Automation I	4.00
	GMA06-EDP	O	Partial Differential Equations	3.00
5	**GMA-HUM06**		**HUMANITIES S6**	**6.00**
	GMA06-ANGL	O	English	2.00
	GMA06-PSH	O	Monographs	2.00
	GMA06-EPS	O	Sport and Physical Education	1.00
	GMA06-PPI	O	Professional Project	1.00

O = compulsary, C= in choice , F= optional

Introduction to SENSORS	TCM06-CAPT
Number of hours : 35.00 h	1.00 ECTS credit
CM : 21.00 h, TD : 14.00 h	
Reference Teacher(s) : DURAND OLIVIER	

Objectives :
In Europe, the sensors market has been estimated to 10 billions Euros in 2007, corresponding to 28% of the glogal world
market, with an estimated growth more than 6% per year and sustained by the security systems, the automotive, aeronautics
and defence. Nowadays, the sensors market swipes to the electronic instrument mass market. Such a market generates a large
amount of employment in a wide range of industries. The aim of this course is a general overview of the properties and the
applications of sensors, with a global understanding, as general knowledge, of the different phenomena used for the sensors
elaboration.

Content :
General introduction to sensors. Active and passive sensor conditioners. Basics of semiconductor physics. Optical sensors.
Notions on the photovoltaic cells. Temperature sensors. Position and displacement sensors. Magnetic sensors. Mechanical
sensors. Introduction to microsensors.

Bibliography :
Les capteurs en instrumentation industrielle (G. Asch et collaborateurs), Dunod Handbook of Modern Sensors 2nd edition (J. Fraden), AIP Presss, Woodbury, New York Principe généraux des capteurs, cours CNAM (F. Lepoutre) Cours capteurs (M. Hubin) : http://perso.orange.fr/michel.hubin/capteurs/instrum.htm

Requirements :
No prerequisite.

Organisation :
Homework.

Evaluation :
Written examination on work covered during lectures and tutorials.

Target :

Energy	TCM06-ENRG
Number of hours : 42.00 h	1.00 ECTS credit
TD : 12.00 h	
Reference Teacher(s) : CORNET CHARLES	

Objectives :
Impact of the choice energy sources of the 21st century. Photovoltaic cells and the thermal efficiency of buildings in terms of
cost, efficiency and environmental impact. Inventory of the energy sources currently in use. Thermodynamic tools. Overview
of the different methods of energy production including combustion engines, boilers, nuclear energy, renewable energies, etc.
Presentation of the different means of transport and energy transfer; thermal isolation or conduction, convection, material
transfer, inverted cycle machines, etc.

Content :
24 hours of lectures, 12 hours of tutorials and 6 hours of practical training.
Introduction to energy management and analysis of the current energy situation. The tools of energy engineering: Fick's laws
of diffusion, black body, thermal machines and basic reminders of thermodynamics. Production of energy: nuclear, thermal
combustion, boiler. Renewable energies: wind power, solar, geothermic energy, etc. Delivery of energy: insulation, conduction, convection, electricity and gas transport, etc.
Chapter I: Introduction to energy engineering.
(I) The energy context
1/ Definitions
2/ Overview of the current energy situation
(II) Energy prospects
1/ Supply and demand
2/ Technological orientation
3/ Conclusions
(III) Energy
1/ The different forms of energy
2/ Energy conversion
3/ Stocking and transport of energy.
Chapter II: Engineering tools for Energy
(I) - Transport phenomena
1/ Particle diffusion
2/ Thermal diffusion
3/ Fourier/Ohm/Fick Analogy
4/ Convection
(II) Energy transfer by radiation: black body model
1/ classic description
2/ quantum description - Planck's law
3/ Spectral characteristics of radiation
4/ Interest of the model
(III) Thermodynamics (Reminder)
1/ Thermal machines and cycles
2/ Energetic and entropic outcomes
3/ Diathermy machines
4/ Performance and efficiency.
Chapter III: The production of energy
(I) Nuclear energy
1/ Principle
2/ Fission and nuclear power
3/ Perspectives : toward thermonuclear fusion
(II) Combustion and combustion engines
1/ Combustion and fuels
2/ Ovens and boilers
3/ Combustion engines
(III) Renewable energies : solar, wind power, etc.
1/ Renewable energies

2/ Geothermic and ocean energy
3/ The thermal conversion of solar energy
4/ Photovoltaic solar energy
5/ Wind power
6/ Other energies.
Chapter IV: Transport and transfer of energy
(I) Heat transfer
1/ Heat transfer by thermal conduction: Applications to insulation
2/ Heat transfer by convection: heat exchangers
(II) Material transfers
1/ Pressure or load losses
2/ Turbo machines
(III) Transport of electricity: three-phase current.

Bibliography :
Energétique : concept et applications : Michel Feidt Systèmes énergétiques : (2004) (bibliothèque insa rennes)
Energies renouvelables : (2006) (bibliothèque insa rennes)

Requirements :
Mathematics: differential equations, complex numbers.
Other: Thermodynamics of diffusion and thermodynamic potentials , entropy, efficiency. Fluid mechanism (Bernoulli's
principle), understanding of semiconductors.

Organisation :
Preparation for tutorials, conferences. Internet research.

Evaluation :
2-hour examination based on the lectures and tutorials.

Target :

Introduction to Production and quality Management	TCM06-IMO
Number of hours : 28.00 h	1.00 ECTS credit
CM : 14.00 h, TD : 10.00 h, TP : 4.00 h	
Reference Teacher(s) : SORRE FREDERIC	

Objectives :
Introduction to production management and quality issues: Nowadays, companies must adopt methods associated with tools,
which will allow them to manage production effectively. Overview of the organisation of a factory.

Content :
PART ONE: Production management
(I) Introduction: definition of production management, classification of production systems.
(II) Scheduling in specialised workshops: scheduling on a machine, scheduling with two or three production centres.
(III) Stock management: stock management policies, associated costs, fixed interval order system for stock with a turnover of
zero, re-order point-management.
(IV) Production planning: Planning of the number of components required, basic principles of MRP2, load adjustment, capacity.
(V) "Just-in-time" techniques: origin and principle of JIT, key factors, the Kanban method.
PART TWO: Quality:
(I) Quality of industrial products: the concepts, Quality function, and the international norms for quality control management.
(II) Quality tools: 5S, SMED, TPM, control system and reception control system.
PART THREE: Case study - A presentation by representatives of manufacturers.

Bibliography :
Gestion de la production - Blondel - DUNOD\ n
La gestion de production - Bénassy - HERMES
Contrôle de la qualité - Jaupi - DUNOD
Industrialisation des produits mécanique (Tome 1) - Linarès-Marty - HERMES

Requirements :

Organisation :

Evaluation :
Two-hour written examination. Continuous assessment of Practical work.

Target :

Science Humaine Economique et Sociale 1	TCM06-SHES1
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Science Humaine Economique et Sociale 2	TCM06-SHES2
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Resistance of Materials	GMA06-RDM
Number of hours : 56.00 h	4.00 ECTS credit
CM : 22.00 h, TD : 22.00 h, TP : 12.00 h	
Reference Teacher(s) : RAGNEAU ERIC	

Objectives :
This module is a more pragmatic extension of the "Continuum Mechanics" module of semester 5, including simplification of
the classic Beam Theory and experimental basics in Resistance of Materials leading to familiarisation with the basic tools
necessary in Mechanics for the calculation and design of parts.

Content :
Theory of Elasticity as applied to beams in 3D (Reminder). Beam Theory (fundamental hypothesis). Strain and deformation
due to normal stress and bending moments (pure flexion, simple flexion, composed flexion, deviated flexion, etc). Strain and
deformation due to the cutting stress (full cross-section, slim cross-section: shearing flux, torsion centre, etc). General
theorems for the calculation of displacement and rotation of mean-plane beams (application of the Energy Theorems seen in
Continuum Mechanics, NAVIER-BRESSE's equation). General methods to solve hyperstatic beam systems. Isostatic straight
beams. Hyperstatic straight beams with one span.

Bibliography :
M. KERGUIGNAS, G. CAIGNAERT : Résistance des Matériaux. DUNOD (1997).
M. ALBIGES : Résistance des Matériaux Appliquée. DUNOD.
J. COURBON : Résistance des Matériaux. DUNOD (1971).

Requirements :
General Mechanics and Continuum Mechanics

Organisation :

Evaluation :
Three-hour written examination.
Mark for practical work in the laboratory

Target :

Kinematics and Dynamics of Mechanisms	GMA06-CDM
Number of hours : 42.00 h	3.00 ECTS credit
CM : 16.00 h, TD : 10.00 h, TP : 16.00 h	
Reference Teacher(s) : ARAKELYAN VIGEN	

Objectives :
Systematic approach to methods and general principles of the study of mechanisms. Calculation of mechanical systems from
given conditions.

Content :
Kinematics and Dynamics of mechanisms
- Structural analysis of mechanisms
- Analysis of the singular positions of mechanisms
- Mechanisms with specific structures (Bennett mechanism, 3D spherical mechanisms with 4 rods, Sarrus mechanism). Kinematic analysis of 3D mechanisms. Method for transformation of coordinates: "Denavit-Hartenberg" method
- Kinematic analysis of closed-chain mechanisms. Cam mechanisms: main laws of motion with their typical characteristics
- Example of a cam fairing with an elastic receptor. Kinematics of articulated mechanisms with gears. Watt mechanism.
- Geometric synthesis of mechanisms. Burmister problem. Synthesis of a polyarticulated mechanism, function generator for
three, four, and five given positions (polynomial method)
- Rough reproduction of a given motion (approximation by quadratic mean-value and the minimisation of the maximum value: Chébichev approximation)
- Synthesis of mechanisms under futher conditions (transmission angle, etc.)
- Newton-Euler equation
- D'Alembert rule and calculation of stress in mechanical bonds: matrix method. Assur groups: Calculation simplification by reduced size matrix.
- Lagrange equation. Examples of industrial systems and applications.
- Equation of motion of single degree of freedom mechanisms (simplified form of the Lagrange equation).
- Momentum: calculation and minimisation. Relief system of elements of a mechanism.

Bibliography :

Requirements :
Linear mapping, matrixes, differential equations, approximation methods (VMQ, Thcebichev, etc).

Organisation :

Evaluation :
Two-hour written examination.
Mark for practical work in the laboratory.

Target :

Computer-aided Mechanical Design	GMA06-CMAO1
Number of hours : 42.00 h	3.00 ECTS credit
CM : 8.00 h, TD : 22.00 h, TP : 12.00 h	
Reference Teacher(s) : LEOTOING LIONEL	

Objectives :
- Presentation in CAD of the mechanisms to create and modify associative volumes and surfaces in preparation for the design
of mechanical parts.
- Application of design methods in CAD (parameters and skeletal models)

Content :
1 - Digital modelling with CATIA V5
- Presentation of the software
- Creation methods in volume modelling
- Assembly of parts and simulation of mechanisms
- Creation of blueprint in 2D
- Mathematical construction of curves and shapes (Bezier curves, NURBS, etc.)
- Creation methods in shape modelling
2 - Design methods
- Table of parameters and catalogs of parts
- Skeletal models
3 - Integration of components in mechanical systems
- Research and choice of technological components
- Integration and assembly of the components
- Re-design.

Bibliography :

Requirements :
No requirements

Organisation :
1 hour per week

Evaluation :
- 1 four-hour written examination on the CATIA computer programme
- 1 mark for practical work

Target :

Industrial Methods and Processes	GMA06-MOPI
Number of hours : 42.00 h	3.00 ECTS credit
CM : 12.00 h, TD : 14.00 h, TP : 16.00 h	
Reference Teacher(s) : SOHIER CHRISTOPHE	

Objectives :
Experimental and practical implementation of industrial processes and methods requires good technical skills. The issues of
quality, performance and production costs are highlighted.

Content :
I- Methods: Process dimensioning. Product range. Modelling of the faults in the manufacturing process. Tool design.
Machining of warped shapes.
II- Processes: Specific manufacturing techniques (spark-machining, water jet cutting). Fast prototyping. Welding techniques.

Bibliography :

Requirements :
Industrial processes and methods.

Organisation :
10 hours.

Evaluation :
Three-hour written examination.
Mark for practical work.

Target :

Automation I	GMA06-AUT1
Number of hours : 42.00 h	4.00 ECTS credit
CM : 14.00 h, TD : 16.00 h, TP : 12.00 h	
Reference Teacher(s) : GUEGAN SYLVAIN	

Objectives :
Analog control of dynamic systems with one input and one output. Synthesis of control instruments in Laplace transform
space. Digital control of dynamic systems with one input and one output. Synthesis of control instruments in Z transform
space.

Content :
(I). Analog control in Laplace transform space:
First and second order model. Precision in steady state and sensitivity. Temporal and frequential specifications. Effects of the
addition of poles and zeros to a transfer function. Study of main poles. Study of stability. Location of poles. Routh-Hurwitz's
criteria and Nyquist's criteria. Proportional, integral and differential actions. Design methods for correctors. Bode, Nyquist,
Nichols and location of the poles. PI, PD and PID correctors. Correctors using main poles. PID control with internal model,
PIR and high gain.
(II). Digital control in Z transform space. Proportional, integral and differential actions. Precision in steady state and
sensitivity. Temporal and frequential specifications. Effects of the addition of poles and zeros to a transfer function. Main
poles. Stability. Location of poles. Jury's criteria. Analysis of sampled systems with single cadence and multiple cadence.
Synthesis of digital correctors. Choice of sampling period. PID corrector. Corrector by bilinear transformation. Corrector by
impulsional or indicial invariance. Corrector using main poles. Minimal response time corrector. Accurate response corrector.

Bibliography :
RIVOIRE M., FERRIER J.-L., 1992, "" Cours d'automatique - tome 2 : asservissement, régulation et commande analogique "", Eyrolles.
RIVOIRE M., FERRIER J.-L., 1993, "" Cours d'automatique - tome 3 : commande par calculateur, identification "", Eyrolles.
KUO Benjamin C., 1995, "" Automatic control systems "", Prentice Hall International Editions.
DE LARMINAT Ph., 1993, "" Automatique, commande des systèmes linéaires "", Hermès.

Requirements :
Mathematics (Fourier transform, Z transform, Laplace transform, distributions, etc.)
- Systems of differential equations with initial conditions.
- "Signal and Systems".

Organisation :
30 hours.

Evaluation :
Three-hour written examination.
Mark for practical work in the laboratory

Target :

Partial Differential Equations	GMA06-EDP
Number of hours : 28.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : LEY OLIVIER	

Objectives :
The main types of partial differential equations from physical models. Introduction to exact and approximate solution methods.

Content :
1. Basic laws of conservation in single dimension: Study of the equation of advection.
2. Systems of laws of conservation: Motion of a fluid in a tube. Study of the wave equation in one dimension.
3. Phenomenon of diffusion: Fourier type equation. Resolution method by Fourier analysis.
4. Stationary problems: Poisson-type equations. Simple examples of numerical methods.

Bibliography :
"Partial Differential Equations - Modeling, Analysis, Computation"
R.M. MATTHEIJ, S.W. RIENSTRA, J.H. TEN THIJE
BLOONKKAMP, SIAM Monographs on Math. Modelling (2005)

Requirements :
Systems of differential equations.
- Elementary analysis of functions of multiple variables.
- Fourier's series.

Organisation :
12 hours.

Evaluation :
Two-hour written examination.

Target :

English	GMA06-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : WEST ANN	

Objectives :
Development of the student's knowledge of everyday English: lexicon, syntax and phonology. Development of listening and
speaking skills.

Content :
The four skills are developed through a variety of supports such as the Internet, press articles, audio and video resources
dealing with topical issues and recent trends (including extracts from movies, TV series and news reports).
- Listening and Speaking includes debates, role-plays, etc, with participation by the class as a whole or in small groups.
- Reading and Writing includes letter writing, drafting of CVs, etc. Syntactic structures associated with English for scientific
purposes.

Bibliography :
1. Dictionnaire : ROBERT et COLLINS Senior.
2. MURPHY Raymond, English Grammar in Use (with Answers), Cambridge University Press, 1999.
3. BERLAND-DELEPINE Serge, Grammaire Anglaise de l'Etudiant, Ophrys, 2000.
4. REY J. BOUSCAREN C., MOUNOLOU A., Le Mot et l'Idée 2, Ophrys 1991 (livre de vocabulaire général).
5. GUSDORF Florent, Words Universités, Médiascopie du vocabulaire anglais, Ellipses 1993.

Requirements :
A-level English

Organisation :
Revision of class notes with focus on grammatical detail and vocabulary building.
Students should read, watch TV series and movies or TV in general in English.

Evaluation :
Two-hour written examination at the end of the semester.
Oral presentation.

Target :

Monographs	GMA06-PSH
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
Overview: Students choose and plan an appropriate project in accordance with the objectives. They carry out rigorous research
on the theme and interview specialists (Emphasis is placed on the use of project management tools and teamwork). A
Presentation is given in front of an invited audience. An inter-departmental competition to finish.

Content :
The aim of this module is to broaden the students' knowledge of their chosen professional field and of the prevailing social and
managerial environment. Students must structure their thinking to argue their point and make sense of the various sources of
information studied. Particular emphasis is placed on the importance of the use and quotation of trustworthy sources. The
monographs, which are archived in the library, will then represent a reliable, recent source of information.
The methodological tools required for project management (aims, organisational chart, task-delegation, work schedule) are
applied, resulting in well-written documents and improved public-speaking skills. Teamwork is particularly encouraged.
The teacher ensures that teams never lose sight of their stated objectives.
The advantages and pitfalls of research via the internet are discussed. Interviews are organised with people from within INSA
(Mr. Aubel of CEIP and various teacher-researchers), and with various engineers and managers from elsewhere. Their thoughts
are added systematically to the monograph to support the analysis. The library and the multimedia centre also prove to be
reliable sources of information.
Proper writing style and editing technique are essential; The main rules of editing a quality document are studied, including
structure of a report, style, bibliography, etc.
At least one rehearsal precedes the final oral presentation in order to give the students confidence and highlight the importance
of a well-delivered speech. Students learn how to create a Power Point presentation.
The last classes focus on the voice, gestures, and carefully communicating information in a clear and rigorous way. The oral
presentation event is open to students, teachers and those interviewed in the course of research. The formal nature of this event
is of significant importance as it underlines INSA's policy for the training of generalist engineers.
An inter-departmental competition is held to reward the three best monographs of the year. The objective is threefold:
- to promote the importance of the students' work
- to bring together those interviewed and explain to them our approach
- to promote exchange between departments.

Bibliography :
Timbal-Duclaux L.: L'Expression écriteEcrire pour communiquer. Editions ESF 1994.
Claret J. :Organiser la pensée. Editions ESF, 1989.
Quivy R. et Van Campenhoudt L. : Manuel de recherche en sciences sociales. Editions Dunod 1995.
Licette C. : La prise de parole en public. Editions Studyrama 2002.

Requirements :

Organisation :
Research, writing of progress reports and press reviews.

Evaluation :
Monograph. Final presentation.

Target :

Sport and Physical Education	GMA06-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : VAILLANT GERARD	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O or
Kayak or golf.

Bibliography :
Several specialized books are available to the students at the library. Links to internet sites are given on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Professional Project	GMA06-PPI
Number of hours : 6.00 h	1.00 ECTS credit
TD : 6.00 h	
Reference Teacher(s) : LE BAIL SYLVIE	

Objectives :
Students are encouraged to reflect upon their future careers.

Content :
1.Discovering enterprises: working for an enterprise, the relationship between "technicians" and other teams: marketing,
direction, sales, finance.
2. Analysis of professional ambition with the aid of human resource specialists and company directors.
3. Meetings: each department sets up meetings to illustrate the situations particular to their sector.
Detailed programme:
Stage1: In groups of twelve, working alongside consultants and company directors on "how to establish and develop a
professional project".
Stage 2: Discovery of the different professions. Meeting professionals. The student is to set up meetings with two professionals
with the objective of understanding the relationship between the engineering department and the other departments of the
enterprise: marketing, sales, finance, human resources, etc.
Stage 3: Debriefing (with the human resources consultants).
The objective is to have the student to refine his professional project with respect to the enterprise. Students must prepare a
document in advance of the interview containing the following; How did you relate to your interviewee? How did you obtain a
meeting? Did you come across difficulties? How did you prepare for your interview? What were your main objectives? What
can you say about the course of your interview? Have you achieved your objectives (Give details)? And finally, what will you
do differently in future interviews?
Networking: how to use first contacts in an enterprise to achieve further goals.
In the framework of their professional project, fifth year students will attend a conference on job opportunities in their chosen
domain. Examples: High quality car production and the requirements of this sector (GMA). Images and networks (ESC-EII-Info). Setting up business in the information technology sector (EII-ESC-Info). Purchasing: the opportunities for the
engineer (GMA). The different professions open to civil engineering students (GCU). Microelectronics and nanotechnology:
job opportunities (MNT).
Write and present a synthesis report on a topic related to economic or social news, or linked to a career project.
An inter-departmental competition takes place to find the "monograph of the year".

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Semestre 7

Parcours Formation Initiale GMA

1	**GMA07-1**		**Mechanical engineering and materials S7**	**7.00**
	GMA07-MNEF	O	Numerical Methods and Finite Elements	3.00
	GMA07-RDM2	O	RDM2: Torsion et calcul de structures	4.00
2	**GMA07-2**		**Design and processes S7**	**8.00**
	GMA07-CMAO2	O	Computer - aided Mechanical Design (Level 2)	4.00
	GMA07-PUIS	O	Mechanical Behaviour of Materials	4.00
3	**GMA07-3**		**Automation and model-building S7**	**6.00**
	GMA07-AUTO2	O	Automation 2: Control of Space State	4.00
	GMA07-EEP	O	Electrotechnique et Electronique de Puissance	2.00
4	**GMA07-4**		**Industrialization Project**	**4.00**
	GMA07-PRIND	O	Project: Industrialisation	4.00
5	**GMA-HUM07**		**HUMANITIES S7**	**5.00**
	GMA07-ANGL	O	English	2.00
	GMA07-ECOGE	O	Economy and Management	2.00
	GMA07-EPS	O	Sport and Physical Education	1.00

O = compulsary, C= in choice , F= optional

Numerical Methods and Finite Elements	GMA07-MNEF
Number of hours : 42.00 h	3.00 ECTS credit
CM : 20.00 h, TD : 22.00 h	
Reference Teacher(s) : RAGNEAU ERIC	

Objectives :
Understanding the methods and algorithms involved in finite element calculation code. Basics of F.E.M. in order to fully
understand calculation software. Application of the methods to solve various field problems in deformable Solid Mechanics
and Heat Transfer. Application of the various formulas to practical problems using CAST3M software.

Content :
Introduction: Main points. Understanding the basic tools of numerical analysis: Interpolation, Approximation. Numerical
resolution of systems of linear equations. Numerical integration techniques. Partial differential equations. Boundary problems:
Finite Elements Methods. Variational formulation of a boundary (Reminder). Matrix formulation of the method in plane
elasticity. Interpolation function of plane elements. Generalisation to 3D. Curved isoparametric elements. Problems associated
with numerical integration. Specific elements: beams, thin plates, thick plates, shells. Extension of the method to heat transfer
problems.

Bibliography :
Zienkiewicz : La méthode des Eléments finis. Edisciences Gallagher : Introduction au calcul par Eléments Finis. Editions
Pluralis Batoz, Dhatt : Modélisation des structures par éléments finis. Editions Hermès
K. J. Bathe : Finite Element Procedures in Engineering Analysis. Prentice et Hall

Requirements :
Basics of Continuum Mechanics.

Organisation :
2 hours per week.

Evaluation :
Three-hour written examination at the end of the semester.
Continuous assessment mark.

Target :

RDM2: Torsion et calcul de structures	GMA07-RDM2
Number of hours : 56.00 h	4.00 ECTS credit
CM : 22.00 h, TD : 22.00 h, TP : 12.00 h	
Reference Teacher(s) : RAGNEAU ERIC	

Objectives :
A continuation of the RDM I module of the third year of studies. This module deals with the dimensioning of beams under
torsion, the study of systems of beams and the modelling of plates.

Content :
Torsion: Theory of Saint Venant Torsion. General theory. Bredt's theory (thin-walled closed sections). Analogy of a membrane. Non-uniform torsion. Vlassov's theory (small distortion). General theorem for the calculation of displacement and
rotation of beams in a common plane. Application of the energy theorems from the "mechanics of continuous media" module.
NAVIER-BRESSE equations. General equations for solving hyperstatic beams and beam systems. Treillis. Porticos. Arcs and
systems of beams. Plate theory. Thin plates. Kirchhoff's theory. Thick plates. Mindlin's theory.

Bibliography :
M. KERGUIGNAS, G. CAIGNAERT : Résistance des Matériaux. DUNOD (1997).
M. ALBIGES : Résistance des Matériaux Appliquée.
DUNOD.
J. COURBON : Résistance des Matériaux. DUNOD (1971).

Requirements :
Basics of mechanics of continuous media.

Organisation :
Two hours per week.

Evaluation :
Three-hour written examination at the end of the semester.
Mark for practical work reports.

Target :

Computer - aided Mechanical Design (Level 2)	GMA07-CMAO2
Number of hours : 42.00 h	4.00 ECTS credit
CM : 10.00 h, TD : 20.00 h, TP : 12.00 h	
Reference Teacher(s) : LEOTOING LIONEL	

Objectives :
- Methods for functional specifications and technical solutions for product functionality
- Advanced Design methods using CATIA
- Virtual evaluation of the adequacy of the product with respect to its specifications
- The principles of PLM.

Content :
1 - Methods of design (AFB, AFT)
2 - Advanced design with CATIA V5 (Design with context, power copies, publications, ...)
3 - Virtual conformity with the product specifications (simulation tools, exchange formats, ...)
4 - Creating geometrically optimal systems
5 - Introduction to PLM

Bibliography :

Requirements :
GMA06-CMAO1

Organisation :
1 hour per week.

Evaluation :
- 1 four-hour written examination on the Catia computer programme
- 1 mark for practical work

Target :

Mechanical Behaviour of Materials	GMA07-PUIS
Number of hours : 56.00 h	4.00 ECTS credit
CM : 16.00 h, TD : 24.00 h, TP : 16.00 h	
Reference Teacher(s) : GUINES DOMINIQUE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :
45h

Evaluation :
Three-hour written examination at the end of the semester
Evaluation of the practical work reports

Target :

Automation 2: Control of Space State	GMA07-AUTO2
Number of hours : 56.00 h	4.00 ECTS credit
CM : 22.00 h, TD : 18.00 h, TP : 16.00 h	
Reference Teacher(s) : LE BARON JEAN-PAUL	

Objectives :
-The concept of State for the modelling of dynamic systems.
-Solutions to state equations.
-Study of controllability, stability and operability of systems.
-Digital or analog command of multivariable dynamic systems.
-Synthesis of means of control by returning to a reconstructed state.

Content :
Analysis of dynamic systems in State-space. Models of State: the concept of State, conversion State - transfer, conversion
Transfer.
- State, Equivalence of models of State.
- Resolution of State equations - own functions of free systems, symbolic or numerical calculation of the transition matrix,
numerical integration of State equations, discrete state equations of pulsed systems (zero order blockers and ideal pulsed
systems). Stability of systems: Stability with respect to initial conditions..
- Stability for limited input.
- Limited output, stability of linear invariant systems.
- Control and observation: Canonical decomposition into controllable and observable subsystems.

Bibliography :
JAUME D., 1989, « Applications du formalisme d'état à la commande des systèmes continus », Eyrolles.
JAUME D., THELLIEZ S., VERGE M., 1991, « Commande des systèmes dynamiques par calculateur », Eyrolles.
KUO Benjamin C., 1995, « Automatic control systems », Prentice Hall International Editions.
DE LARMINAT Ph., 1993, « Automatique, commande des systèmes linéaires », Hermès.
GILLE J.-C., CLIQUE M., 1990, « Systèmes linéaires - Equations d'état », Eyrolles.

Requirements :
GMA05 SISYS -GMA05 AUT1

Organisation :
Revision of lecture notes. Preparation of exercises, problems and practical work (Three hours per week).

Evaluation :
Three-hour written examination at the end of the semester.
Mark for practical work report.

Target :

Electrotechnique et Electronique de Puissance	GMA07-EEP
Number of hours : 28.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 14.00 h, TP : 8.00 h	
Reference Teacher(s) : GUEGAN SYLVAIN	

Objectives :
Fundamentals of electrotechnics in order to understand the functionality, energy supply, modelling and controls of electric
machines.

Content :
-Single-phase and three-phase circuits: Analysis methods. Real power and reactive power. Measurement of power.
-Magnetic circuits and inductance: Electromagnetism (Reminder). Magnetic circuit. Inductance and coupled circuits.
-Transformers: Single-phase and three-phase power transformers.
-Conversion of electric energy: Principles of the conversion of electric energy. Power components: diode, thyristor, bipolar
transistor, MOSFET, IGBT. Basic converter circuits: AC-DC, DC-DC, DC-AC, AC-AC. Applications.
-Electric machines: Principles (Reminder). Introduction of various types of machines (applications and trends). Main points on
the making and dimensioning of machines and materials used. Equilibrium and stability of a force. Characteristics of
couple-velocity of common driven loads. Characteristics and limits.

Bibliography :
R. MERAT et al., ""Génie électrotechnique"", Etapes références, Nathan, 1997.
G. GRELLET, G. CLERC, ""Actionneurs électriques : principes - modéles - commandes"", Eyrolles, 2000.
M. MARTY, D. DIXNEUF, D. GARCIA GILABERT,
""Principes d'électrotechnique"", Sciences Sup, Dunod, 2005.

Requirements :
Basics in electrotechnics and electromagnetism.

Organisation :
30 hours.

Evaluation :
2-hour written examination.
Continuous evaluation.

Target :

Project: Industrialisation	GMA07-PRIND
Number of hours : 42.00 h	4.00 ECTS credit
CM : 2.00 h, TD : 20.00 h, TP : 20.00 h	
Reference Teacher(s) : SOHIER CHRISTOPHE	

Objectives :
This is a proactive project in which the student plays a fundamental role calling upon previously acquired knowledge while
developing new technical and organisational skills. The aim of this module is to present the student with the following
objectives: Find solutions to technical procedural issues. Establish a clear overview of the process. Make necessary
adjustments to production tools.

Content :
From product specifications, set out the various manufacturing phases including design. Establishment of the manufacturing
process and the production phase. Subdividing the process into three steps allows the clear identification of the relationships
and constraints between the various phases and resources. The financial constraints are established through a cost estimate and
form an important part of the approach to the project.

Bibliography :

Requirements :
GMA05-PMI and GMA06-MOPI

Organisation :
20 hours.

Evaluation :
Manufacturing report.
Oral presentation.

Target :

English	GMA07-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : MORAN GARRETT	

Objectives :
The main objective is to pass the TOEIC (Test of English for International Communication). Conversational English, however,
is not neglected and the improvement of oral skills continues to play an important role.

Content :
Revision of all the main grammar points: tenses, active/passive voice, noun phrases, etc. Vocabulary building including
work-environment vocabulary.

Bibliography :

Requirements :
Although students should, by now, be quite competent in the four skills, groups are formed according to level.

Organisation :
Practice half-an-hour per day by reading press articles, watching television, doing grammar exercises, etc.

Evaluation :
Two-hour written examination at the end of the module, which may contain grammar exercises.
Writing task such as an essay and listening exercises.

Target :

Economy and Management	GMA07-ECOGE
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
- Understand the main topics of management
- Analyse financial information published by companies
- Calculate and analyse costs.
- Be aware of the relations between the different functions of a company.
- Work on a project in a team.

Content :
- Fundamentals of management: fiscal concerns - accounting and financial management - marketing
- Business simulation for an industrial company.

Bibliography :

Requirements :
None.

Organisation :
An average of one hour per week.

Evaluation :
Continuous assessment.

Target :

Sport and Physical Education	GMA07-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : HINAULT YVAN	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O or
Kayak or golf.

Bibliography :
Several specialized books are available to the students at the library. Links to internet sites are given on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Semestre 8

Parcours Formation Initiale GMA

1	**GMA08-1**		**Mechanical engineering and materials S8**	**7.00**
	GMA08-CMAT	O	Mechanical Behaviour of Materials	3.00
	GMA08-COMP	O	Mechanics of Composite Materials	2.00
	GMA08-MDF	O	Fluid Mechanics	2.00
2	**GMA08-2**		**Design and processes S8**	**6.00**
	GMA08-PRCONS	O	Manufacturing & Design Project	4.00
	GMA08-PROD	O	Production and Quality Control Management	2.00
3	**GMA08-3**		**Automation and model-building S8**	**4.00**
	GMA08-MOROB	O	Modélisation des robots	2.00
	GMA08-VIB	O	VIBRATIONS: Analytical and Experimental Approch	2.00
4	**GMA-HUM08**		**HUMANITIES S8**	**5.00**
	GMA08-ANGL	O	English	2.00
	GMA08-ECOGE	O	Economy and Management 2	2.00
	GMA08-EPS	O	Sport and Physical Education	1.00
5	**STAGEGMA-08**		**Work placement S8**	**8.00**
	GMA08-STAGE	O	4GMA Work Placement	8.00

O = compulsary, C= in choice , F= optional

Mechanical Behaviour of Materials	GMA08-CMAT
Number of hours : 56.00 h	3.00 ECTS credit
CM : 26.00 h, TD : 22.00 h, TP : 8.00 h	
Reference Teacher(s) : GUINES DOMINIQUE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Mechanics of Composite Materials	GMA08-COMP
Number of hours : 28.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 8.00 h, TP : 8.00 h	
Reference Teacher(s) : RAGNEAU ERIC	

Objectives :
The design of structural elements made of composite materials.
Part One: Mathematical formulas for the thermo-mechanical behaviour of composite materials (anisotropy, homogenisation, rupture criteria) leading to the dimensioning of composite cross-sections (beams or plates).
Part Two: Implementation and manufacturing technologies.

Content :
Part One: Introduction. Formulas for the behaviour of an anisotropic elastic media (Reminders). Full anisotropy. Orthotropy.
Transversal isotropy. Mechanical formulation of the rupture criteria in anisotropic materials. Hill-Tsaï's criterion. Wu's
criterion. Homogenisation techniques. thermoelastic constants of a unidirectional composite. Thermoelastic behaviour of a
layer in any direction. Matrix formulas for the behaviour of a laminate. Predimensioning and checking of the laminate in
comparison with the rupture criterion.
Part Two: General introduction. General definition of a composite material, reinforcements, matrices. semi-finished products.
Manufacturing procedures. Casting without press. Casting under pressure. Continuous transformation. Manufacturing of
revolution's form. Case study comparison. Scopes of application. Functional analysis. Design of composite parts. The market
for composites. Sandwich materials. The sandwich effect. Components. Mechanical analysis. Applications.

Bibliography :
Daniel Gay - Matériaux Composites 3ème édition. Hermès Editeur.
Jean-Marie Berthelot - Matériaux Composites :
comportement mécanique et analyse des structures. Editions Masson, Paris 1996.

Requirements :

Organisation :
2 hours per week.

Evaluation :
Two-hour written examination at the end of the semester.
Mark for reports on practical work (laboratory).

Target :

Fluid Mechanics	GMA08-MDF
Number of hours : 42.00 h	2.00 ECTS credit
CM : 16.00 h, TD : 14.00 h, TP : 12.00 h	
Reference Teacher(s) : HELLOU MUSTAPHA	

Objectives :
Primary objective: Extension of the Fluid Mechanics studied during the pre-specialisation modules. Second objective: Practical
applications of fluid mechanics (Essential for an engineer in mechanical and automatic engineering; especially in the fields of
turbulence and aerodynamics).

Content :
Quantity of movement theorems. Euler's theorem for incompressible perfect fluids. Compressible real fluids. Isentropic flows.
Shock waves. Resolution methods (exact, potential). Compressible fluids. Basics of aerodynamics

Bibliography :
R. Comolet, Mécanique expérimentale des fluides, 3 tomes, éditions Masson
P. Chassaing, Mécanique des fluides : éléments d'un premier parcours, éditions Cépadues
P. Chassaing, La turbulence en mécanique des fluides , éditions Cépadues
M.Lesieur, La turbulence, éditions EDP sciences
A. Bonnet, J. Luneau,Aérodynamique, éditions Supaero
R. Ouziaux, J. Perrier, Mécanique des fluides appliquée, éditions
Dunod
R. Joulié Mécanique des fluides appliquée, éditions ellipses

Requirements :
GMA05-MMC STP04-MFLU Mathematics.

Organisation :
Two hours per week.

Evaluation :
Three-hour examination at the end of the semester.
Mark for practical work reports.

Target :

Manufacturing & Design Project	GMA08-PRCONS
Number of hours : 56.00 h	4.00 ECTS credit
CM : 12.00 h, TP : 44.00 h	
Reference Teacher(s) : LEOTOING LIONEL	

Objectives :
This project deals with the study of a mechanical system and the implementation of research techniques for solutions,
geometrical modelling, digital simulation and component dimensioning.

Content :
1) Obtaining solutions from functional specifications.
2) Technical definition of solution (choosing bonds and components).
3) Dimensioning of the components.
4) Geometric optimisation of the system.
5) Integration of manufacturing and assembly constraints.

Bibliography :

Requirements :
GMA07-CMAO2 GMA05-TCONS.

Organisation :
3 hours per week.

Evaluation :
Mark for project.

Target :

Production and Quality Control Management	GMA08-PROD
Number of hours : 28.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : SORRE FREDERIC	

Objectives :
To manufacture, in accordance with requirements, low-cost, high-quality products, which respect consumers' requirements and
can be supplied in reasonable time. Organisational techniques, production management, quality control, communication.

Content :
I- Experimental methodology: Introduction. Vocabulary and study approach. Calculation tools. Screening. Common
experiment matrices. Analysis of results. Validation of the model. Taguchi's method.
II- Production control. Concept of capability. Quality checking cards: particular cases. Forecasting techniques. Advanced
planning techniques. Organisation in specialised workshops. Manufacturing lines. ERP

Bibliography :
P. Souvay La statistique : outil de la qualité Recueil des normes ISO 9000 G. et M.C. Sado, De l'expérimentation à l'assurance qualité - Afnor Technique Jacques Goupy, Introduction aux plans d'expériences - Dunod

Requirements :
TCM06-ISIP

Organisation :
1 hour per week.

Evaluation :
Two-hour written examination at the end of the semester.

Target :

Modélisation des robots	GMA08-MOROB
Number of hours : 42.00 h	2.00 ECTS credit
CM : 16.00 h, TD : 10.00 h, TP : 16.00 h	
Reference Teacher(s) : MAURINE PATRICK	

Objectives :
Methods and basic tools necessary for the modelling of simple, open-chain manipulating robots.

Content :
-Modelling of simple open-chain manipulating robots. Terminology and main definitions.
-Transformation matrixes between vectors, frames and torque.
-Direct and inverse geometrical models.
-Study of singularities.
-Analysis of the workspace.
-Analysis of manipulability. Transfer of velocities and stresses.
-Static equilibrium.

Bibliography :
KHALIL W., DOMBRE E., 1999, « Modélisation, identification et commande des robots », Hermès.

Requirements :
Matrix calculus

Organisation :
2 hours per week

Evaluation :
A two-hour written examination at the end of the semester.
Mark for reports on practical work in the laboratory.

Target :

VIBRATIONS: Analytical and Experimental Approch	GMA08-VIB
Number of hours : 42.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 14.00 h, TP : 16.00 h	
Reference Teacher(s) : COURTEILLE ERIC	

Objectives :
Awareness of problems linked to noise and vibrations. Basics of vibration dynamics and acoustics. Reduction methods for
noise and vibration. Industrial measuring techniques.

Content :
1. Fundamental models for vibration. Discrete systems with one degree of freedom. Systems with two or more degrees of
freedom. Various damping models.
2.Basics and principles of digital signal processing: Digital acquisition (Reminder). Sampling and Fourier transform discrete
quantification. Digital acquisition: common errors.
3. Introduction to experimental modal analysis techniques. Purpose of experimental modal analysis. Synthesis of transfer
functions in frequency domain. Main time methods. Main frequency methods.
4. Principles of machinery vibration isolation. The vibroacoustic diagnosis. Choice and size of a suspension. Evolved
suspension systems.

Bibliography :
1. University of Cincinnati, « Vibrations : analytical and experimental modal analysis », 1999.
2. Harris, C. et Piersol, A., « Shock and Vibration Handbook », Mc Graw-Hill, 5ième édition.
3. Plusquellec, J., « Vibrations », Techniques de l'ingénieur,
A410.

Requirements :
1. Matrix calculation.
2. Solving differential equations.
3. Laplace and Fourier transform.

Organisation :
25 hours.

Evaluation :
Two-hour written exam at the end of the semester.
Mark for practical work report.

Target :

English	GMA08-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : MORAN GARRETT	

Objectives :
The principal objective is to achieve a minimum of 750 points the TOEIC (Test of English for International Communication).
Conversational English, however, is not neglected and improvement of oral expression remains one of the objectives.

Content :
Overall grammar review: tenses, active/passive voice, nominal group, etc. Vocabulary-building, particularly Business English
vocabulary.

Bibliography :

Requirements :
Although students should, by now, be competent in the four skills, groups are formed according to level.

Organisation :
Revision of class notes. TOEIC preparation tests.

Evaluation :
TOEIC test. minimum score of 750 points required.
Oral examination.

Target :

Economy and Management 2	GMA08-ECOGE
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
- To improve the understanding of economy and management topics
- To be able to work on a project in a team.

Content :
- The firm
- Introduction to industrial property
- Introduction to project management
- Accounting and Finance
- Economy

Bibliography :

Requirements :
None.

Organisation :
An average of 1 hour a week.

Evaluation :
Continuous assessment and exam.

Target :

Sport and Physical Education	GMA08-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : HINAULT YVAN	

Objectives :
Team work, discovery of one's capabilities, communication, invention, autonomy, self-discovery and management responsibilities.

Content :
Whole class: "role of the coach, role of the referee, management" (knowledge of the rules, getting involved, leading, decision
making and communicating). Practice and knowledge of the sociomotive roles involved in the strategies of team attack and
team defence. Finding one's place in a group and awareness of your team-mates and their responsibilities.
Organisation: two 15-hour and one 30-hour sports or physical activity programme in groups.

Bibliography :
Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education
website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

4GMA Work Placement	GMA08-STAGE
Number of hours : 240.00 h	8.00 ECTS credit
TP : 1.00 h	
Reference Teacher(s) : GAVRUS ADINEL	

Objectives :
Students put into practice the industrial context of the scientific and technical skills they have acquired.

Content :
First-hand work experience is an essential step in the education of GMA engineers. The work experience internship at the end
of the eighth semester can last from 8 to 16 weeks and is compulsory. The objective is to solve a real technical issue in an
industrial context. The student has four months, from the end of May to the end of September, to carry out the training course,
by the end of which he will have gained a better insight into the professional world which lies ahead of him.
Each student has the responsibility of finding a host company and the further task of defining a plan for the internship with his
employer. Students are advised that their internship plan must be relevant to the domains of Mechanical Engineering or
Automatics and cannot commence without an Internship Agreement being signed between the company and INSA-Rennes. In
any case, before the establishment of this agreement, a clear plan for the internship must be defined and submitted to the
department for agreement.

Bibliography :

Requirements :

Organisation :
Each student undertakes to find his own work placement. See "Programme" (above) for further details.

Evaluation :
A twenty-page synthesis-report is compulsory and may be written in French or in English (for students having completed their internship abroad). It can be accompanied by one or more appendices of unrestricted length. Each student must present to a jury comprising his tutor(s) and representatives of the host company a poster (designed by himself) describing the context and the objectives of the internship. Note: Reports must not be a chronological description.

Target :

Semestre 9

Parcours Formation Initiale GMA

1	**GMA09-1**		**Mechanical engineering and materials S9**	**7.50**
	GMA09-MATME	O	Metallic Materials: Shaping	3.50
	GMA09-MATNM	O	Non-Metallic Materials: Processing	2.00
	GMA09-MNEF	O	Numerical Methods: Nonlinear Finite Elements	2.00
2	**GMA09-2**		**Automation and model-building S9**	**6.00**
	GMA09-ROB2	O	Robotics II	2.00
	GMA09-SYSME	O	Mechanical Systems	2.00
	GMA09-COMOP	O	Automation III: Optimal Control	2.00
3	**GMA09-3**		**OUVERTURE**	**11.00**
	GMA09-CORO	C	Robust Design	2.00
	GMA09-CODYM	C	Comportement dynamique des matériaux et des structures	2.00
	GMA09-INGAS	C		2.00
	GMA09-VATR	C	Accuracy of Robots and Machine-tools	2.00
	GMA09-PI	O	Industrial project	7.00
	GMA09-ANNUM	C	Analyse numérique pour ingénieur	2.00
4	**GMA-HUM09**		**HUMANITIES S9**	**5.50**
	GMA09-CONF	O	Conferences	2.00
	HUMT1-PGE-A	C	Economics, Law and Business Studies A (serious game)	2.00
	HUMT1-PGE-B	C	Economics, Law and Business Studies B (Lean six sigma)	2.00
	HUMT1-PGE-C	C	Economics, Law and Business Studies C (human resource management)	2.00
	HUMT1-PGE-D	C	Economics, Law and Business Studies D (Marketing for ICT Companies)	2.00
	HUMT1-PGE-E	C	Economics, Law and Business Studies E (Industrial design and innovation)	2.00
	HUMT1-PGE-F	C	Economics, Law and Business Studies F (Mangement and decision making)	2.00
	HUMT1-ANGL/CONV	C	English S9 Conversation	1.50
	HUMT1-ANGL/TOEIC	C	TOEIC 5th year	1.50

O = compulsary, C= in choice , F= optional

Metallic Materials: Shaping	GMA09-MATME
Number of hours : 44.00 h	3.50 ECTS credit
CM : 24.00 h, TD : 10.00 h, TP : 8.00 h	
Reference Teacher(s) : GAVRUS ADINEL	

Objectives :
Metallurgy of Metallic Materials.Introduction to the plasticity of materials and elasto-(visco)plastic behaviour definition. Study
of the relationship between structure and rheology. Formulation of the rheological and tribological laws. Examination of
mechanical and tribological tests. Description of the principal processes for metals forming. Optimization and Inverse Analysis
Principle.

Content :
1° Mechanical Metallurgy of Metallic Materials.
2° Elasticity, viscoplasticity, plasticity, criteria of plasticity.
3° Elements of physical and mechanical metallurgy concerning metals forming.
4° Rheology and Tribology of metals forming.
5° Analysis of Industrial Metals Forming Processes.
6° Numerical Simulations, Optimization and Inverse Analysis applied to the rheological and tribological properties identification according to the forming conditions.

Bibliography :
[1] J. PHILIBERT A. VIGNES Y. BRECHET P. COMBRADE « Métallurgie du minerai au matériau » Ed Masson 1998
[2] D. FRANCOIS, A. PINEAU, A. ZAOUI, « Comportement mécanique des matériaux », Tome1, Hermes, 1995
PHILIBERT, VIGNES, BRECHET, COMBRE, " Métallurgie du minerai au matériau ", Masson,
[3] J-M. HAUDIN, F. MONTHEILLET ²Notions Fondamentales sur les Matériaux², Ed. S.N.P.M.D., Paris, 1989.
[4] M. BELLET, J-L. CHENOT, L. FOURMENT, E. MASSONI, P. MONTMITONNET ²Séminaire de Plasticité : Eléments Finis et Mise en Forme des Métaux ², Ed. Ecole Nationale Supérieure des Mines de Paris, Sophia Antipolis, 1994.
[5] M. RAPPAZ, M. BELLET, M. DEVILLE ²Modélisation Numérique en Science et Génie des Matériaux², Ed. Presses
Polytechniques et Universitaires Romandes, 1998.

Requirements :
Physics, materials science, technology modules (4th year)
Mechanics of continuous elements (3thd year)
Fluid mechanics (4th year)

Organisation :
Revision of lecture notes. Problems solving: 10 hours

Evaluation :
Two-hour written examination and practical works evaluation.

Target :

Non-Metallic Materials: Processing	GMA09-MATNM
Number of hours : 28.00 h	2.00 ECTS credit
CM : 22.00 h, TD : 6.00 h	
Reference Teacher(s) : GAVRUS ADINEL	

Objectives :
Introduction of Polymers Technology; Physical-Chemical description of Polymers; Structure-Behaviour-Properties Interaction;
Thermo-viscoplasticity and rheological analysis of the melted state; Thermal theory and applications concerning the thermal
analysis; Injection, Extrusion and Calendering Processes Analysis; Rheology of solid polymers; Technology and properties of
ceramics.

Content :
1. Comparison between metals, polymers, ceramics and composites materials and its optimal choice.
2. Introduction to the technology principles of polymers manufacturing.
3. Physical and Chemical description of a polymer.
4. Definition and properties of thermoplastics, thermosettings and elastomers materials.
5. Thermo-viscoplasticity and rheology of polymers in melted state.
6. Thermal Theory and Applications.
7. Manufacturing process for polymers industry.
8. Rheology of solid polymers.
9. Elaboration, properties and technology of ceramics.

Bibliography :
[1] J. F. AGASSANT, P. AVENAS, J.-Ph. SERGENT- "La Mise en Forme des Matériaux Plastiques", Ed. Technique &
Documentation, Ed. Lavoisier, 1996.
[2] J. BOST -"MATIERES PLASTIQUES II : Technologie Plasturgie", Ed. Technique & Documentation, Lavoisier, 1982.
[3] M. REYNE-"LES MATERIAUX NOUVEAUX", Ed. Hermes, Paris, 1990.
[4] M. REYNE "TECHNOLOGIE DES PLASTIQUES", Ed. Hermes, Paris, 1998.
[5] C. GSELL, J.-M. HAUDIN-"INTRODUCTION A LA MECANIQUE DES POLYMERES", Ed. Institut National Polytechnique de Lorraine, 1995.
[6] W.D. KINGERY, H.K. BOWEN, DR UHLMANN -"Introduction to Ceramics", John Wiley & Sons, New-York (1976), ISBN 0.471.47860.1
[7] J.L. CHERMAN -"Caractérisation des poudres et des céramiques", Hermès, Paris (1992), ISBN 2.86601.307.7
[8] L.L. HENCH, R.W. GOULD -"Characterization of Ceramics", M. Dekker Inc, New-York (1971), ISBN 0.8247.1302.8

Requirements :
Physics and Chemistry (1st en 2sd years).
Materials Science (3thd and 4th years).
Continuum Media Mechanics and Fluid Mechanics (3thd and 4th years).

Organisation :
One hour per week.

Evaluation :
Two-hour written examination and project evaluation.

Target :

Numerical Methods: Nonlinear Finite Elements	GMA09-MNEF
Number of hours : 26.00 h	2.00 ECTS credit
CM : 26.00 h	
Reference Teacher(s) : RAGNEAU ERIC	

Objectives :
An extension of the MEFI module (4th year), the consequences of taking material and geometrical nonlinearities into account
in a finite element model are examined. A mini-project on modelling in the nonlinear domain completes the module.

Content :
1. Introduction: Classification of nonlinearities.
2. Matrix formulation of non linearity: understanding tangent and cutting matrix of rigidity.
3. Solution models (Newton-Rahpson).
4. Application to geometrical nonlinearities: Hyperelasticity. Hypoelasticity. Elastoplasticity.
5. Application to geometrical nonlinearity: Lagrangian description "UL" and "TL". Euler's description "ALE". Approximations
for large displacements. Flame and sail effects on thin elements.
6. Application with the Cast 3M program (mini project).

Bibliography :
Zienkiewicz : La méthode des Eléments finis. Edisciences
Gallagher : Introduction au calcul par Eléments Finis. Editions Pluralis Batoz,
Dhatt : Modélisation des structures par éléments
finis. Editions Hermès
K. J. Bathe : Finite Element Procedures in Engineering Analysis. Prentice et Hall

Requirements :
Basics of the mechanics of continuous media and linear finite element modelling.

Organisation :
Two hours per week.

Evaluation :
Two-hour written examination.
Mark for mini-project.

Target :

Robotics II	GMA09-ROB2
Number of hours : 24.00 h	2.00 ECTS credit
CM : 16.00 h, TD : 8.00 h	
Reference Teacher(s) : ARAKELYAN VIGEN	

Objectives :
Theoretical principles to understand the mechanics of articulated robots. Recent developments in direct polynomial kinematics
and the study of the assembly of parallel robots. Inverse kinematics, Statics, Architecture and Dynamics for parallel robots.
Case studies. Tutorials: Simulation of these applications through models using the ADAMS programme.

Content :
Statics of anthropomorphic and parallel manipulators. Direct and inverse kinematics of parallel manipulators. Generalisation of
movements in articulated and operational space: Polynomial interpolation and calculating minimal time. Newton-Euler and
Newton-Lagrange equations: Application to robotic systems. Balancing of manipulating arms and parallel robots: application
to walking and manual-manipulator robotic systems. Open-loop kinematics for dynamic decoupling and linearization of
movement equations for manipulators. Architecture: calculations and optimisation.

Bibliography :
1. O. Bottema, B. Roth. Theoretical Mechanics. Dover Publications, New York, 1990, 558p.
2. J. Angeles. Fundamentals of robotic mechanical systems. Springer, 2003, 521p.
3. L.W. Tsai. Robot Analysis. John Wiley et Sons, 1999, 505p. Evaluation

Requirements :

Organisation :

Evaluation :
Two-hour written examination at the end of the semester.

Target :

Mechanical Systems	GMA09-SYSME
Number of hours : 24.00 h	2.00 ECTS credit
CM : 16.00 h, TD : 8.00 h	
Reference Teacher(s) : ARAKELYAN VIGEN	

Objectives :
- New analytical methods for the design and fabrication of modern machines.
- Concepts and techniques of the mechanics of complex systems.
- General principles and methods for the study of rigid/articulated multi-body systems.
- Case Studies.

Content :
Use of graphs to describe systems. Position: kinematic (the Gosselin-Angeles method) and dynamic. Kinematic analysis of
closed-loop spatial mechanisms using the Denavit-Hartenberg method. Synthesis of multiple body articulated systems:
Burmester's problem and the problem of the approximate reproduction of a given motion (Roth-Gupta method). Dynamic
synthesis of multiple body systems. Moving moment and optimisation methods. Optimal balance for complex systems based
on the Techichev's approximation. Dynamics of multiple body closed loop systems with multiple degrees of liberty. The
mechanical-electronic approach to the study of mechanical systems.

Bibliography :
1. L.W. Tsai. Mechanism Design. CRC Press, 2001, 311p.
2. H. Dresig., F. Holzweißer. Maschinendynamik. Springer, 2004, 526p.
3. O. Bottema, B. Roth. Theoretical Mechanics. Dover Publications, New York, 1990, 558p.

Requirements :

Organisation :

Evaluation :
Two-hour written examination at the end of the semester.

Target :

Automation III: Optimal Control	GMA09-COMOP
Number of hours : 24.00 h	2.00 ECTS credit
CM : 10.00 h, TD : 6.00 h, TP : 8.00 h	
Reference Teacher(s) : LE BARON JEAN-PAUL	

Objectives :
Problems associated with optimal control of dynamic systems, including a number of practical problems: Control with minimal
expenditure of energy, Control in minimal time, etc. Study of linear quadratic commands. Introduction of robustness of the
Gaussian linear quadratic commands; H2 and H¥

Content :
Mathematics in optimal control. Calculation of variations. Principle of the maximum. Dynamic programming. Optimal control
of linear systems. Additions from Lyanpunov's theory. Quadratic optimisation of continuous systems. Continuous stationary
regulator. Quadratic optimisation of discrete systems. Discrete stationary regulator. Linear quadratic command system + stability. Gaussian linear quadratic commands H2 et H¥

Bibliography :
KWAKERNAAK H. SIVAN R., 1972, « Linear optimal control systems», John Wiley 1 Sons, Inc.
THOMAS Y., 1992 « Signaux et systèmes linéaires » 1991, Masson
DE LARMINAT Ph. 1993, « Automatique, commande des systèmes linéaires », Hermès.

Requirements :
Signaux et Systèmes - Automatique 1 - Automatique 2

Organisation :
Revision of lecture notes. Preparation of exercises, problems and practical work (Two hours per week).

Evaluation :
Three-hour written examination at the end of the semester(lecture notes and handouts allowed).
Two practical work reports .

Target :

Robust Design	GMA09-CORO
Number of hours : 24.00 h	2.00 ECTS credit
CM : 10.00 h, TP : 14.00 h	
Reference Teacher(s) : LEOTOING LIONEL	

Objectives :
The choice of an optimal mechanical solution requires the study of its robustness. The evaluation of the reliability of the
product can be an efficient tool for this choice.

Content :
1 - Main optimization algorithms
2 - Introduction to Mechanical reliability
3 - Applications on optimization software ModeFrontier
4 - Project
5 - Lecture on industrial applications

Bibliography :

Requirements :
GMA07-CMAO2

Organisation :
1 hour per week

Evaluation :
- 1 two-hour written examination
- 1 mark for practical work

Target :

Comportement dynamique des matériaux et des structures	GMA09-CODYM
Number of hours : 24.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 12.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

	GMA09-INGAS
Number of hours : 24.00 h	2.00 ECTS credit
CM : 16.00 h, TP : 8.00 h	
Reference Teacher(s) : KOUADRI-DAVID AFIA	

Objectives :
The majority of industries must integrate during their manufacture a stage of assembly and of welding. In this aim, the engineer in mechanics and automatism must have a global vision of the manufacturing processes, machines of assembly or the welding, their operation but also of their limit for better acting and thus guaranteeing the reliability of the end product. Also the objective of this module is to bring to the engineers tools and methods to acquire a competence in the field of the engineering of assembly by the taking into account the process of the welding as well as choice of material in metallurgical, thermal and mechanical terms.

Content :
The module is carried out in the form of course (16 H) and 8 hours of TP. The course part is broken up into several fields which constitute the training of an engineer welder and who requires several level of knowledge:
1. Run
- Process study: Presentation and study of the various processes of welding, control parameters of the process,
- Materials study: Influence of the processes and parameters on the metallurgical and thermal aspects.
- Mechanical study: Impact and effects on the welded structures.
- Coupling: Study of the coupling Process-Material-Mechanics.
- Defects of welding study: Appreciation and recognition of the various types of defects generated by welding.
- Quality controls of the structures: methods of destructive and nondestructive control of the welded structures.
- Qualification: Study of the step of qualification of an engineer welder: QMOS and DMOS.
- Application to various welded systems in automotive, aeronautic¿..

2. Work practice
The TP are realized in the form of welding of plates by the use of various processes. A mechanical qualification is carried out by the students in order to confirm the influence of the process on the final quality of the process. Various tests are carried out to highlight the proceeded coupling material-mechanics.

Bibliography :

Requirements :
- Knowledge of the mechanics of materials
- Knowledge of the manufacturing processes

Organisation :
- 2 H of course per week
- 8 hours of pratics (TP)

Evaluation :
- Exam during 2 Hours
- Practices (TP)

Target :

Accuracy of Robots and Machine-tools	GMA09-VATR
Number of hours : 24.00 h	2.00 ECTS credit
CM : 8.00 h, TD : 8.00 h, TP : 8.00 h	
Reference Teacher(s) : SOHIER CHRISTOPHE	

Objectives :
The Mechanics Industry is a complex environment with many branches of activity. To be competitive each branch has to
involve automated machines and robots. As a result, the mechanical engineers must have a global overview of these machines
in order to well understand their behaviour and their limits. For machining and assembly applications, the trajectories of the
machines-tools and robots have to be accurately controlled. Therefore the objective of this module is to provide the students
the knowledge and the tools required to enhance the static and dynamic accuracies of robots and machines.

Content :
Courses:
1/ Problem statement:
Problem of Machine and robot accuracy,
Off-line Programming,
CAD/CAM
2/ Objectives and available calibration methods :
Modelling
Identification
Measurement
Compensation
Tutorials:
1/ Practical verification of machines-tool and robot accuracy
2/ Machine and robot modelling
3/ Application to calibration methods to machines and robots
Laboratory :
1/ Application to 3 and 5 axis machine tools
2/ Application to industrial anthropomorphic robots (KUKA, FANUC)

Bibliography :

Requirements :

Organisation :
12 hours

Evaluation :

Target :

Industrial project	GMA09-PI
Number of hours : 110.00 h	7.00 ECTS credit
TD : 110.00 h	
Reference Teacher(s) : COURTEILLE ERIC	

Objectives :
Solving problems in a simulated industrial situation. A look at companies working in the field of Mechanical and Control
Systems Engineering.

Content :
Working alone or in pairs, students must complete a project proposed by a company which is involved in mechanical
engineering, mechanics or automation.

Bibliography :

Requirements :

Organisation :
From 6 to 10 hours per week.

Evaluation :
Two oral presentations:(a) On the planning and organisation of the project (15%) (b) At the end of the project(30%).
Written report (30%).
Mark awarded by teachers and company supervisors (25%).

Target :

Analyse numérique pour ingénieur	GMA09-ANNUM
Number of hours : 24.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 8.00 h, TP : 4.00 h	
Reference Teacher(s) : GAVRUS ADINEL	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Conferences	GMA09-CONF
Number of hours : 24.00 h	2.00 ECTS credit
CM : 24.00 h	
Reference Teacher(s) : DEBLAISE DOMINIQUE	

Objectives :
Students are encouraged to reflect upon their future careers. To complete the training received during the Mechanical and
Control Systems Engineering by : going futher into a subject studied during the semester, meeting people from the industrial
sector in order to become familiar with their work methods and the problems and constraints they meet daily.

Content :
Lectures on various aspects of Mechanical and Control Systems Engineering are given by invited consultants from the world
of industry.

Bibliography :

Requirements :

Organisation :
attendance at conference

Evaluation :
Based on attendance at conferences

Target :

Economics, Law and Business Studies A (serious game)	HUMT1-PGE-A
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
-Establishing a strong, specific vocabulary base
-Understanding the main issues that industrial companies deal with (in a specific management field).
-Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Business Simulation (serious game) (24h / in English)
The business simulation ¿Global Challenge¿ (a CESIM product) has been designed to improve the understanding and knowledge of the complexity of global business operations in a dynamic, competitive environment. It focuses on strategic management, international management and business policy.
The task for the student teams is to manage a global mobile telecommunications company through technological and market evolution. Students will develop and execute strategies for their simulated company operating in the USA, Asia, and Europe.
The simulation is based on an online platform that allows students to play in their own language (many languages available: English, Spanish, Portuguese, Chinese,¿).

* Law (8h / in French)
Main principles of the French legal system

* Patents (4h / in French)

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies B (Lean six sigma)	HUMT1-PGE-B
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Lean Six Sigma (28h / in French)
Lean Six Sigma is a methodology that enables firms to make their processes more effective and efficient. It¿s the current industry standard for process improvement designed to reduce waste and enhance output quality.

* Law (8h / in French)
Main principles of the French legal system

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies C (human resource management)	HUMT1-PGE-C
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field)
- Understanding the importance of teamwork: making collective decisions and producing the expected work in time

Content :
* Human Resource Management (20h / in French)
    - Main current challenges of Human Resource Management
    - Human Resource Management¿s tools and organization
    - Focus on how team managers deal with Human Resource Management

* Law (8h / in French)
    Main principles of the French legal system

* Social legislation (8h / in French)

* Main principles of French social legislation

* Employment contract

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies D (Marketing for ICT Companies)	HUMT1-PGE-D
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This module is designed to equip students with the knowledge and analytical techniques required for effective strategic marketing management in ICT companies. Through this course, students are faced with a real case study provided by a marketing director of an international ICT company. Students are placed in a decision-making situation and should emerge with a 3 years strategic program.

ICT : Information and Communications Technology

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies E (Industrial design and innovation)	HUMT1-PGE-E
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time.

Content :
The program¿s main objective is to provide a multidisciplinary approach to the field of innovation, strategy and industrial design. This course will give an overview of the innovative process.
During this program, participants will have the opportunity to explore a business case covering the first stage of a product development project.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advice to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies F (Mangement and decision making)	HUMT1-PGE-F
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This course is about how to improve decision making as a future manager.
In addition to calling for academic insights and existing literature, this module provides practical improvement strategies to avoid costly decision making errors.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

English S9 Conversation	HUMT1-ANGL/CONV
Number of hours : 10.00 h	1.50 ECTS credit
TD : 10.00 h	
Reference Teacher(s) : LE TINNIER ANNE	

Objectives :
- Improving communication skills in everyday life situations as well as in a professional or social context.
- Obtaining or reinforcing C1 level, strongly advised/recommended by the CTI. t.

Content :
- Learning by doing: students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
- Expressing oneself accurately and fluently: students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
1. English Grammar in Use (Cambridge University Press)
2. Dictionnaire Collins Cobuild
3. Polycopié de l' INSA

Requirements :
Having taken and passed the TOEIC test during the previous two years (800 required)
or any other B2 certification recognized by the CTI.

Organisation :
- Each class lasts one hour and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
- Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet.

Evaluation :
Continuous assessment: The final mark (out of 20) will be based on the attendance rate and the personal implication of the student during the class.

Target :

TOEIC 5th year	HUMT1-ANGL/TOEIC
Number of hours : 20.00 h	1.50 ECTS credit
TD : 20.00 h	
Reference Teacher(s) : LE VOT PHILIPPE	

Objectives :
- Improving communication skills in everyday life situations as well as in company and business context.
- Obtaining or reinforcing the B2 level requested by the CTI.
- Obtaining 800 score at the final TOEIC test.

Content :
Learning by doing : students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
Expressing oneself accurately and fluently : students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
- English grammar in Use, Intermediate Edition (CUP)
- Robert and Collins bilingual dictionary or Collins Cobuild

Requirements :
Not having already taken and passed the TOEIC test during the previous two years
B1/B2 level advised

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet. B2 level tests are also taken throughout the course.

Evaluation :
Final mark based on :
TOEIC score at final exam + attendance (more than 4 non justified absences result in 0/20 mark).

Target :
5th year students who haven't already passed their TOEIC

Academic year 2013/2014

Courses offered by the programme

Science et Génie des Matériaux (SGM)

Semester(s) : 1-2-3-4-5-6-7-8-9

Commonly used abbreviations
CM : Lectures
TD : Tutorials
TP : Laboratory Work
CONF : Conferences
TA : Personal Work
PR : Project
ST : Internship
DIV : Miscellaneous

Semestre 5

Parcours Formation Initiale SGM

1	**TCM05**		**Science and technology of engineer S5**	**9.00**
	TCM05-ANAL	O	Mathematical Analysis for the Engineer	2.00
	TCM05-PROBA	O	Probability Tools for Engineers	2.00
	TCM05-INFOC	C	C language	3.00
	TCM05-PROG	C	C and Matlab programming	3.00
	TCM05-RISQ	O	Risk Management	2.00
2	**SGM05-1**		**Physics 1**	**7.50**
	SGM05-PR	O	Wave propagation 1	3.00
	SGM05-MQ	O	Quantum Mechanics	4.00
	SGM05-CONF	O	Conferences	0.50
3	**SGM05-2**		**Instrumentation & Measurement**	**4.00**
	SGM05-IM	O	Instrumentation and measurements	4.00
4	**SGM05-3**		**Electronics**	**4.50**
	SGM05-EL	O	Electronic Circuits	4.50
5	**SGM-HUM05**		**Humanities**	**5.00**
	SGM05-EPS	O	Sport and physical activities	1.00
	SGM05-PSH	O	Bibliographic project (written)	2.00
	SGM05-ANGL	O	Foreign language 1 : English	2.00

O = compulsary, C= in choice , F= optional

Mathematical Analysis for the Engineer	TCM05-ANAL
Number of hours : 28.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : BRIANE MARC	

Objectives :
Integration, Fourier transform, complex variables

Content :
1. Integration
Convergence theorems
Integrals with a parameter
Integrable functions
Fubini's theorems and convolution
Change of variables
2. Fourier transform
Fourier transform of a integrable function
Inversion theorem
Fourier transform of a square-integrable function
Plancherel theorem
Fourier transform and convolution
3. Complex variables
Holomorphic functions
Entire functions
Exponential and logarithmic functions
Cauchy's formula
Residues method

Bibliography :
G. GASQUET, P. WITOMSKI : « Analyse de Fourier et applications ». Masson, 1990.

Requirements :
Mathematical analysis of first and second year

Organisation :
30h

Evaluation :
1 written examination

Target :

Probability Tools for Engineers	TCM05-PROBA
Number of hours : 28.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : HERVE LOIC	

Objectives :
Probability calculus
- Large-samples
- Elements of statistics

Content :
1. Probability distributions. Examples.
2. Gaussian models.
3. Characteristic functions.
4. Limit theorems for Large-samples. Statistical applications.

Bibliography :
Modélisation probabiliste et statistique- Bernard Garel - Collection POLYTECH des éditions CEPADUES

Requirements :
Bases of analysis and linear algebra. Elements of probability theory of STP03-PROBA « Introduction aux probabilités »

Organisation :
30h

Evaluation :
One two hours written examination.

Target :

C language	TCM05-INFOC
Number of hours : 42.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 8.00 h, TP : 20.00 h	
Reference Teacher(s) : LEPLUMEY IVAN	

Objectives :
Basic understanding of the C programming language.
Ability to resolve all common problems.
Find the minimal intersection of needs / C. language.
Writing and comprehension of the code. Syntax and associated semantic.

Content :
1. Introduction to C programming language:
   Introduction.
   Chain of production, from the code source to the executable.

2. Basic C:
   Lexical entities.
   Language syntax.
   Variable declaration.
   Predefined types.
   Operators and expressions.
   General structure of a program.
   Basic input/output.
   Control structures and instructions.
   Fields: 1st form.
   Functions and pass-by-value parameter passing.

3. Advanced C:
   Pointers.
   Functions and pass-by-address parameter passing.
   Standard library functions.
   Memory models for functions and pointers.
   Fields : 2nd form.
   New types and types constructor.
   Explicit type conversion.
   File input/output.
   Allocation class.
   Dynamic Allocation.
   Pointers to functions.

Bibliography :
J.P. BRAQUELAIRE. Méthodologie de la programmation en langage C - Principes et applications. Manuels Informatiques Masson. Masson, 1993.
J.P. BRAQUELAIRE. Méthodologie de la programmation en langage C - Norme C99 - API POSIX. Sciences Sup. Dunod, 2005.
C. DELANOY. Programmer en langage C, avec exercices corrigés. Eyrolles, 1997.
B.W. KERNIGHAN and D.M. RITCHIE. Le langage C. Manuels Informatiques Masson. Masson, 1990.
J.L NEBUT. Le langage C - définition de la norme ANSI. Technical Report Cours C81, IFSIC -Université de Rennes 1, juillet 1989.

Requirements :
Understanding of Algorithms Foundations

Organisation :
Revision of the lecture notes.
Preparation for the practical work.
14hours of course, 8 hours of directed work and 20 hours of practical work

Evaluation :

2-hour written examination at the end of the semester (documents allowed).

Target :

C and Matlab programming	TCM05-PROG
Number of hours : 35.00 h	3.00 ECTS credit
CM : 9.00 h, TD : 8.00 h, TP : 18.00 h	
Reference Teacher(s) : MORIN LUCE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Risk Management	TCM05-RISQ
Number of hours : 21.00 h	2.00 ECTS credit
CM : 21.00 h	
Reference Teacher(s) : GALL PHILIPPE	

Objectives :
The engineer must always remain master of his choices and his actions within the limits defined by acceptable risk.

Content :
I- THE PRINCIPAL CONCEPTS OF RISK ANALYSIS: Dangerous situations. The five dimensions: facts, models, objectives, norms, values. The dissonances between players in a network. The deficits that affect dimensions. Options for
preventative action.
II. DANGER: AN INTRINSIC REALITY. WHEN AND WHERE TO EXPECT DANGER. Danger inherent to the natural
environment. Climate-related uncertainties. Terrestrial uncertainties. Fire as a man-made danger: facilities, production,
creation, etc. Sources of danger in the workplace: electrical, mechanical, chemical, toxicological, radiation, etc.
III - RISK: A LIKELY EVENT WHICH INDUCES DANGER: Characterisation of risk or estimation of danger: probability
and gravity. Natural or man-made danger. Error or approximation. Economic and financial risk. Complexity of the models.
Sport-related risk. Information-related risk. Alarm-related risk. Numerical treatment of problems. Risk; chemical-related risk.
IV. SECURITY: Development of a secure environment. Regulations: logic, criticism and use; technical regulations.
V. PREVENTION AND ASSUMING RESPONSIBILITY: JURIDICAL ASPECTS.

Bibliography :
Risque et Génie Civil - AFGC - 8 -10 nov 2000, Presse des Ponts et Chaussées Konstantin PROTASSOV, 1999,
""Probabilités et Incertitudes"", PUG Michèle NEUILLY - CETAMA
""Modélisation e estimation des erreurs de mesure"" GIS - MR-GenCi J.A. CALGARO, 1996,
- Introduction aux Eurocodes, Presse de l'ENPC Peter G. NEUMANN, 1995,
Computer-Related Risks, Addison-Wesley/ACM Press, ISBN 0-201-55805-X, 384pp

Requirements :

Organisation :

Evaluation :
Two-hour written examination in French.

Target :

Wave propagation 1	SGM05-PR
Number of hours : 43.50 h	3.00 ECTS credit
CM : 19.50 h, TA : 21.00 h, TD : 3.00 h	
Reference Teacher(s) : ROBINET SYLVIE	

Objectives :
The fundamentals of how to understand and represent propagation of electromagnetic waves in linear, isotropic, homogeneous,
infinite or confined environments. Two thirds of the module is based on active pedagogy (WebCt) with question and answer
sessions and auto-evaluation. This develops the student's organisation and autonomy and allows for differences in the students
knowledge of the subject matter.

Content :
- Propagation of electromagnetic waves in linear, isotropic, homogeneous environments.
- Polarisation of electromagnetic waves.
- Reflection and transmission at an interface between two media (Fresnel equations).
- Homogeneous transmission lines: applied to hyperfrequency. Active power transferred to a load, reflexion coefficient, Smith
chart, hyperfrequency guides and passive components.

Bibliography :
- C. FRERE et P. KREMPF "Physique des Ondes" (2ème année PC - PC*, PSI, PSI*) Ellipses
- J.P. PEREZ et Coll. "Electromagnétisme", Masson (3ème édition)
- S. HUARD "Polarisation de la lumière", Masson
- M. HULIN et coll. "Equations de Maxwell : Ondes électromagnétiques". Dunod
- J.P. FAROUX et J. RENAULT "Electromagnétisme 2". Dunod
- P.F. COMBES, "Ondes métriques et centimétriques", Dunod Université
- G. DUBOST, "Propagation des ondes électromagnétiques". Masson

Requirements :
Maxwell equations, Theory of linear electrical networks using a sine wave.

Organisation :
Revision of lecture notes. Completion of the exercises (2hrs per week) via an ICT platform (WebCt).

Evaluation :
2 written examinations of 1hr30 and 2hrs respectively.

Target :

Quantum Mechanics	SGM05-MQ
Number of hours : 56.00 h	4.00 ECTS credit
CM : 28.00 h, TD : 28.00 h	
Reference Teacher(s) : EVEN JACKY	

Objectives :
Quantum Mechanics: Introduction to fundamental concepts and methods.

Content :
- Introduction to Quantum Mechanics: Wave-particle Duality, Energy Quantification, Wave Function, Schödinger Equation,
Wave Packets, Uncertainty Principle.
- Formulation of Quantum Mechanics: Picture concept, System of States "kets" and "bras", Operators and results from the
Measurement of an Observable, Eigenvectors and Eigenvalues of an operator, Commutators, Mathematical formulation of
Quantum Mechanics, Complet set of commuting observables, Evolution Operator, Continuity Equation.
- Kinetic momentum: Kinetic momentum characteristics, Commutation relation, General Theory, Orbital Kinetic Momentum,
Spin.

Bibliography :

Requirements :
Mathematics of the first two years at INSA (or equivalent).

Organisation :
Three hours per week.

Evaluation :
Two-hour written examination.

Target :

Conferences	SGM05-CONF
Number of hours : 14.00 h	0.50 ECTS credit
CONF : 14.00 h	
Reference Teacher(s) : DURAND OLIVIER, GLORIANT THIERRY, JANCU JEAN-MARC	

Objectives :
Professionals from a wide range of companies hold conferences on the various career options open to students in the MNT
department. The guest speakers describe their companies' engineering work and market structure. The aim is to help students in
their choice of career.

Content :
Career guidance through conferences.

Bibliography :

Requirements :

Organisation :

Evaluation :
Signed attendance sheets.

Target :

Instrumentation and measurements	SGM05-IM
Number of hours : 62.50 h	4.00 ECTS credit
CM : 19.50 h, TA : 3.00 h, TP : 40.00 h	
Reference Teacher(s) : PARANTHOEN CYRIL	

Objectives :
Bring students the basics of a whole measurement set-up (from the sensor, the measurement and the acquisition software)._Introduction to noises and its origin, and to specific set-up to increase signal to noise ratio.
Initiation to Labview acquisition software (Core I), in order to pass certification, considering Labview Academy partnership.

Content :
Teaching is organized with courses and exercises and related practical works (3 hours), ending with a small project (5 practical work sessions)._Program :_- Overview of the architecture of a calculator._- Overview of computer- instrument communication interfaces : RS232, RS485, GPIB, USB and RJ45._- Sensors and associated electronics_- Functions of a data acquisition card (analogical-numerical and numerical-analogical conversion of signals, sampling)_- Overview of measurement noises and its origin (thermic, Jonhson, Flickers), electronic noise equivalence and association, specific set-up for increasing signal/noise ratio (modulation, lock-in detection) and its applications._- Initiation to Labview acquisition software, in order to get the basics of the certified formation module labelled as Core I.
- Implementation of acquired basics through small projects. These projects aim to acquire several signals, in order to fulfil specifications and extract specific parameters.

Bibliography :
- D. Patterson, J. Hennessy, "" Organisation et conception des ordinateurs : interfaçage matériel/logiciel "", Dunod 1994 - F.
Cottet "" Traitements des signaux et acquisition de données "", Dunod 2002 - G. Ash "" Acquisition de données : du capteur à l'ordinateur".

Requirements :
Basic electronics.

Organisation :
Review of lecture notes. Preparation for the practical work (Summary required for each session: 1h per week).

Evaluation :
2hr written examination(documents allowed).
Evaluation mark on a small project (5 practical work sessions).

Target :

Electronic Circuits	SGM05-EL
Number of hours : 66.00 h	4.50 ECTS credit
CM : 18.00 h, TD : 18.00 h, TP : 30.00 h	
Reference Teacher(s) : BENHLAL JAMAL	

Objectives :
A study of the fundamentals of linear electronic circuits.

Content :
1. Linear amplification: amplification function, operational amplifier (O.A.), characteristics of a real O.A., realisation of
controlled current and voltage sources.
2. Active semiconductor components: Diode, bipolar transistors, field effect transistors. (operational principle, introduction to
the physical quantities, functioning point, equivalent-circuit model, classic circuits).
3. Low frequency differential amplifiers.
4. Feedback and network stability: Study of the effect of a negative feedback loop on the composite gain, input and output
impedance, stability of the gain, bandwidth, noise. Network stability: Barkhausen, Nyquist and Bode criterias.
5. Analog filters. Size and physical quantities of a filter (4 different filters), filter synthesis method, low-pass prototype filter,
approximation functions (Butterworth, Legendre, Tchébyscheff, Cauer and Bessel), finding the order and transfer function of a
filter, practical making of filters.

Bibliography :
- J. BLOT, ""Electronique linéaire"", Dunod Paris 1995.
- J. BLOT, ""Les transistors"", Dunod Paris 1995.
- D.P. LEACH, ""Discrete and Integrated Circuit Electronics"", Sounders College Publishing, New-York 1992.
- G.J. R ITCHIE, ""Transistor Circuit Techniques""

Requirements :
Knowledge of the behaviour of linear electric networks in sinusoid steady-state.

Organisation :
3hrs per week: Revision of lecture notes. Preparation and revision of the exercises.

Evaluation :
Two-hour written examination at the end of the semester.

Target :

Sport and physical activities	SGM05-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : LE LAGADEC PIERRE	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice of two A.P.S. from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O or
Kayak or golf.

Bibliography :
Several specialized books are available to the students at the library. Links to internet sites are posted on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Bibliographic project (written)	SGM05-PSH
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : ECHARD PHILIPPE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Foreign language 1 : English	SGM05-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : WEST ANN	

Objectives :
Improve expression, comprehension and interaction skills within everyday contexts, with special emphasis on professional and social life.
Language Objectives
Obtain or reinforce B2 level (as required for graduation and defined by CECRL)

Content :
-Action-oriented approach - learning by doing: students have to listen and speak, write documents while using their problem-solving, reasoning, arguing, and demonstrating capabilities, in an articulate manner.
-Expressing oneself accurately by a rigorous use of syntax and phonology :
Activities requiring creative and reactive skills, ranging from debating, role-playing, individual oral presentations (PowerPoint), projects ¿ are based on scientific topics and current events.
-Building up specific skills in connection with the working world:
- writing e-mails
- conducting telephone conversations
- technical English
- intercultural contexts

Bibliography :
- Oxford advanced Learners¿ Dictionary
- English Grammar in Use (Cambridge University Press)

Requirements :
Good command of the STPI curriculum is essential : B1/B2

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for students to work in a stimulating environment.
-Teaching resources include press articles, audio and video documents (TV reports, film and series extracts) as well as the Internet.
-Regular personal work is required. Students must be curious and practise their English outside the classroom.

Evaluation :
Two-hour written test.
Oral presentation in class.

Target :

Semestre 6

Parcours Formation Initiale SGM

1	**TCM06**		**Science and technology of engineer S6**	**4.00**
	TCM06-CAPT	C	Introduction to SENSORS	1.00
	TCM06-ENRG	C	Energy	1.00
	TCM06-IMO	O	Introduction to Production and quality Management	1.00
	TCM06-SHES1	O	Science Humaine Economique et Sociale 1	1.00
	TCM06-SHES2	O	Science Humaine Economique et Sociale 2	1.00
2	**SGM06-1**		**Physics 2**	**7.00**
	SGM06-PR	O	Wave propagation 2	2.50
	SGM06-CONF	O	Conferences - company visit week	0.50
	SGM06-TP	O	Physics - Practical work	4.00
3	**SGM06-2**		**Material science**	**8.50**
	SGM06-PS	O	Solid State Physics	3.00
	SGM06-SC	O	Physics of semiconductor devices	3.00
	SGM06-TM	O	Thermodynamic Properties of Materials	2.50
4	**SGM06-3**		**Wave and Materials**	**4.50**
	SGM06-TS	O	Signal processing	2.50
	SGM06-ELFI	O	Finite Elements - Mini projects	2.00
5	**SGM-HUM06**		**Humanities**	**6.00**
	SGM06-EPS	O	Sport and physical Activities S6	1.00
	SGM06-PSH	O	Bibliographic project (Oral)	2.00
	SGM06-ANGL	O	Foreign language 1 : English	2.00
	SGM06-PPI	O	Professional Project	1.00

O = compulsary, C= in choice , F= optional

Introduction to SENSORS	TCM06-CAPT
Number of hours : 35.00 h	1.00 ECTS credit
CM : 21.00 h, TD : 14.00 h	
Reference Teacher(s) : DURAND OLIVIER	

Objectives :
In Europe, the sensors market has been estimated to 10 billions Euros in 2007, corresponding to 28% of the glogal world
market, with an estimated growth more than 6% per year and sustained by the security systems, the automotive, aeronautics
and defence. Nowadays, the sensors market swipes to the electronic instrument mass market. Such a market generates a large
amount of employment in a wide range of industries. The aim of this course is a general overview of the properties and the
applications of sensors, with a global understanding, as general knowledge, of the different phenomena used for the sensors
elaboration.

Content :
General introduction to sensors. Active and passive sensor conditioners. Basics of semiconductor physics. Optical sensors.
Notions on the photovoltaic cells. Temperature sensors. Position and displacement sensors. Magnetic sensors. Mechanical
sensors. Introduction to microsensors.

Bibliography :
Les capteurs en instrumentation industrielle (G. Asch et collaborateurs), Dunod Handbook of Modern Sensors 2nd edition (J. Fraden), AIP Presss, Woodbury, New York Principe généraux des capteurs, cours CNAM (F. Lepoutre)
Cours capteurs (M. Hubin) : http://perso.orange.fr/michel.hubin/capteurs/instrum.htm

Requirements :
No prerequisite.

Organisation :
Homework.

Evaluation :
Written examination on work covered during lectures and tutorials.

Target :

Energy	TCM06-ENRG
Number of hours : 42.00 h	1.00 ECTS credit
TD : 12.00 h	
Reference Teacher(s) : CORNET CHARLES	

Objectives :
Impact of the choice energy sources of the 21st century. Photovoltaic cells and the thermal efficiency of buildings in terms of
cost, efficiency and environmental impact. Inventory of the energy sources currently in use. Thermodynamic tools. Overview
of the different methods of energy production including combustion engines, boilers, nuclear energy, renewable energies, etc.
Presentation of the different means of transport and energy transfer; thermal isolation or conduction, convection, material
transfer, inverted cycle machines, etc.

Content :
24 hours of lectures, 12 hours of tutorials and 6 hours of practical training.
Introduction to energy management and analysis of the current energy situation. The tools of energy engineering: Fick's laws
of diffusion, black body, thermal machines and basic reminders of thermodynamics. Production of energy: nuclear, thermal
combustion, boiler. Renewable energies: wind power, solar, geothermic energy, etc. Delivery of energy: insulation, conduction, convection, electricity and gas transport, etc.
Chapter I: Introduction to energy engineering.
(I) The energy context
1/ Definitions
2/ Overview of the current energy situation
(II) Energy prospects
1/ Supply and demand
2/ Technological orientation
3/ Conclusions
(III) Energy
1/ The different forms of energy
2/ Energy conversion
3/ Stocking and transport of energy.
Chapter II: Engineering tools for Energy
(I) - Transport phenomena
1/ Particle diffusion
2/ Thermal diffusion
3/ Fourier/Ohm/Fick Analogy
4/ Convection
(II) Energy transfer by radiation: black body model
1/ classic description
2/ quantum description - Planck's law
3/ Spectral characteristics of radiation
4/ Interest of the model
(III) Thermodynamics (Reminder)
1/ Thermal machines and cycles
2/ Energetic and entropic outcomes
3/ Diathermy machines
4/ Performance and efficiency.
Chapter III: The production of energy
(I) Nuclear energy
1/ Principle
2/ Fission and nuclear power
3/ Perspectives : toward thermonuclear fusion
(II) Combustion and combustion engines
1/ Combustion and fuels
2/ Ovens and boilers
3/ Combustion engines
(III) Renewable energies : solar, wind power, etc.
1/ Renewable energies

2/ Geothermic and ocean energy
3/ The thermal conversion of solar energy
4/ Photovoltaic solar energy
5/ Wind power
6/ Other energies.
Chapter IV: Transport and transfer of energy
(I) Heat transfer
1/ Heat transfer by thermal conduction: Applications to insulation
2/ Heat transfer by convection: heat exchangers
(II) Material transfers
1/ Pressure or load losses
2/ Turbo machines
(III) Transport of electricity: three-phase current.

Bibliography :
Energétique : concept et applications : Michel Feidt Systèmes énergétiques : (2004) (bibliothèque insa rennes)
Energies renouvelables : (2006) (bibliothèque insa rennes)

Requirements :
Mathematics: differential equations, complex numbers.
Other: Thermodynamics of diffusion and thermodynamic potentials , entropy, efficiency. Fluid mechanism (Bernoulli's
principle), understanding of semiconductors.

Organisation :
Preparation for tutorials, conferences. Internet research.

Evaluation :
2-hour examination based on the lectures and tutorials.

Target :

Introduction to Production and quality Management	TCM06-IMO
Number of hours : 28.00 h	1.00 ECTS credit
CM : 14.00 h, TD : 10.00 h, TP : 4.00 h	
Reference Teacher(s) : SORRE FREDERIC	

Objectives :
Introduction to production management and quality issues: Nowadays, companies must adopt methods associated with tools,
which will allow them to manage production effectively. Overview of the organisation of a factory.

Content :
PART ONE: Production management
(I) Introduction: definition of production management, classification of production systems.
(II) Scheduling in specialised workshops: scheduling on a machine, scheduling with two or three production centres.
(III) Stock management: stock management policies, associated costs, fixed interval order system for stock with a turnover of
zero, re-order point-management.
(IV) Production planning: Planning of the number of components required, basic principles of MRP2, load adjustment, capacity.
(V) "Just-in-time" techniques: origin and principle of JIT, key factors, the Kanban method.
PART TWO: Quality:
(I) Quality of industrial products: the concepts, Quality function, and the international norms for quality control management.
(II) Quality tools: 5S, SMED, TPM, control system and reception control system.
PART THREE: Case study - A presentation by representatives of manufacturers.

Bibliography :
Gestion de la production - Blondel - DUNOD\ n
La gestion de production - Bénassy - HERMES
Contrôle de la qualité - Jaupi - DUNOD
Industrialisation des produits mécanique (Tome 1) - Linarès-Marty - HERMES

Requirements :

Organisation :

Evaluation :
Two-hour written examination. Continuous assessment of Practical work.

Target :

Science Humaine Economique et Sociale 1	TCM06-SHES1
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Science Humaine Economique et Sociale 2	TCM06-SHES2
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Wave propagation 2	SGM06-PR
Number of hours : 24.00 h	2.50 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : DURAND OLIVIER	

Objectives :
Propagation phenomena. An overview of applications in optics, optoelectronics and electromagnetism.

Content :
Digital information transmission. Limits.
Waveguide characteristics: metallic guides, coaxial cables, microstrip lines, optical fibres.
Polarisation effects: natural and induced birefringence. Applications which result in the Pockels, Kerr or Faraday effects;
Liquid crystals.
Propagation of plane waves. Application in a multilayer environment, in a Fabry-Perot cavity. Mechanical vibrations in solids.
Physical phenomena linked to Phonons.

Bibliography :
- G. BRUHAT ""Optique"", Masson, Paris.
- M. BORN and E. WOLF, ""Principles of optics"", Pergamon Oxford.
- B.E.A.SALEH and M.C. TEICH, ""Fundamentals of Photonics"", John Wiley et Sons inc. New-York.
- J.Ph. PEREZ, ""Optique"", Masson.
- J.Ph PEREZ, ""Electromagnétisme", Masson.

Requirements :
Knowledge of Maxwell's equations, of the theorem of linear electric networks and of cissoids.

Organisation :
Revision of lecture notes. Completion of exercises (3 hours per week).

Evaluation :
Two-hour written examination.

Target :

Conferences - company visit week	SGM06-CONF
Number of hours : 14.00 h	0.50 ECTS credit
CONF : 14.00 h	
Reference Teacher(s) : DURAND OLIVIER, GLORIANT THIERRY, JANCU JEAN-MARC	

Objectives :
Professionals from a wide range of companies hold conferences on the various careers open to students in the MNT
department. The speaker describes his companies' engineering work and market structure. Students must organise an activity
week "semaine blanche" dedicated to visiting companies either in France or abroad. Participation is compulsory and a
collective report must be written. The objective is to prepare students for job seeking and familiarise them with company
practices. This module, once validated, gives 1 ECTS credit.

Content :
Attendance at conferences.
Organising and participating in the company visit week "semaine blanche".

Bibliography :

Requirements :

Organisation :

Evaluation :
Validation depends on:
Involvement in the company visit week.
Signed attendance sheets for the conferences.

Target :

Physics - Practical work	SGM06-TP
Number of hours : 48.00 h	4.00 ECTS credit
TP : 48.00 h	
Reference Teacher(s) : GUEZO MAUD	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Solid State Physics	SGM06-PS
Number of hours : 36.00 h	3.00 ECTS credit
CM : 18.00 h, TD : 18.00 h	
Reference Teacher(s) : LOUALICHE SLIMANE	

Objectives :
This module fundamentally deals with crystal lattices and the electronic properties of solids, leading to semiconductor band
structure.

Content :
Symmetries and special lattices: seven crystal systems and fourteen Bravais lattices. Basic lattices: simple cubic, body-centred,
face-centred, diamond and zincblende structure. Reciprocal lattice: base, cubic lattice, body-centred, face-centred, Brillouin
zone, Bloch theorem, from direct to reciprocal lattice, BvK conditions. Electrons in a solid: linear crystal, free electron,
nearly-free electron, Brillouin zone. Bonding in a crystal: covalent bond, hybridisation. Orbital hybridisation: interaction and
crossing of levels. Filling of the levels. First evaluation of band gap. Band calculation with the tight binding approximation:
Secular equation in the diamond system. Band structure, gap and filling in of bands at 0K, Cohesion energy. Overview of real
bands: wave function symmetries, band gaps, valence and conduction bands, description of the zone-centre.

Bibliography :
Polycopiés de cours : S. Loualiche; Polycopiés de TD et TP
H. Mathieu, Physique des semiconducteurs et des composants optiques (Masson)
J. Singh, Optoelectronics , McGraw Hill Book Co
Ashcroft, Mermin, Solid State Physics (sauders company)

Requirements :
In mathematics:
3D differential equations, Space geometry, Calculation of Eigenvalues and eigenvectors.
Basic knowledge of wave functions and projections of an operator on a base.
3D Fourier transform.
In other fields:
Plane waves, overview of atomic orbitals, electrostatics and electromagnetism.

Organisation :
Revision of lecture notes. Preparation of exercises (three hours per week).

Evaluation :
1 written and 1 practical examination.

Target :

Physics of semiconductor devices	SGM06-SC
Number of hours : 30.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 16.00 h	
Reference Teacher(s) : LOUALICHE SLIMANE	

Objectives :
The band structure of a solid is used to develop and to understand its electronic properties. It is also used to in optoelectronic
devices such as diodes or pn junctions.

Content :
Electron dynamics in a solid: Moment and group velocity, Acceleration theorem in reciprocal space, Effective mass and
acceleration in a real space. Density of states in a solid: Fermi statistics, "hole" concept, energy level occupation, impurities
and Fermi level. Concentration of carriers depending on temperature. Transport: Boltzmann's equation, conduction, diffusion,
general equations. Hall effect: metal, insulator, semiconductor. Hall effect with one or two types of carriers. Recombination
and generation processes: SRH laws (Shockley Read Hall). High and low carrier injection cases. Continuity equations in a
solid, equations for diffusion of minority carriers. PN junction: energy bands, built in potential of the junction. Approximation
of the depleted zone. Direct and inverted polarisation of the pn junction. Current voltage characteristics of the pn junction at
equilibrium and under voltage polarisation. I-V characteristics of a thin diode. Electric properties of the pn junction: capacitance and conductance. Schottky diode : Metal work function and electronic affinity. I-V characteristics of a Schottky
diode.

Bibliography :
Preprinted lecture aids: S. Loualiche ; Polycopiés de TD et TP
H. Mathieu, Physique des semiconducteurs et des composants optiques (Masson)
J. Singh, Optoelectronics , McGraw Hill Book Co
Ashcroft, Mermin, Solid State Physics (sauders company)

Requirements :
In mathematics: 3D differential equations, Space geometry.
In other fields: Plane waves, overview of atomic orbitals, electrostatics and electromagnetism.

Organisation :
Revision of lecture notes. Preparation of the exercises (three hours per week).

Evaluation :
1 written and 1 practical examination.

Target :

Thermodynamic Properties of Materials	SGM06-TM
Number of hours : 28.00 h	2.50 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : GLORIANT THIERRY	

Objectives :
Basics of Thermodynamics as preparation for the lectures on materials. Topics: equilibrium in binary systems, material/environment interactions, processing and transforming process, thermodynamic model of metallic, ceramic and
semiconductor systems.

Content :
Thermodynamic systems and functions (Reminder).
Partial and integral molar quantities, activities and thermodynamic activity coefficients.
Binary solutions, binary solution models, quasi-chemical approach of solid solutions.
Thermodynamics and equilibrium diagrams of a binary system. Practical determination of thermodynamic quantities.
Utilisation of thermodynamic databases.
Overview of models for thermodynamics of materials.

Bibliography :
- A. PRINCE, ""Alby phase equilibra"" (1966) Elsevier Publishing Company - R.A. SWALIN, ""Thermodynamics of solids"" (1962) John Wiley and Sons, New-York.
- N.A. Gokcen, ""Thermodynamique"" (Traduction française) CIRP (Saint Denis).

Requirements :
Thermodynamics - Bachelor level (Physics and Chemistry).

Organisation :
Revision of lecture notes. Completion of exercises (two - three hours per week).

Evaluation :
Three-hour written examination at the end of the semester (no documents allowed).

Target :

Signal processing	SGM06-TS
Number of hours : 28.00 h	2.50 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : LE CORRE ALAIN	

Objectives :
The basics of the theory and the processing of an analog signal.

Content :
1. Introduction to signal processing: Overview of analog signals, deterministic signals and random signals, signal classification, finite energy or power signals.
2. Deterministic signals: time domain representation, introduction to distributions, linear time-invariant systems (LTIS),
impulse response, convolution, complex transfer function. Frequency domain representation, Fourier series and Fourier
transform.
3. Response of an LTIS to an impulse: response to a periodic signal (Fourier Series). Response to an unspecified signal,
Fourier Transform (cissoid mode), La Place Transform (isomorphic mode). Application to linear electronic circuits.
4. Energetic and spectral characteristics of a signal: energy and power of a signal, energy or power spectral density. Auto- and
intercorrelation functions, Wiener-Kitchine theorem. Energy and power spectral density in time and frequency (sliding Fourier
transform, wavelets)

Bibliography :

Requirements :
Linear electrical networks in sinusoid steady-state.

Organisation :
Revision of lecture notes. Preparation and revision of exercises (2hrs per week).

Evaluation :
Two-hour written exam at the end of term.

Target :

Finite Elements - Mini projects	SGM06-ELFI
Number of hours : 18.00 h	2.00 ECTS credit
CM : 2.00 h, EP : 8.00 h, TP : 8.00 h	
Reference Teacher(s) : EVEN JACKY, FRANCILLETTE HENRI, JANCU JEAN-MARC	

Objectives :
- To give the necessary support for the understanding of the method and the algorithms taken into account in finite element softwares.
- To assimilate the basic concepts of the F.E.M. for acquiring the mastery of a software.
- To use the method for the resolution of different field problems, in solid mechanics, in heat transfers, in electromagnetism, in électronics of semi-conductors.
- Apply the different formulations to practical problems, with the Comsol software.

Content :
Reminder of the variational formulation of a problem. Matrix formulation in 1D. Interpolation functions of the plane elements - Three-dimensional generalization. Isoparametric elements. Numerical integration aspects. Generalization of the method in order to treat non-linear problems.

Bibliography :
1. ZIENKIEWICK : Finite Element Method. EDISCIENCES.
2. GALLAGHER : Introduction of the Finite Element Computation. PLURALIS.
3. REDDY : An Introduction to finite element method MC GRAW HILL.
4. K. J. BATHE : Finite Element Procedures in Engineering Analysis. PRENTICE AND HALL.
Hall

Requirements :
Algebra, matrix calculuses, numerical analysis, semiconductors, electromagnetism, heat transfer, mechanics.

Organisation :
20 h

Evaluation :
Report of the work and of the mini-project.

Target :

Sport and physical Activities S6	SGM06-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : LE LAGADEC PIERRE	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice of two A.P.S. from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O or
Kayak or golf

Bibliography :
Several specialized books are available to the students at the library. Links to internet sites are given on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Bibliographic project (Oral)	SGM06-PSH
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : ECHARD PHILIPPE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Foreign language 1 : English	SGM06-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : WEST ANN	

Objectives :
Improve expression, comprehension and interaction skills within everyday contexts, with special emphasis on professional and social life.

Language Objectives
Obtain or reinforce B2 level (as required for graduation and defined by CECRL)

Content :
-Action-oriented approach - learning by doing: students have to listen and speak, write documents while using their problem-solving, reasoning, arguing, and demonstrating capabilities, in an articulate manner.
-Expressing oneself accurately by a rigorous use of syntax and phonology :
Activities requiring creative and reactive skills, ranging from debating, role-playing, individual oral presentations (PowerPoint), projects ¿ are based on scientific topics and current events.
-Building up specific skills in connection with the working world:
- writing e-mails
- conducting telephone conversations
- technical English
- intercultural contexts

Bibliography :
- Oxford advanced Learners¿ Dictionary
- English Grammar in Use (Cambridge University Press)

Requirements :
Good command of the STPI curriculum is essential : B1/B2

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for students to work in a stimulating environment.
-Teaching resources include press articles, audio and video documents (TV reports, film and series extracts) as well as the Internet.
-Regular personal work is required. Students must be curious and practise their English outside the classroom.

Evaluation :
Two-hour written test.
15 minute oral exam

Target :

Professional Project	SGM06-PPI
Number of hours : 6.00 h	1.00 ECTS credit
TD : 2.00 h, TD : 2.00 h, TD : 2.00 h	
Reference Teacher(s) :	

Objectives :
Students are encouraged to reflect upon their professional future.

Content :
1. Discovering enterprises: working for an enterprise, the relationship between "technicians" and other teams: marketing,
direction, sales, finance.
2. Analysis of professional ambition with the aid of human resource specialists and company directors.
3. Meetings: each department sets up meetings to illustrate the situations particular to their sector.
Detailed programme:
1. First stage: In groups of twelve, working alongside consultants and company directors on "how to establish and develop a
professional project".
2. Second stage: Discovery of the different professions, meeting professionals. The student is to set up meetings with two
professionals with the objective of understanding the relationship between the engineering department and the other
departments of the enterprise: marketing, sales, finance, human resources, etc.
3. Third stage: debriefing (with the human resources consultants). The objective is to have the student to refine his professional
project with respect to the enterprise. Students must prepare a document in advance of the interview containing the following;
How did you relate to your interviewee? How did you obtain a meeting? Did you come across difficulties? How did you
prepare for your interview? What were your main objectives? What can you say about the course of your interview? Have you
achieved your objectives(Give details)? And finally, what will you do differently in future interviews? The opportunity now
presents itself to speak with the students about the idea of networking: how to use first contacts in an enterprise to obtain
achieve further goals?
In the framework of their third year Professional Project, students will attend a conference on job opportunities in their chosen
domain. Examples: High quality car production and the requirements of this sector (GMA). Images and networks (ESC-EII-Info). The creation of enterprises in information technology (EII-ESC-Info). Purchasing: the opportunities for the
engineer (GMA). The different professions open to civil engineering students (GCU). Microelectronics and nanotechnology:
job opportunities (MNT).

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Semestre 7

Parcours Formation Initiale SGM

1	**SGM07-1**		**Electronic Devices Technology 1**	**8.50**
	SGM07-DISP	O	Semiconductor devices	4.00
	SGM07-OPTO	O	Optoelectronics 1	3.00
	SGM07-TPPED	O	Electronic and opto.properties of Solid - based devices	1.50
2	**SGM07-2**		**Materials Science 1**	**6.50**
	SGM07-CRIS	O	Crystallography 1	2.00
	SGM07-MGST	O	Structural Metallurgy	2.00
	SGM07-MEMA	O	Mechanics of materials	1.00
	SGM07-TPMA	O	Materials 1 - Practical Work	1.50
3	**SGM07-3**		**Electronic & Measurement 1**	**5.00**
	SGM07-CILO	O	Logical systems	1.50
	SGM07-AUTO	O	Automated Systems	3.00
	SGM07-CONF	O	Conferences	0.50
4	**SGM07-4**		**Science and Technology**	**5.00**
	SGM07-MCN	O	Methods for Numerical Analysis	3.50
	SGM07-MICO	O	Continous media	1.50
5	**SGM-HUM07**		**Humanities**	**5.00**
	SGM07-ANGL	O	ENGLISH - 4th year SGM-1st semester	2.00
	SGM07-ECOG	O	ECONOMICS AND BUSINESS MANAGEMENT - 1	2.00
	SGM07-EPS	O	Sport and physical Education	1.00
7	**SGM07-6**		**SOUTIEN**	**0.00**
	SGM07-CILOs	F	remedial lessons in Logical Systems	0.00

O = compulsary, C= in choice , F= optional

Semiconductor devices	SGM07-DISP
Number of hours : 31.00 h	4.00 ECTS credit
CM : 18.00 h, TD : 13.00 h	
Reference Teacher(s) : FOLLIOT HERVE	

Objectives :
Basics of the operational principle of electronic devices.

Content :
Lesson 1: Semiconductor physics (Reminder), transport phenomena in semiconductors, PN junction and junction diodes.
Lesson 2: the bipolar transistor (NPN, PNP, Ebers-Moll equations, high and low level properties, high frequency characteristics).
Lesson 3: the metal-semiconductor diode (Schottky diode).
Lesson 4: Metal-Insulator-Semiconductor structures.
Lesson 5: Field effect devices (JFET, MOSFET, HEMT, MESFET, memory, charge transfer devices)
Lesson 6: Introduction to nanoscience and nanoelectronics (nanoMOS, SOI technology, single-electron device SED, Carbon
Nanotube Transistor CNTFET).

Bibliography :
- H. Mathieu, Physique des semiconducteurs et des composants électroniques. Masson 1997.
- S.M.Sze, Physics of semiconductor Devices. 2nd Ed. A. Willey. Intersci. Publ. 1981.
- Donald A. Neamen, Semiconductor Physics And Devices, 3rd Ed, Mcgraw Hill 2003.

Requirements :
Basics of semiconductor and junction physics.

Organisation :
One to two hours per lesson hour.

Evaluation :
Two written examinations of one hour and two hours respectively.

Target :

Optoelectronics 1	SGM07-OPTO
Number of hours : 27.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 13.00 h	
Reference Teacher(s) : LE CORRE ALAIN	

Objectives :
Further basics of physics of solids with focus on polarisation and interaction with radiation. Description of operational
principles, properties and optoelectronic structures using these properties.

Content :
- General properties of dielectrics: polarisation, dielectric constant, polarisability, local electrical field, Clausius Mossoti
relation, Lyddane-Sachs-Teller relation.
- Solids optical properties: Classic approach. Optical constants, Kramers- Kronig relations, classical theory of dispersion in an
isotropic solid in a linear response situation for dielectrics, conductors and ionic crystals. Application to metals and semiconductors.
- Matter-radiation interaction: consequences of the quantification. Black body radiation: Plank's law. Einstein's emission and
absorption constants, detailed balance.
- Application of stimulated emission: laser effect.

Bibliography :
- Physique du Solides et Propriétés électroniques, M. BROUSSEAU, Masson 1992,
- Physique des semi-conducteurs et des composants électroniques, H. MATHIEU, Masson 1987.
- Initiation à la Physique du Solides, Exercices commentés, J. CAZAUX, Masson 1989.
- Optoelectronics, E Rosencher, B. Vinter, P. G. Priva, Masson 1998, Cambridge University Press, 2002

Requirements :
Basics of Quantum Mechanics.

Organisation :
3 hours per week minimum.

Evaluation :
two-hour written examination.

Target :

Electronic and opto.properties of Solid - based devices	SGM07-TPPED
Number of hours : 32.00 h	1.50 ECTS credit
TP : 32.00 h	
Reference Teacher(s) : BERTRU NICOLAS, PARANTHOEN CYRIL	

Objectives :
Familiarisation with research laboratory conditions over several long-duration practical sessions: set up experiments on a given
subject, gather the necessary data, process and utilise the results and write a report.

Content :
Themes:
- Electronic Paramagnetic Resonance, Ferromagnetic Resonance.
- Ferroelectric behaviour.
- Heterojunctions.
- Optical absorption of Quantum Wells.

Bibliography :
- Practical work lecture notes (1er semester).
- H. MATHIEU, Physique des semiconducteurs et des composants électroniques, Masson (2007).
- S.M. SZE, Physics of Semiconductor Devices, Wiley-Interscience (2006).
- M. BROUSSEAU, Physique du Solide : propriétés électroniques, Dunod (1997).
- C. KITTEL, J. DION, M. GICQUEL, B. VILQUIN, Physique de l'état solide : cours et problèmes, Dunod (2007).

Requirements :
Solid-state physics.
Basic physics of semiconductors and junctions.
Quantum Mechanics.

Organisation :
Preparation before each session: 1 to 2 hours.

Evaluation :
Final mark is based on:
- Work achieved.
- Enthusiasm and initiative.
- Quality of the report.

Target :

Crystallography 1	SGM07-CRIS
Number of hours : 25.00 h	2.00 ECTS credit
CM : 13.00 h, TD : 12.00 h	
Reference Teacher(s) : CASTANY PHILIPPE	

Objectives :
The basics of geometric crystallography. The classical methods of radiocrystallography.

Content :
Geometric crystallography (Reminder): Miller indices, Bravais lattices, reciprocal lattice, symmetry elements, point groups,
space groups, use of the International Tables of Crystallography.
Stereographic projection: definition, representation of directions and planes, Wulff net (angle measurements, rotations),
standard stereographic projection, orientation of a crystal.
Crystal X-ray diffraction: Laue's equations and Bragg's law, Ewald construction.
X-ray diffraction techniques: study of a polycrystalline aggregate (Debye-Scherrer method) and a monocrystal (Laue method,
rotating crystal method).

Bibliography :
- L.V. AZAROF, Elements of X-Ray Crystallography, McGraw-Hill Book Company, New-York, London (1968)
- O. JOHARI and J.THOMAS, The Stereographic Projection and its Applications Techniques of Metals Research , Vol. IIa,
Interscience Publishers (1969)
- J. PROTAS, Diffraction des Rayonnements : Introduction aux concepts et méthodes, Dunod, Paris (1999) - ISBN 2.10.004144.4
- J.J. ROUSSEAU, Cristallographie géométrique et Radiocristallographie, Dunod, Paris (2000) - ISBN 2.10.004902.X
- http://www.univlemans.fr/enseignements/physique/02/cristallo/cristal.html
- http://cst-www.nrl.navy.mil/lattice/spcgrp/index.html

Requirements :
General knowledge of the structure of matter (bachelor level).
General knowledge of diffraction phenomena.

Organisation :
Approximately 2 hours per week.

Evaluation :
Two-hour written examination.

Target :

Structural Metallurgy	SGM07-MGST
Number of hours : 15.00 h	2.00 ECTS credit
CM : 8.00 h, TD : 7.00 h	
Reference Teacher(s) : CORNEN MARILYNE	

Objectives :
Basics of physics and chemistry of materials. Structural metallurgy.

Content :
Microstructure of Materials
Example Copper alloys and lost wax casting
Phase diagrams solutions, compounds and mixtures; simple phase diagrams; tie lines and invariant points ; eutectic, peritectic and eutectoid reactions.
Solidification of pure materials and solutions: driving force for solidification; homogeneous and heterogeneous nucleation, cells and dendrites, eutectic and peritectic microstructures;
Ingot solidification, segregation, partition coefficient; Scheil equation , purification, constitutional supercooling.
Solid state phase transformations: homogeneous and heterogeneous nucleation; eutectoid decomposition
General points about ternary phases diagrams
Analysis methods and properties characterization: thermal analysis, thermal expansion, electrical resistivity, Mechanical tests.

Bibliography :
- Précis de Métallurgie J. Barralis, G. Maeder, , Nathan, Paris (1997)
- Traité des matériaux - Tome 1 - Introduction à la science des matériaux - W. Kurz, J.P. Mercier, G. Zambelli, Presses
Polytechniques Romandes, (1999)
- Propriétés et comportement des matériaux, du microscopique au macroscopique - A. Cornet, F Hlawka, Ellipses (2003).
- Métallographie et techniques d'analyses - PYC Livres (1998).
- Des Matériaux - J.M. Dorlot, J.P. Bailon, J. Masounave, Editions de l'Ecole Polytechnique de Montréal (1986) (2000)

Requirements :
General knowledge of phase diagrams.

Organisation :
Two hours per week for 7 weeks.

Evaluation :
One-hour written examination.

Target :

Mechanics of materials	SGM07-MEMA
Number of hours : 14.00 h	1.00 ECTS credit
CM : 7.00 h, TD : 7.00 h	
Reference Teacher(s) : FRANCILLETTE HENRI	

Objectives :
Structural characterization is employed in order to fundamentally understand the mechanical behavior of metals.

Content :
- Experimental tests for the mechanical characterization.
- Structural defects.
- Mechanisms of deformation.
- Elasticity, plastiicity (movement of dislocations).
- Relatioships between structural characterization and properties.

Bibliography :
-J. PHILIBERT, A. VIGNES, Y. BRECHET, P. COMBRADE, Metallurgie
"Du minerai au métal", Masso, Paris (1997) ISBN 2.225.82978.01
-J. BARRALIS, G. MAEDER, Précis de Métallurgie, Nathan, Paris (1997) ISBN 2.12.260121.6.

Requirements :
Structural metallurgy

Organisation :
2h per week

Evaluation :
1h exam

Target :

Materials 1 - Practical Work	SGM07-TPMA
Number of hours : 32.00 h	1.50 ECTS credit
TP : 32.00 h	
Reference Teacher(s) : THIBON ISABELLE	

Objectives :
Basics of the physics and chemistry of materials. Structural metallurgy.

Content :
Metallography.
Thermal analysis.
Hardening.
Phase diagrams and micrographs.

Bibliography :
- A. DE SY, J. VIDTS, Traité de métallurgie structurale théorique et appliquée, Dunod, Paris (1968).
- L. HABRAKEN, J.L. DE BROUWER, De Ferri Metallographia I, Fundamentals of Metallography, Presses Académiques
Européennes, Bruxelles (1968)
- A. SCHRADER, A. ROSE, De Ferri Metallographia II, Structures of Steels, Verlag Stahleisen m.b.H., Düsseldorf (1966)
- R.F. MEHL, Atlas of Microstructures of Industrial Alloys, Metals Handbook, vol.7, A.S.M. (1972)
- J. PHILIBERT, A. VIGNES, Y. BRECHET, P. COMBRADE, Métallurgie du minerai au matériau, Masson, Paris (1997)
ISBN 2.225.82978.0
- A. TAYLOR, X-Ray Metallography, J. Wiley and Sons Inc., New-York, London (1961)

Requirements :
General knowledge of phase diagrams (bachelor level).
General knowledge of thermodynamics applied to materials science.

Organisation :
Two hours per week.

Evaluation :
One report per practical session.

Target :

Logical systems	SGM07-CILO
Number of hours : 15.00 h	1.50 ECTS credit
CM : 4.00 h, TD : 11.00 h	
Reference Teacher(s) : RONSIN JOSEPH	

Objectives :
The necessary methods and tools to manage logical systems.

Content :
-Numeral systems: representation of a signed or an unsigned number, change of base or conversion, code representation (DCB
codes, continuous codes).
-Basic logic functions: variables and logic functions (inclusive OR, AND, NOR, NAND, exclusive OR, Identity).
-Representation of logic functions: truth tables, Karnaugh tables, logic equations, decimal equivalents, complete and
incomplete logic functions.
- Simplification of logic functions: Boole's algebra, Karnaugh tables.
- Integrated logic circuits technology: logic signals (conventions, defects, definition threshold), bipolar transistor and MOS
transistor, integration and technologies, study of a logic gate (overview, totem pole output, open collector output, three-state
output), characteristics of integrated logic circuits.
- Combinatory circuits: this chapter presents an overview of the main combinatory circuits including a general description for
each circuit.

Bibliography :
- Cours polycopiés, Recueil d'exercices, Manuel de travaux pratiques, TTL Data Book de Texas instruments.
- C. BRIE : "logique combinatoire et séquentielle" Collection Technosup- Ellipses
- D. MANGE : "Analyse et synthèse des systèmes logiques" (Traité d'électricité, vol. V), Presses Polytechniques Universitaires
Romandes, Lausanne, 1992.
- J. LETOCHA : "Introduction aux circuits logiques", Ed. McGraw-Hill, 1985.
- R. J. TOCCI : "Circuits numériques - Théorie et applications", Ed. Dunod, 1992.

Requirements :

Organisation :
13 hours approximately.

Evaluation :
One-hour written examination (documents allowed).

Target :

Automated Systems	SGM07-AUTO
Number of hours : 39.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 13.00 h, TP : 12.00 h	
Reference Teacher(s) : GUEGAN SYLVAIN	

Objectives :
Classic methods of the study of control loop feedback mechanisms: model of a physical process, step and frequency response,
open loop and closed loop performance analysis, synthesis of correctors.

Content :
Simple models and graph-based methods for system identification: first order, time delay.
First order, second order.
Feedback systems, structure and representation: closed-loop concept, relevance and diagram, transfer plot in a closed and open
loop, Black-Nichols chart.
Stability and precision of feedback systems: Routh-Huswitz and Nyquist criteria, stability margin, static and dynamic
precision, performance indices.
Regulator synthesis: proportional-integral-derivative (PID) controls, influence on the response and tuning methods. Command
with an internal model, Smith predictor. Introduction to non-linear command, all-or-nothing system.

Bibliography :
- RIVOIRE M., FERRIER J.-L., 1992, « Cours d#automatique - tome 2 : asservissement, régulation et commande analogique», Eyrolles.
- RIVOIRE M., FERRIER J.-L., GROLEAU J., 1992, « Exercices d'automatique - tome 2 : asservissement, régulation et
commande analogique », Eyrolles.
- DE LARMINAT P., 1993, « Automatique », Ed. Hermès.
- MARET L., 1987, « Régulation automatique », Ed. Presses Polytechniques Romandes.
- BORNE P. 1993, « Analyse et régulation des processus industriels », Tome 1 : Régulation continue, Ed. Technip.

Requirements :
Third year Electronics.
Mathematics: Linear differential equations, Laplace transform.

Organisation :
30 hours

Evaluation :
Two-hour written examination. Mark for practical work.

Target :

Conferences	SGM07-CONF
Number of hours : 15.00 h	0.50 ECTS credit
CONF : 15.00 h	
Reference Teacher(s) : JANCU JEAN-MARC	

Objectives :
Professionals from a wide range of companies hold conferences on the various career options open to students in the MNT
department. The guest speakers describe their companies' engineering work and market structure. The aim is to help students in
their choice of career.

Content :
Career guidance through conferences.

Bibliography :

Requirements :

Organisation :

Evaluation :
Signed attendance sheets.

Target :

Methods for Numerical Analysis	SGM07-MCN
Number of hours : 54.00 h	3.50 ECTS credit
CM : 26.00 h, TD : 10.00 h, TP : 18.00 h	
Reference Teacher(s) : EL HAJJ RAYMOND	

Objectives :
A presentation of the basic methods of numerical analysis.

Content :
Solving of equations and nonlinear systems.
Complements to matrix analysis.
Linear systems. Direct methods: Gauss, Cholesky.
Linear systems. Iterative methods and infinite descent methods: conjugate gradient method.
Eigenvalues calculation.
Interpolation. Splines.
Approximation with the least squares method. Smoothing.
Numerical integration methods.
Differential equations.
Introduction to solving partial differential equations: finite difference method.

Bibliography :
- BARANGER : ""Analyse Numérique"", Hermann. - DEMAILLY : ""Analyse Numérique et Equations Différentielles"", PUG.
- SAIAC : ""L'Informatique appliquée au Calcul Scientifique"", Dunod.
- SAINSAULIEU : ""Calcul Scientifique"", Masson.
- SCHATZMAN : ""Analyse Numérique"

Requirements :
Algebra (bachelor level).

Organisation :
Revision of lecture notes (one hour per week).

Evaluation :
Three-hour written examination.

Target :

Continous media	SGM07-MICO
Number of hours : 14.00 h	1.50 ECTS credit
CM : 7.00 h, TD : 7.00 h	
Reference Teacher(s) : FRANCILLETTE HENRI	

Objectives :
Basics of cohesion. Introduction continuous media, application to the physical, mechanical and thermal properties of a
network. Piezoelectric materials..

Content :
Force constants and mechanical properties of solids.
Vibration modes in crystals in high symmetric directions, density of states of phonons. Anisotropic and piezoelectric materials.
Specific heat of the network and thermal expansion.

Bibliography :
- C. Kittel, Physique de l'état solide, Dunode Université 1983.
- W.A. Harrison, Electronic Structure and the properties of solids. W.H. Free man and Co 1980.
- M. Brousseau, Physique du Solide, Masson, Paris (1992).
- N.W. Aschcroft, N.D. Merwin, Solid

Requirements :
Basics and statistics of Quantum Mechanics.

Organisation :
One hour per week over a period of seven weeks.

Evaluation :
One-hour written examination.

Target :

ENGLISH - 4th year SGM-1st semester	SGM07-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : LE TINNIER ANNE	

Objectives :
Acquiring the required skills for working in a firm as an engineer. Reaching the required level (B2) is compulsory in order to graduate.

Content :
-Learning by doing:
The student will have to be able to talk and listen, write documents while showing he/she can solve problems, reason, convince and demonstrate in an articulate manner.
-Expressing oneself accurately and fluently.
The student will engage in activities requiring creative and reactive skills (such as debates, role-plays, individual oral presentations using PowerPoint, projects), which will be based on scientific topics and current events.
-Writing CVs and cover letters
-Scientific English
-Discovering the professional world in an international context
-Preparing for the TOEIC (during the second semester, a specific ¿Toeic Booster¿ course will be available)

Bibliography :
- Robert and Collins Dictionary (bilingual edition), Collins Cobuild (English only)
- English Grammar in Use (Cambridge University Press)

Requirements :
1st, 2nd and 3rd year English courses (or equivalent)

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia language lab and computer rooms are also available and make it possible for the students to work in a stimulating environment. Our teaching resources include press articles, audio and video documents (TV reports, extracts from films and series). We also use the Internet.
Regular personal work is obviously required. The student must be curious and practise English outside the classroom as well.

Evaluation :
One two-hour written exam.

Target :

ECONOMICS AND BUSINESS MANAGEMENT - 1	SGM07-ECOG
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course focuses on the complexity of the decision-making process in a company.
Main learning outcomes:
-Understanding information relative to marketing and finance
-The ability to use specific tools and vocabulary in the field of management
-Understanding the importance of teamwork: making collective decisions and producing the expected work in time

Content :
The course is mainly focused around a Business simulation game called Simbrand, which empowers participants to run their own virtual businesses. Just like in real life, the teams compete against each other in order to gain market shares. The right decisions lead to success while the wrong ones engender invaluable problem solving experiences. The learning process becomes efficient and fun, and allows ¿learning by doing¿ as well as ¿learning from mistakes¿.
As an outcome of the simulation exercise, participants will fully comprehend the different aspects of the marketing decision making process, their relationship with each other, and their impact on the company¿s overall results. In addition, participants will gain invaluable experience in teamwork and problem solving.
The simulation is based on an online platform that allows students to play in their own language (many languages available: English, Spanish, Portuguese, Chinese ¿).

Bibliography :
Provided during the course

Requirements :
None.

Organisation :
2 hours per week

Evaluation :
Each team produces a written report in French and makes an oral presentation in English

Target :

Sport and physical Education	SGM07-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : LE LAGADEC PIERRE	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.
Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O or Kayak or golf.

Bibliography :
Several specialized books are available to the students at the library. Links to internet sites are given on the EPS website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

remedial lessons in Logical Systems	SGM07-CILOs
Number of hours : 6.00 h	0.00 ECTS credit
TD : 6.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Semestre 8

Parcours Formation Initiale SGM

1	**SGM08-1**		**Electronic Devices Technology 2**	**5.50**
	SGM08-TCSI	O	Silicon Devices Technology	1.00
	SGM08-TPSB1	C	CCMO Clean room experimental work	1.00
	SGM08-TPSB2	C	TOP35 Clean room experimental work	1.00
	SGM08-OPTO	O	Optoelectronics 2	2.00
	SGM08-TPPED	O	Electronic and Opto. Properties of Solid-Based Devices	1.50
2	**SGM08-2**		**Materials Science 2**	**6.00**
	SGM08-CRIS	O	Crystallography 2	2.00
	SGM08-MGST	O	Structural Metallurgy	1.00
	SGM08-DIFF	O	Diffusion in Solids	1.50
	SGM08-TPMA	O	Materials 2 (Practical Work)	1.50
3	**SGM08-3**		**Electronic & Measurement 2**	**5.50**
	SGM08-ELEC	O	Electronic Devieces and Components	3.50
	SGM08-PLAN	O	Design of experiments methodology	1.00
	SGM08-ENER	O	Energetics	0.50
	SGM08-CONF	O	Conferences	0.50
4	**SGM08-4**		**STAGE S8**	**8.00**
	SGM08-ST04	O	4th year Work Placement	8.00
5	**SGM-HUM08**		**Humanities**	**5.00**
	SGM08-ANGL	O	ENGLISH - 4th year SGM-2nd semester	2.00
	SGM08-ECOG	O	ECONOMICS AND BUSINESS MANAGEMENT - 2	2.00
	SGM08-EPS	O	Sport and physical Education	1.00

O = compulsary, C= in choice , F= optional

Silicon Devices Technology	SGM08-TCSI
Number of hours : 20.00 h	1.00 ECTS credit
CM : 20.00 h	
Reference Teacher(s) : PERRIN MATHIEU	

Objectives :
Basics of Silicon microelectronics. Description of the basic manufacturing processes and the different process technologies.
Study of the quality and reliability aspects of microelectronics. Applications.

Content :
- Description of the different stages of manufacturing from conception to delivery. Integrated quality control.
- Conception flow, foundry operations, assembly and video test flow.
- Bipolar process technology. Assembly of a bipolar process technology with junction insulation, basic elements (npn
transistors, pnp, Schottky, resistors, diodes), advanced bipolar technologies.
- CMOS process technology. Assembling of a CMOS process technology, basic elements (inverters, nand, nor), advanced
CMOS technologies and BiCMOS.
- Quality and reliability of the technologies.
- The manufacturing processes of the customer-provider interface. reliability of the devices, case study.
- Silicon products. Present and future fields of application.
- Predictable evolution of the technology and performance.

Bibliography :
- Solid State Technology (Penwell Publication)
- Semiconductor Technology (Semiconductor Technology)
- Silicon Processing for the VLSI Era Vol. 1 et 2 par Stanley Wolf (Lattice Press)
- CMOS Technology par James A Cunningham (Technology Associates)

Requirements :
Course on Semiconductor devices.
Course on Solid-state physics.
Course on Logics.
Course on Crystallography and Metallurgy.

Organisation :
8 hours approximately.

Evaluation :
Two-hour written examination (documents allowed) at the end of the semester.

Target :

CCMO Clean room experimental work	SGM08-TPSB1
Number of hours : 24.00 h	1.00 ECTS credit
TP : 24.00 h	
Reference Teacher(s) : LEVALLOIS CHRISTOPHE	

Objectives :
This practical course is devoted to the fabrication of MOS transistors based on a 4 mask levels process. This course is given in
the IETR clean-room at the University of Rennes1. The main objective is to introduce students to the different technology
steps required for the fabrication of MOS transistors. At the end of the formation the devices fabricated are also characterized
by electrical tests under probes.

Content :
The process starts with an oxidized silicon substrate and the students process themselves all the operations which are required
(photolithography, chemical etching, thermal oxidation, doping by thermal diffusion, metallization) for the transistor MOS
fabrication. At the end of the fabrication, electrical tests are performed on basic devices (diodes, resistances, MOS capacity,
MOS transitor)

Bibliography :
- S.M. SZE, VLSI Technology, Mc Graw Hill (1998)
- C.Y. CHANG and S.M. SZE, ULSI Technology, Mc Graw Hill (1996)
- P.N. FAVENNEC, Technologie pour les composants à semiconducteurs, Dunod (1997)

Requirements :
- course on semiconductors devices.
- course on the technological process of silicon devices

Organisation :
This course required around 2 hours of personal work

Evaluation :
A group of students (mostly 4) has to realize a single manuscript for the evaluation.

Target :

TOP35 Clean room experimental work	SGM08-TPSB2
Number of hours : 20.00 h	1.00 ECTS credit
TP : 20.00 h	
Reference Teacher(s) : PARANTHOEN CYRIL	

Objectives :
TOP35 (III-V semiconductors Optoelectronic based processing) objective is to propose a complete formation dedicated to
optoelectronic devices, through the realization of a photonic device : a laser diode for telecommnunication applications. The
formation spans all the fundamentals necessary for the realization of a device, from the device growth and design, the
clean-room processing, ending with the electro-optical characterizations.

Content :
The 20 hours long practical work (on 2.5 days) deals with :
- device growth and design with molecular beam epitaxy (MBE)(2h + individual work) : basics of MBE, RHEED oscillations
flux calibrations, X-ray diffraction and photoluminescence analysis.
- single transverse mode edge emitting laser processing in clean-room (16 h) : optical photolithography (2 levels), insulating
material deposition with PECVD, dry etching (RIE), electrical contacts deposition with RF sputtering, back-end technologies
(mechanical thinning, cleaving) and controls (optical microscope, profilometer, electrical tests on probe station)
- Electro-optical characterizations of lasers diodes (2 h) : spectral, I(V) and P(I) measurements, efficiencies measurements.

Bibliography :
lecture notes :
- semiconductors and semcondcutors laser diodes basics
- semiconductors laser diodes processing

Requirements :
Basics in quantum mechanics, optoelectronics, device processing.

Organisation :
2 to 3 h per student.

Evaluation :
A group of students (mostly 4) has to realize a single manuscript for the evaluation.

Target :

Optoelectronics 2	SGM08-OPTO
Number of hours : 27.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 13.00 h	
Reference Teacher(s) : LE CORRE ALAIN	

Objectives :
Final part of solid-state physics with focus on the optical properties of semiconductors. Description of the operating principles
of semiconductor optoelectronic devices (photodetectors, lasers and optical amplifiers).

Content :
- Optical properties of semiconductors: quantum mechanics approach, radiation/semiconductor interaction, optical absorption
in a semiconductor, selection rules for optical transitions, absorption coefficient calculation, (direct or indirect gap), density of
state, calculation of the bimolecular coefficient, calculation of the spontaneous emission spectrum.
- Semiconductor radiation detection devices: Various types of detectors, physical quantities. Noise sources, detection limits.
- Photodetection using photoconductors: photoexcitation in a homogeneous semiconductor, photo-carrier distribution, response
of a photoconductor.
- Photodetection using photodiodes: general overview of photodiodes. Photocurrent calculations, PIN photodiode.
- Other semiconductor detection devices: avalanche photodiode, Schottky photodiode, phototransistor. Image detectors or
imagers: CCD matrices, infrared imager. Semiconductor radiation emitting devices.
- Population inversion in an out-of-equilibrium semiconductor: pseudo-Fermi levels, net emission rate, recombination of
excess carriers, radiative and non-radiative lifetime. Semiconductor Light-Emitting Diodes (LED): operational principle, yield,
recombination mechanisms. Typical structures of LEDs.
- Semiconductor lasers. Radiation amplification in a semiconductor. Threshold current. Spectral distribution of the radiation,
modulation, electrical and optical conconfinement, advantages of double heterostructures.
- Evolution of semiconductor laser structures: response time, cut-off frequency, energy distribution of the radiation, spectral
width.

Bibliography :
- Physique du Solides et Propriétés électroniques, M. BROUSSEAU, Masson 1992.
- Physique des semi-conducteurs et des composants électroniques, H. MATHIEU, Masson 1987.
- Initiation à la Physique du Solide, Exercices commentés, J. CAZAUX, Masson 1989.
- Optoelectronics, E. Rosencher, B. Vinter,P. G. Priva, Masson 1998, Cambridge University Press, 2002

Requirements :
Basic knowledge of Solid-state Physics, Quantum Mechanics. (3rd year of the MNT course) and Physics of electronic devices.

Organisation :
3 hours per week minimum.

Evaluation :
Two-hour written examination.

Target :

Electronic and Opto. Properties of Solid-Based Devices	SGM08-TPPED
Number of hours : 32.00 h	1.50 ECTS credit
TP : 32.00 h	
Reference Teacher(s) : BERTRU NICOLAS	

Objectives :
Familiarisation with research laboratory conditions over several long-duration practical sessions. Setting up experiments on a
given subject, gathering the necessary data, processing and utilising the results, writing a report.

Content :
Topics:
- MIS structure.
- Optical cavity and distributed Bragg reflectors.
- Er doped fibre optical amplifier, lasers (Er doped fiber lasers, semiconductor lasers).
- NMOS device simulation.

Bibliography :
- Practical work lecture notes (2nd semester)
- E.H. NICOLLIAN and J.R. BREWS, MOS Physics and Technology, Wiley-Interscience (2002)
- H. MATHIEU, Physique des semiconducteurs et des composants électroniques, Masson (2007)
- S.M. SZE, Physics of Semiconductor Devices, Wiley-Interscience (2006)
- E. ROSENCHER et J. VINTER, Optoélectronique : cours et exercices corrigés, Dunod (2002)
- S. M. SZE, Very Large Scale Integration Technology, Mc Graw Hill (1998)

Requirements :
Modules on Electronic and optoelectronic devices and the technology of components.

Organisation :
This module requires approximately 1-2 hours of personal work for each session

Evaluation :
Final mark is based on:
- Work achieved.
- The student's personal interest and initiative.
- Quality of the reports.

Target :

Crystallography 2	SGM08-CRIS
Number of hours : 19.00 h	2.00 ECTS credit
CM : 10.00 h, TD : 9.00 h	
Reference Teacher(s) : CORNEN MARILYNE	

Objectives :
Basics of x-ray techniques in crystallography. Application to the characterisation of materials.

Content :
X-ray diffraction: structure factor, diffraction intensity.
X-ray diffraction techniques applied to metallurgy: precise calculation of cell parameters; study of crystal structures; influence
of grain size, of crystal perfection and of plastic deformation (work hardening).
Generation and detection of X-rays.
Absorption and X-fluorescence phenomena, consequences and applications.
X-ray filtering and monochromatisation.

Bibliography :
- L.V. AZAROF, Elements of X-Ray Crystallography, McGraw-Hill Book Company, New-York, London (1968)
- H.P. KLUG, L.E. ALEXANDER, X-Ray Diffraction Procedures, J. Wiley and Sons Inc., New-York, London (1967,1974),
ISBN 0.471.49369.4
- A. TAYLOR, X-Ray Metallography, J. Wiley and Sons Inc., New-York, London (1961)
- A. GUINIER, Théorie et Technique de la Radiocristallographie, Dunod, Paris (1964)
- J.P. EBERHART, Analyse structurale et chimique des matériaux, Dunod, Paris (1997), ISBN 2.10.003367.0
- J. PROTAS, Diffraction des Rayonnements : Introduction aux concepts et méthodes, Dunod, Paris (1999), ISBN 2.10.004144.4
- http://escher.epfl.ch/eCrystallography/
- http://www.univ-lemans.fr/enseignements/physique/02/cristallo/cristal.html
- http://lcr.epfl.ch/page37304.html

Requirements :
Crystallography module of the first semester.

Organisation :
10 hours.

Evaluation :
One-hour written examination.

Target :

Structural Metallurgy	SGM08-MGST
Number of hours : 12.00 h	1.00 ECTS credit
CM : 6.00 h, TD : 6.00 h	
Reference Teacher(s) :	

Objectives :
Basics and applications of thermal treatment.
Applications : steels

Content :
Thermal and thermochemical treatment: quenching, tempering, annealing, surface treatments.
Isothermal transformation diagrams (also known as time-temperature-transformation or TTT diagrams) and continuous cooling
Transformation (CCT): applications.
Steel thermal treatments, hardenability.

Stainless steels.

Bibliography :
Précis de Métallurgie J. BARRALIS, G. MAEDER, , Nathan, Paris (1997) Métallurgie Mécanique A. CORNET, F. HLAWKA, Ellipses (2006)

Requirements :
Phase diagrams.

Organisation :
6 hours.

Evaluation :
One-hour written examination.

Target :

Diffusion in Solids	SGM08-DIFF
Number of hours : 23.00 h	1.50 ECTS credit
CM : 12.00 h, TD : 11.00 h	
Reference Teacher(s) : THIBON ISABELLE	

Objectives :
Study of diffusion phenomena in crystallised solids. Mathematical equations for diffusion phenomena in crystallised solids.
Identification of the different diffusion coefficients. Solutions to materials science problems involving diffusion (metallurgy,
semiconductors).

Content :
Fick's law - Diffusion equation - Solving simple problems - Boltzmann-Matano method
Diffusion mechanisms - Arrhenius' law
Diffusion in poly-phase systems - Example: metal oxidation.
Interdiffusion and the Kirkendall effect.
Diffusion short-circuits - Grain boundary diffusion.

Bibliography :
J. PHILIBERT, Diffusion et transport de matière dans les solides, Ed. de Physique (1985)
M. GLICKSMAN, Diffusion in solids, John Wiley et Sons ed., (2000)
J. CRANK, The Mathematics of diffusion, Oxford University Press, (1980)

Requirements :
Basic knowledge of phase diagrams and of thermodynamics.

Organisation :
12 hours.

Evaluation :
Two-hour written examination.

Target :

Materials 2 (Practical Work)	SGM08-TPMA
Number of hours : 32.00 h	1.50 ECTS credit
TP : 32.00 h	
Reference Teacher(s) : THIBON ISABELLE	

Objectives :
Study of physics and chemistry of materials. Structural metallurgy.

Content :
Steel hardenability: Jominy test.
Gas-solid diffusion: zirconium oxidation. Crystallography: Laue and Debye-Scherrer methods.
Crystallography: Structure and calculation of diffraction intensity.

Bibliography :
- A. DE SY, J. VIDTS, Traité de métallurgie structurale théorique et appliquée, Dunod, Paris (1968).
- L. HABRAKEN, J.L. DE BROUWER, De Ferri Metallographia I, Fundamentals of Metallography, Presses Académiques Européennes, Bruxelles (1968)
- A. SCHRADER, A. ROSE, De Ferri Metallographia II, Structures of Steels, Verlag Stahleisen m.b.H., D uuml;sseldorf (1966)
- R.F. MEHL, Atlas of Microstructures of Industrial Alloys, Metals Handbook, vol.7, A.S.M. (1972)
- J. PHILIBERT, A. VIGNES, Y. BRECHET, P. COMBRADE, Métallurgie du minerai au matériau, Masson, Paris (1997) ISBN 2.225.82978.0
- A. TAYLOR, X-Ray Metallography, J. Wiley and Sons Inc., New-York, London (1961),

Requirements :
Materials and Metallurgy module (lectures and exercises) Basics in heat treatment of alloys, diffusion in solids and crystallography.

Organisation :
16 hours.

Evaluation :
One report for each practical session.

Target :

Electronic Devieces and Components	SGM08-ELEC
Number of hours : 58.00 h	3.50 ECTS credit
CM : 16.00 h, TD : 18.00 h, TP : 24.00 h	
Reference Teacher(s) : BOYER SOLINE	

Objectives :
Basic knowledge of the functioning of electronic devices. Practical Work: study of the basic operating principles of various
electronic devices using simulation and measurement. Study of oscillators and classic systems for signal modulation.

Content :
Lesson 1: negative feedback, feedback amplifiers.
Lesson 2: sine wave oscillators (study of the oscillation conditions, high and low frequency circuits, study of nonlinear
amplitude stability. Modelling of nonlinearities. Frequency and amplitude stability. Quartz oscillator).
Lesson 3: flip flops, voltage-frequency and voltage time converters: comparators, Schmitt trigger, monostables and astables.
Complex circuits of voltage-frequency converters, function generators (voltage controlled oscillators).
Lesson 4: analog modulation / demodulation: sampling, spectrum translation, amplitude and frequency modulation (spectrum,
modulation and demodulation circuits). Application: synchronous detection, spectrum analyser
Lesson 5: power amplifiers (class A, B, C or D operating circuits diagrams. Yield calculations).
TP1: transistor oscillator: Characteristics of a bipolar transistor, differential amplifier, sine wave oscillator.
TP2: Switching circuits; non sine wave oscillators: Oscillator setup with a NE555 circuit, fabricate a transistor voltage
controlled oscillator.
TP3: Voltage modulation and demodulation: modulation principle, study of various demodulation setups.
TP4: Frequency modulation and demodulation: principle, study of the signal spectrums, Armstrong modulator, phase angle and
differentiation demodulation.
TP5: Phase Locked Loop (PLL): principle and application to frequency demodulation.

Bibliography :
1. Electronique tome 1 et 2. J.D. CHATELAIN et R. DESSOULAVY, Dunod France.
2. Microélectronic circuits. A.D. SEDRA and K.C. SMITH, Saunders Collège Publishing.
3. Commutation circuits : analysis and design. K.K. CLARKE and
D.T. HESS, Addison Wesley. Publishing Company NY.

Requirements :
"Electronic circuits" module.

Organisation :
Two hours per week.

Evaluation :
Three-hour written exam and a mark for practical work .
Mark for Practical Work: one third - continuous appraisal(reports done in pairs); two thirds - based on a two-hour individual examination in the laboratory.

Target :

Design of experiments methodology	SGM08-PLAN
Number of hours : 12.00 h	1.00 ECTS credit
TD : 12.00 h	
Reference Teacher(s) : LEGUESDRON Abdelly	

Objectives :
The aim of the course is to make students aware of industrial system experimentation problems. The chosen approach is the designing of experiments. We introduce a methodology which permits both conception and analysis of such designs. A design of the experiments proposed, for a particular system, a sequence of trials to study the obtained outputs. This method is based on the use of two complementary tools : an algebriac tool to study factors and their interactions and a statistic tool to take into account the natural variability. The course is illustrated with examples and case studies which mainly come from the industry.

Content :
Contents:
- Introduction to design of experiments;
- Design of experiments modeling : algebraic and statistic tool presentation;
- Making use of the design of experiments : from conception to the result analysis;
- Case studies.

Bibliography :
- Stephen R. Schmidt, Robert G. Launsby. Understanding Industrial Designed Experiments. Air Academy Press, 1992.
- J.-J Droesbeke, J. Fine, G. Saporta. Plans d'expériences : Applications à l'entreprise. Editions Technip, 1997.

Requirements :
Mathematical backgrounds of undergraduate studies and statistic inference.

Organisation :

Evaluation :
A 1-hour test is scheduled at the end of the semester.

Target :

Energetics	SGM08-ENER
Number of hours : 6.00 h	0.50 ECTS credit
CM : 6.00 h	
Reference Teacher(s) :	

Objectives :
Introduction to the heat exchanges and fluid flows with concrete examples borrowed from the domain of the HVAC (Heating, Ventilation and Air Conditioning) : thermal carrying by hot and cold fluid flows, heat transfers through liquids and gases. This initiation is illustrated with some practical examples.

Content :
3 conferences for 6 hours among the following subjects :
- Inititation to the heat exchangers (brief reminder of the laws of heats transfers, description of heat exchangers, quick sizing)

- Fluid flows in HVAC (pressure losses, hydraulic pumps, parallel - serial meshing, balancing)

- Advanced fluid flows solving ("Z" coefficients method, non linear Kirchhoff laws, solving examples) Excel Small utilities will be available on the Moodle Internet site.

Bibliography :
ASHRAE FUNDAMENTALS HANDBOOK ; Thermodynamics, Heat Transfer and Fluid Flow, US Department of Energy (June 1992)
TECHNIQUES DE L'INGENIEUR ; Génie Energétique ; BE6 ; Echangeurs de chaleur - dimensionnement thermique (1994)
TECHNIQUES DE L'INGENIEUR ; Génie Energétique ; BE5 ; Echangeurs de chaleur - description des échangeurs (1995)
Equilibrage thermo-hydraulique des installations de chauffage ; Pierre Fridmann ; Les Editions Parisiennes (1989)
HYDRAULIQUE PRATIQUE ; Christian Roux ; PYC Edition ; 2ème tirage ; 1991

Requirements :
Third year energetic conferences, first Thermodynamics principle and Fluid mechanics (equation of Bernouilli).

Organisation :

Evaluation :
1 hour terminal event with multiple choices form.

Target :
4th year students of GCU and SGM departments

Conferences	SGM08-CONF
Number of hours : 15.00 h	0.50 ECTS credit
CONF : 15.00 h	
Reference Teacher(s) : JANCU JEAN-MARC	

Objectives :
Professionals from a wide range of companies hold conferences on the various career options open to students in the MNT
department. The guest speakers describe their companies' engineering work and market structure. The aim is to help students in
their choice of career. The validation of the module gives 1 ECTS credit.

Content :
Career guidance through conferences.

Bibliography :

Requirements :

Organisation :

Evaluation :
Validation system:
Signed attendance sheets.

Target :

4th year Work Placement	SGM08-ST04
Number of hours : 240.00 h	8.00 ECTS credit
ST : 240.00 h	
Reference Teacher(s) : JANCU JEAN-MARC	

Objectives :
This fourth year placement constitutes a minimum of eight weeks in a company or in a research laboratory. It must take place
between the end of the fourth year and the beginning of the fifth year and must enable the student to put into practice the
knowledge acquired on the course. Finding the placement and the placement itself will prepare the student for job seeking.
Each proposal must be approved by the person in charge of work placements and the Director of the department. The former
validates the placement (8 ECTS credits).

Content :
Finding a suitable placement is up to the student's own initiative: establishing contacts, job interviews, ect.
Length of the placement: 8 weeks minimum.
Period: from the beginning of June onwards.

Bibliography :

Requirements :
Level corresponding to three semesters of training on the course.

Organisation :
Full-time work in the host establishment.

Evaluation :
Supervisor's assessment - handed in with the report on final project.
Report on the fourth year placement written either in English or in French.
Poster
Oral presentation before a jury composed of 2 teachers from the MNT department.
Final evaluation will be given in terms of a mark scaled from 0 to 20.

Target :

ENGLISH - 4th year SGM-2nd semester	SGM08-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : LE TINNIER ANNE	

Objectives :
Acquiring the required skills for working in a firm as an engineer. Reaching the required level (B2) is compulsory in order to graduate.

Content :
-Learning by doing:
The student will have to be able to talk and listen, write documents while showing he/she can solve problems, reason, convince and demonstrate in an articulate manner.
-Expressing oneself accurately and fluently.
The student will engage in activities requiring creative and reactive skills (such as debates, role-plays, individual oral presentations using PowerPoint, projects), which will be based on scientific topics and current events.
-Writing CVs and cover letters
-Scientific English
-Discovering the professional world in an international context
-Oral presentation of a
-Preparing for the TOEIC (during the second semester, a specific ¿Toeic Booster¿ course will be available)

Bibliography :
-Robert and Collins Dictionary (bilingual edition), Collins Cobuild (English only)
-English Grammar in Use (Cambridge University Press)

Requirements :
1st, 2nd and 3rd year English courses (or equivalent).

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia language lab and computer rooms are also available and make it possible for the students to work in a stimulating environment. Our teaching resources include press articles, audio and video documents (TV reports, extracts from films and series). We also use the Internet.
Regular personal work is obviously required. The student must be curious and practise English outside the classroom as well.

Evaluation :
One 15-minute individual oral test

Target :

ECONOMICS AND BUSINESS MANAGEMENT - 2	SGM08-ECOG
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course focuses on economic, legal and social matters. Students are encouraged to develop their curiosity and their ability to analyse topics related to the general environment of a company.
Main learning outcomes:
-Understanding key concepts related to a firm¿s environment and strategies
-The accumulation of high-quality information on these topics
-Establishing a strong, specific- vocabulary base
-Understanding how different stakeholders act

Content :
- Economics: How markets operate. Growth, financing and regulation of the economy
-Law: Corporate law. Industrial and intellectual property rights
-Management: Project management. Corporate social responsibility

Bibliography :
Provided during the course

Requirements :
None.

Organisation :
2 hours per week

Evaluation :
Continuous assessment (collective work) + final examination (2 hours)

Target :

Sport and physical Education	SGM08-EPS
Number of hours : 26.00 h	1.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : LE LAGADEC PIERRE	

Objectives :
Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :
Whole class: "role of the coach, role of the referee, management" (knowledge of the rules, getting involved, leading, decision
making and communicating). Practice and knowledge of the sociomotive roles involved in the strategies of team attack and
team defence. Finding one's place in a group and awareness of your team-mates and their responsibilities.
Organisation: two 15-hour and one 30-hour sports or physical activity programme in groups.

Bibliography :
Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education website.

Requirements :

Organisation :

Evaluation :
Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Semestre 9

Parcours Formation Initiale SGM

1	**SGM09-1**		**Emerging technologies**	**6.50**
	SGM09-TC1	O	Elaboration and characterisation of nanostructures and Devices	2.00
	SGM09-TC2	O	Renewable Energy	1.50
	SGM09-TC3	O	Case Studies	1.50
	SGM09-TC4	O	Carbon Nanotubes and Large - Facility Experiments	1.50
2	**SGM09-2**		**Materials Science 4**	**7.00**
	SGM09-TC5	O	Microstructures of Materials	2.50
	SGM09-TC6	O	Mechanical Properties of Materials	1.00
	SGM09-TC7	O	Ceramics	1.00
	SGM09-TC8	O	Biomaterials, biochips and microsystems	1.50
	SGM09-TC9	O	Materials Selection - Mechanics and applications	1.00
3	**SGM09-3**		**Optional Group : Materials Science**	**11.00**
	SGM09-opMA1	C	Advanced Materials Science	2.00
	SGM09-opMA2	C	Polymers	1.50
	SGM09-opMA3	C	Welding Metallurgy and Non Destructive Testing	2.50
	SGM09-opMA4	C	Durability and corrosion	1.50
	SGM09-opMA5	C	Etude de cas Industriels - Parcours Matériaux	1.50
	SGM09-opMA6	C	Materials (Practical Work)	2.00
	SGM09-opMO1	C	Nonlinear Optics	1.50
	SGM09-opMO2	C	Electrical Properties of Nanostructures	1.50
	SGM09-opMO3	C	Optical Properties of Nanostructures	1.50
	SGM09-opMO4	C	Etude de cas Industriels - Parcours Micro-Opto	1.50
	SGM09-opMO5	C	Signal processing and Transmission	1.50
	SGM09-opMO6	C	Applications of lasers and photonics	1.50
	SGM09-opMO7	C	Circuit Design (VHDL, VLSI)	2.00
4	**SGM-HUM09**		**HUMANITES**	**5.50**
	HUMT1-ANGL/CONV	C	English S9 Conversation	1.50
	HUMT1-ANGL/TOEIC	C	TOEIC 5th year	1.50
	HUMT1-PGE-A	C	Economics, Law and Business Studies A (serious game)	2.00
	HUMT1-PGE-B	C	Economics, Law and Business Studies B (Lean six sigma)	2.00
	HUMT1-PGE-C	C	Economics, Law and Business Studies C (human resource management)	2.00
	HUMT1-PGE-D	C	Economics, Law and Business Studies D (Marketing for ICT Companies)	2.00
	HUMT1-PGE-E	C	Economics, Law and Business Studies E (Industrial design and innovation)	2.00
	HUMT1-PGE-F	C	Economics, Law and Business Studies F (Mangement and decision making)	2.00
	SGM09-SPEC	O	Conferences and 4 th year Work Placement / Presentation	2.00

O = compulsary, C= in choice , F= optional

Elaboration and characterisation of nanostructures and Devices	SGM09-TC1
Number of hours : 28.00 h	2.00 ECTS credit
CM : 28.00 h	
Reference Teacher(s) : DURAND OLIVIER, LE CORRE ALAIN	

Objectives :
Epitaxial growth and characterisation of semiconductor heterostructures and electronic and optoelectronic devices.

Content :
Semiconductor epitaxy and applications.
Different growth technics (LPE, CVD, MOCVD, MBE, CBE...).
In-situ and ex-situ characterisation methods:
- RHEED, Refectance Anisotropy Spectroscopy.
- Optical, electrical and structural characterizations.
- Physico-chemical analysis (photoelectrons spectroscopy, Auger spectroscopy, Electron micro probe,SIMS....).
- Scanning probe method (Scanning tunnelling microscopy, STM, AFM...)
Growth of lattice matched and mismatched III-V heterostructures (elastic and plastic strain relaxation processes).
Growth of III-V nanostructures (multi-quantum well and superlattices, quantum wires and quantum dots).
Applications : Elaboration of device structures (Lasers, transistors, modulators and photodetectors).

Bibliography :
- M.A. Herman, H. SITTER, Molecular Beam Epitaxy; Springer-Verlag Berlin Heidelberg 1989.
- G.B. Stringfellow, Organoetallic Vapor Phase Epitaxy : Theory and Practice; Academic Press 1989.
- E. H. C. Parker "The Technology and Physics of Molecular Beam Epitaxy; Plenum Press New York 1985
- Jeffrey Y. Tsao "Materials fundamentals of molecular beam epitaxy"; Academic Press 1992.
- W.K. Liu et M.B. Santos "Thin Films: Heteroepitaxial Systems"; Series on Direction in Condensed Matter Physics
- Vol.15, World Scientific Publishing 1999
- John C. Vickerman, "Surface Analysis: The principle techniques"; ed ed. John Wiley et sons, Chichester, New York, 1997.

Requirements :
Properties of semiconductors (3rd and 4th year of the MNT course).

Organisation :
One hour for every hour of lecture time.

Evaluation :
Two-hour written examination.

Target :

Renewable Energy	SGM09-TC2
Number of hours : 12.00 h	1.50 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : DURAND OLIVIER	

Objectives :
Taught in the 5th year of studies, this twelve-hour SGM module presents the different renewable energy sources of the 21st century in terms of cost, yield and also impact on the environment. The module begins with an overview of their utilisation, a look at worldwide energy consumption and the economic, environmental and cultural constraints which influence the industrial world. Later, the technical, scientific, economic and environmental aspects of renewable energies (wind-driven, solar, geothermal, biomass, etc.) are presented. Emphasis is put on photovoltaic solar panels which are an expanding field and which are likely to be of interest to future engineers. The presentations may be completed by lectures given by engineers or managers working in the field of renewable energies.

Content :
Presentation of the current energy situation and the role of renewable energies in this context.
Presentation of each renewable energy: wind power, solar energy, geothermal energy, biomass, hydropower, etc.
The different aspects of photovoltaic solar power: crystalline silicon, polycrystalline silicon, amorphous silicon, tandem cells, Grätzel cells, multi-function cells, cells using other materials.

Bibliography :
Energétique : concept et applications : Michel Feidt Systèmes énergétiques : (2004) (bibliothèque insa rennes) Energies renouvelables : (2006) (bibliothèque insa rennes) Renewables energies 2007 rapport de l'IEA (International Energy Agency sur les énergies renouvelables dans le monde)

Requirements :
No specific mathematics tools. The same prerequisites as for the semiconductors modules.
Required knowledge: advanced level in Thermodynamics, yield. Fluid mechanics (Bernouilli equations), semiconductor physics. P-n junction. Quantum Mechanics.

Organisation :
Research on the Internet. Articles from Science publications .

Evaluation :
One-hour written examination.

Target :

Case Studies	SGM09-TC3
Number of hours : 18.00 h	1.50 ECTS credit
CM : 18.00 h	
Reference Teacher(s) : CORNEN MARILYNE	

Objectives :
Introduction

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Carbon Nanotubes and Large - Facility Experiments	SGM09-TC4
Number of hours : 12.00 h	1.50 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : GUEZO MAUD, LETOUBLON ANTOINE	

Objectives :
Properties of carbon nanotubes(structural electronic and optical). Basic methods for the study of nanostructured materials using
X-ray and neutron scattering.

Content :
(A). CARBON NANOTUBES (M. Gicquel):
I. Introduction to the C element (diamond, graphite, nanotubes (NT), fullerene)
II. History of carbon NT (CNT), since 1991(date of discovery).
III. Fabrication techniques for CNT.
IV. Structural properties of CNT.
V. Optical properties of CNT : linear and non linear(absorption, PL, PLE) (pump probe measurements).
VI. Recent and future applications : nanoelectronics, NEMS, fibres, biomedical...
VII. Other NT : BN, SIC, Si.
(B). LARGE FACILITY (A. Létoublon).
0. Introduction and concept of "large facility".
I. Basics of ray scattering history and type sources of neutron and synchrotron.
II. X-ray and neutron methods.
- Small angles.
- Wide angles.
- Microdiffraction.
- Anomalous scattering.
- Imaging topography..
- notion of coherent scattering
- brief view on inelastic scattering

Bibliography :
A Carbon nanotubes
- "Carbon nanotubes and related structures", Peter J.F. Harris.
- "Physical properties of carbon nanotubes", Dresselhaus, Dresselhaus, Saito.
- "Etude des propriétés optiques des nanotubes de carbone", J.-S. Lauret, thèse de doctorat de l'Université Paris VI, Décembre 2003.
- "Physique de l'état solide", Charles Kittel, 8e édition :nouveau chapitre sur les nanostructures (1D et 0D).-
or in English : "Solid state physics", C. Kittel, Wiley 8th edition.
B Larges instruments
- www.esrf.eu
- www.ill.eu
- mot clef/key words in bibliographic database and library
X-rays diffraction/scattering
wide/small angle scattering/diffraction (SAXS/WAXS)
grazing incidence (GISAXS/GIXD)
anomalous diffraction/scattering ((X)MAD/MAS)
coherent scattering/diffraction
X-ray topography / phase contrast
synchrotron
neutron scattering

Requirements :
Properties of semiconductors (3rd and 4th years of MNT).
Structural analysis.
Scattering/diffraction and reciprocal space.

Organisation :
One hour for every hour of lecture time.

Evaluation :
One-hour written examination.

Target :

Microstructures of Materials	SGM09-TC5
Number of hours : 26.00 h	2.50 ECTS credit
CM : 24.00 h, TP : 2.00 h	
Reference Teacher(s) : GLORIANT THIERRY, THIBON ISABELLE	

Objectives :
Introduction to thermodynamics and phase transformation in polycrystalline solids.

Content :
General aspects of thermodynamics and phase transformation. Germination and growth mechanisms. Surfaces and interfaces in
crystalline solids. Interphases and grain boundaries: notion of coherence.
Texture and anisotropy in polycrystalline materials. Recovery and recrystallisation.

Bibliography :
J.W. MARTIN, R.D. DOHERTY, Stability of microstructure in metallic systems, Cambridge University Press, London,1976 , ISBN 0.521.20875.0.
D.A. PORTER, K.E.EASTERLING, Phase transformations in metals and alloys, Taylor et Francis Group, 2004, ISBN
0.7487.5741.4.
V.RANDLE, O.ENGLER, Introduction to texture analysis : macrotexture, microtexture and orientation mapping, Gordon and Breach ed., 2000.
F.J.HUMPHREYS, M.HATHERLY, Recrystallization and Related Annealing Phenomena, Pergamon ed., 2004.

Requirements :
Fundamental knowledge of Structural Metallurgy and Crystallography.

Organisation :
Sixty to ninety minutes per week.

Evaluation :
Two-hour written examination.

Target :

Mechanical Properties of Materials	SGM09-TC6
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : FRANCILLETTE HENRI	

Objectives :
Study of the mechanical properties of materials in relation to their microstructure.

Content :
Physical mechanisms of material plasticity.
Tensors, elasticity, plasticity.
Microscopic plasticity, dislocations.
Macroscopic plasticity.

Bibliography :
- J. PHILIBERT, A. VIGNES, Y. BRECHET, COMBRADE, "" Métallurgie du minerai au matériau "", Masson, 1998
- D. FRANCOIS, A. PINEAU, A. ZAOUI, "" Comportement mécanique des matériaux "", Tome1, Hermes, 1991

Requirements :
Materials Science. General Mechanics.

Organisation :
12 hours.

Evaluation :
One-hour written examination.

Target :

Ceramics	SGM09-TC7
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : FRANCILLETTE HENRI, GLORIANT THIERRY	

Objectives :
Essential knowledge of ceramic materials: processing methods and physical properties.

Content :
Definition. General overview. Classification of ceramics. Traditional and technical ceramics.
Examples of simple and complex ceramics.
Ceramic processing: sintering. Definition of the different stages of sintering.
Processing procedures by deposition (CVD, PVD).
Physical mechanisms of the mechanical behaviour of ceramics: ductility, frailty, stress intensity factor, creep mechanisms.
Electric, magnetic and thermal properties.

Bibliography :
W.D. KINGERY, H.K. BOWEN, DR UHLMANN, Introduction to Ceramics, John Wiley et Sons, New-York (1976), ISBN
0.471.47860.1
J.L. CHERMANT, Caractérisation des poudres et des céramiques, Hermès, Paris (1992), ISBN 2.86601.307.7
L.L. HENCH, R.W. GOULD, Characterization of Ceramics, M. Dekker Inc, New-York (1971), ISBN 0.8247.1302.8

Requirements :
Basic knowledge in Crystallography. Materials Thermodynamics. Structural Metallurgy.

Organisation :
One hour per week.

Evaluation :
One-hour written examination.

Target :

Biomaterials, biochips and microsystems	SGM09-TC8
Number of hours : 18.00 h	1.50 ECTS credit
CM : 18.00 h	
Reference Teacher(s) : GORDIN DOINA-MARGARETA, PIRON ROZENN	

Objectives :
Use of biology and chemistry orientated applications to set up a multi-disciplinary technology for the development of
microsystems. Presentation of the different biomaterials. Presentation of various biomaterials for medical applications.

Content :
General introduction to biochips: DNA chips, protein chips, chip laboratory, cell chips.
Introduction to microfluidics (overview of hydrodynamics, microsystem mixes, surface effects).
Overview of methods for handling and/or separating chemical or biological substances (electrophoresis, dielectrophoresis,
magnetophoresis, optical tweezers).
Short presentation of microfabrication techniques enabling biomicrosystem manufacturing (etching, PDMS technology, soft
lithography, surface functionalisation).
Introduction to biomaterials.
Main categories of biomaterials (natural biomaterials, synthetic biomaterials).
Interaction between biomaterials and a physiological environment.
Biomaterials in medicine.

Bibliography :
Introduction à la microfluidique - Collection Echelles. Par Tabeling, P. Editions Belin (2003).

Requirements :
Basics of physics, materials science, biology and anatomy.

Organisation :
Two - three hours per week.

Evaluation :
One-hour written examination.

Target :

Materials Selection - Mechanics and applications	SGM09-TC9
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : FRANCILLETTE HENRI	

Objectives :
Determination of the best materials for a specific use.
Study of the stress and deformation fields in solids for differe,nt boundary conditions. Applications.

Content :
Criteria for materials selection.
Selection.
Use of a software for choosing materials.
Lagrangian et eulerian descriptions, stresses and deformations in solids.
Fundamental equations and resolution.
Applications.
Study of tubes under internal pressure.
Study of spherical solids under pressure.

Bibliography :
- M. F. ASHBY - D. R.H. JONES, " Matériaux ", Tome 1 : "Propriétés et applications" DUNOD -1998, ISBN 2 10 004160 6.
- M. F. ASHBY - D. R.H. JONES, " Matériaux ", Tome 2 : "Microstructure et mise en oeuvre" DUNOD -1998, ISBN 2 10003652 1.
- D. BELET, "Cours de Mécanique générale", Ed CEPADUES

Requirements :
Basics of Physics, Structural Metallurgy, General Mechanics.

Organisation :
Sixty to ninety minutes per week.

Evaluation :
One-hour written examination.

Target :

Advanced Materials Science	SGM09-opMA1
Number of hours : 20.00 h	2.00 ECTS credit
EP : 20.00 h	
Reference Teacher(s) : GLORIANT THIERRY, GORDIN DOINA-MARGARETA, THIBON ISABELLE	

Objectives :
Familiarisation with bibliographic research, especially using specialised journals and dedicated databases; synthesise and
present the collected information; provide an insight into recent innovations in various fields of materials science.

Content :
A case study on materials and their applications, which should highlight the innovative and prospective aspects of the material.
Students are encouraged to choose from the following materials: composites, nanocomposites, biomaterials, ceramics, special
alloys, metal glasses.

Bibliography :

Requirements :

Organisation :
2 hours per week.

Evaluation :
Oral presentation before the group.
Group discussion.

Target :

Polymers	SGM09-opMA2
Number of hours : 12.00 h	1.50 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : FRANCILLETTE HENRI, GUILLOU OLIVIER	

Objectives :
General knowledge of polymers. Relationships between chemical composition and physical properties. Study of the
relationship between formation and composition of polymers. Study of the mechanical behaviour of polymers.

Content :
Overview of Polymers.
Basics of polymer chemistry (synthesis, additives).
Structure and physical properties of polymers.
Monographs of various polymers (properties and applications).
Formation of polymers.
Rheology models.
Non-ageing linear viscoelasticity.

Bibliography :

Requirements :
Basic knowledge of general chemistry and organic chemistry. General metallurgy, continuum mechanics.

Organisation :
Sixty to ninety minutes per week.

Evaluation :
One-hour written examination.

Target :

Welding Metallurgy and Non Destructive Testing	SGM09-opMA3
Number of hours : 20.00 h	2.50 ECTS credit
CM : 20.00 h	
Reference Teacher(s) : CORNEN MARILYNE	

Objectives :
Study of the properties and applications of metal alloys.

Content :
Welding

Non-destructive tests. Penetrant testing. Magnetoscopy. Ultrasound.
Foucault's currents. Radiography.
Acoustic emission.

Bibliography :
- A. LAMBERT, J. RIVENEZ, G. WACHE, "Les contrôles non destructifs, généralités", Les cahiers du CETIM 1994.
- J. PERDIJON, "Le contrôle non destructif par ultrasons", Hermès 1993.

- Matériaux Métalliques , Dunod 2000. - J. ROUX, 'Résistance des matériaux par la pratique"" Tome1, Eyrolles 1995
- Techniques de l'ingénieur

Requirements :
Materials Science.

Organisation :

Evaluation :
One-hour written examination.

Target :

Durability and corrosion	SGM09-opMA4
Number of hours : 12.00 h	1.50 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : GUILLOU ANNIE	

Objectives :
Basics of wet and hot corrosion.

Content :
- Corrosion phenomena and morphology.
- Electrochemistry (Reminder): electrode potential and batteries, Pourbaix diagrams.
- Laboratory study methods: intensity-potential graphs, polarisation resistance, measuring of complex impedance.
- Corrosion situations: galvanic corrosion, differential airing corrosion, pitting corrosion, stress corrosion.
- Protection against corrosion: choice of materials, coatings, cathodic or anodic protection.
- Hot gas corrosion.

Bibliography :
- J. PHILIBERT A. VIGNES Y. BRECHET P. COMBRADE " Métallurgie du minerai au matériau " Ed Masson.
- D. LANDOLT " Corrosion et chimie de surfaces des métaux ", Ed. Presses .Polytechniques et Universitaires Romandes.
- J.J. LAMOUREUX "Précis de corrosion " Ed. Masson.
- J.C. SCULLY " Corrosion Protection : principes fondamentaux " Ed. Masson.
- C. VARGEL " Corrosion de l'aluminium ", Ed. Dunod.

Requirements :
Electrochemistry (as studied during the first two years at INSA).

Organisation :
Sixty to ninety minutes per week.

Evaluation :
One-hour written examination.

Target :

Etude de cas Industriels - Parcours Matériaux	SGM09-opMA5
Number of hours : 18.00 h	1.50 ECTS credit
CM : 18.00 h	
Reference Teacher(s) : CORNEN MARILYNE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Materials (Practical Work)	SGM09-opMA6
Number of hours : 16.00 h	2.00 ECTS credit
TP : 16.00 h	
Reference Teacher(s) : FRANCILLETTE HENRI, GLORIANT THIERRY, THIBON ISABELLE	

Objectives :
Further learning of experimental techniques for studying materials.

Content :
Mechanical properties and choice of materials.
Study of crystalline textures.
Corrosion - non-destructive tests.
Presentation of radioprotection and safety (various types of ionising radiation, physical quantities and units of measurement of
radioactivity, ray-matter interaction, biological effects, etc.) followed by a synthesis and characterisation of a ceramic.

Bibliography :
- M. F. ASHBY - David R.H. Jones, " Matériaux ", Tome 2 : "Microstructure et mise en oeuvre" Dunod (1998)
- L.V. AZAROF, Elements of X-Ray Crystallography, McGraw-Hill Book Company, New-York, London (1968)
- A.J. SCHWARTZ, M. KUMAR, B.L. ADAMS, Electron Backscatter Diffraction in Materials Sciences, Kluwer Academic/Plenium Publishers, New-York, London (2000), ISBN 0-306-46487-X
- V. RANDLE, O. ENGLER, Introduction to Texture Analysis, Macrotexture and Microtexture, Gordon and Breach Ed. (2000), ISBN 9056992244.
- D. LANDOLT " Corrosion et chimie de surfaces des métaux ", Ed. Presses Polytechniques et Universitaires Romandes.
- J.J. LAMOUREUX " Précis de corrosion " Ed. Masson
- J.C. SCULLY " Corrosion Protection : principes fondamentaux " Ed. Masson
- J. PERDIJON, "Le contrôle non destructif par ultrasons", Hermès 1993.
- J.L. CHERMANT, Caractérisation des poudres et des céramiques, Hermès, Paris (1992), ISBN 2.86601.307.7
- L.L. HENCH, R.W. GOULD, Characterization of Ceramics, M. Dekker Inc, New-York (1971), ISBN 0.8247.1302.8
- J.L. POUCHOU, L'analyse EBSD : principes et applications; EDP Sciences (2004), ISBN 2.86883.730.1

Requirements :
Very good knowledge of materials science and of structural metallurgy.

Organisation :
Two to three hours per practical session.

Evaluation :
A report for each practical session.

Target :

Nonlinear Optics	SGM09-opMO1
Number of hours : 12.00 h	1.50 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : PIRON ROZENN	

Objectives :
Study of nonlinear optics and this discipline's major developments and applications. Knowledge on nonlinear optics is relevant
in order to understand optical telecommunications and optical information processing.

Content :
-Introduction to nonlinear optics: Physical origin of nonlinear optics. Requirements on materials. Local electric field impact.
Nonlinear wave equation (light propagation in nonlinear medium). Presentation of nonlinear optical effects.
- Second-order nonlinear optics: Second-harmonic generation. Electro-optic effect. Three-wave mixing. Optical parametric
amplification and oscillation.
- Third-order nonlinear optics: Third-harmonic generation. Optical phase conjugation. Optical bistability. Kerr effect.
Self-focusing, self-phase modulation. Solitons.
- Organic materials for nonlinear optics applications.
- Nonlinear optics for biological applications: Multiphotonic microscopy. Visualisation of electrical potential in biological
environment.

Bibliography :
1. Optique non-linéaire : F. Sanchez - Éditions Ellipse, Grenoble 1999
2. Nonlinear Optics: R.W. Boyd - Academic Press 1992
3. Fundamentals of Photonics: B.E.A. Saleh, M.C. Teich - Wiley Interscience 1991
4. Nonlinear Optics: N. Bloembergen- WA Benjamin, New-York 1965
5. Optical Waves in Crystals, A. Yariv, P. Yeh, John Wiley & Sons 1983
6. Quantum electronics, A. Yariv, John Wiley & Sons 1975

Requirements :
Electromagnetic optics. Anisotropic media. Optics in general.

Organisation :
Two - three hours per week.

Evaluation :
One-hour written examination.

Target :

Electrical Properties of Nanostructures	SGM09-opMO2
Number of hours : 12.00 h	1.50 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : JANCU JEAN-MARC	

Objectives :
- Integrated optics: Techniques and procedures.
- New professions in this field: fibres, integrated optics, telecom, optoelectronic devices, medical.
- Recent subjects of research and development in this field such as photonic crystals.
- Various medical applications.

Content :
Guided Optics: Introduction, optical fibres, planar guides, coupled guides, devices based on coupled guides (Bragg mirrors,
optical couplers and modulators, DFB lasers).

Bibliography :
Guided Wave Optics : Marcuse Theory of dielectric optical waveguides (Academic press) , Fundamental of photonics , BEA
Saleh and MT Teich Wiley Interscience (1991).

Requirements :
Classic optics and Fourier optics.
Electromagnetism and Quantum Mechanics.

Organisation :
Revision of lecture notes. Study of course books (approximately 12 hours).

Evaluation :
One-hour written examination.

Target :

Optical Properties of Nanostructures	SGM09-opMO3
Number of hours : 12.00 h	1.50 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : FOLLIOT HERVE	

Objectives :
- Description of the optical properties of semiconductor nanostructures and their applications.
- A look at some recent subjects of research and development in this field.
- This module comprises half theoretical and half practical work.

Content :
Quantum Mechanics (Reminder).
Optical transitions in large semiconductors (3D) (excitonic effects).
Optical transitions in quantum wells (2D) (intra- and interband optical transitions, exciton peak 2D, applications).
Semiconductor lasers (quantum well lasers (2D), the advantages of nanostructure lasers (0D)).
Photonic crystals and microcavities.

Bibliography :
Optoélectronique-Emmanuel Rosencher, Borge Vinter (Dunod-Collection Sciences Sup) . Physique de l'état solide : Cours et
problèmes (Charles Kittel, Dunod) (chapitre nano) . Fundamentals of Semiconductors, Peter Y. Yu, Manuel Cardona
(Springer) . Physics of optoelectronic devices, Shun Lien Chuang, A Wiley-Intersciences Publication (Joseph W. Goodman,
Series Editor) . Quantums Wel Laser, Peter S. Zory, Jr(Academic Press, Inc. Harcourt Brace Jovanovich, Publisher) . Theory
of optical processes in semiconductors, P. K. Basu (Oxford sciencee publication) . Physique des semi-conducteurs, Bernard
Sapoval et Claudine Hermann, Ecole polytech. (ellipse)\ r

Requirements :
Basic knowledge of quantum mechanics. Basic knowledge of semiconductor band structure, effective mass, doping, electronic
transport.
It is recommended but not compulsory for the students to have followed the "Electronic Nanostructures (C 12h)" module.

Organisation :
Sixty to ninety minutes per week.

Evaluation :
One-hour written examination.

Target :

Etude de cas Industriels - Parcours Micro-Opto	SGM09-opMO4
Number of hours : 18.00 h	1.50 ECTS credit
CM : 18.00 h	
Reference Teacher(s) : DURAND OLIVIER	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Signal processing and Transmission	SGM09-opMO5
Number of hours : 12.00 h	1.50 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : PERRIN MATHIEU	

Objectives :
Basis of digital signal processing. Introduction to the processing principles used for measuring (spectral analysis) and for
transmitting.

Content :
- Digital signal processing : Review on signal digitization, linear time invariant (LTI) systems;
- z-transform, reduced frequency Fourier transform, discrete Fourier transform (DFT), Fast Fourier Transform (FFT)
- Digital filter synthesis.
- Digital transmission: Description of a the architecture of a transmission chain; source and channel coding; baseband
transmission, inter-symbol interference (ISI), Nyquist criteria; eye pattern, bit error ratio.
- Description of an optical fiber digital transmission line.

Bibliography :
- Traitement des signaux et acquisition de données, F. Cottet, Dunod
- Traitement numérique du signal, M. Berllanger, Dunod
- Méthodes et techniques de traitement du signal et applications aux mesures physiques, tome 1, 5ème édition, J. Max et J.L.
Lacoume, Masson.
- Optical fiber communications, 2ème édition, G. Keiser, McGraw-Hill International Editions
- Les télécommunications par fibres optiques, Irène et Michel Joindot et douze co-auteurs, Dunod.

Requirements :
Engineering mathematics methods, probability and statistics, analog signal processing.

Organisation :
Revision of lecture notes (2 hours a week).

Evaluation :
One hour written examination.

Target :

Applications of lasers and photonics	SGM09-opMO6
Number of hours : 12.00 h	1.50 ECTS credit
EP : 12.00 h	
Reference Teacher(s) : PERRIN MATHIEU	

Objectives :
Students have to study in pairs a particular subject related to applications of lasers and photonics. Each group will have to collect the necessary documentation to make a presentation of the project in front of the class at the last session. This course will provide the opportunity for students to demonstrate independence and creativity, and their ability to leverage their formation to tackle new problems.

Content :
- Session 1: Several topics, in the broad area of lasers and their applications will be proposed for students to choose.
- Session 2 & 3: The class will meet twice in order to discuss projects advancement. Each team of two students should also meet and discuss their project more specifically with their tutor.
- Session 4: Final presentation of their research by each group.

Bibliography :

Requirements :
Knowledge of laser physics, such as the Optoelectronics course in 4th year.

Organisation :
A total personal work of 12h is expected from students during the course of the semester. This amounts roughly to 1h30 per week.

Evaluation :
1 oral presentation in front of the class.

Target :

Circuit Design (VHDL, VLSI)	SGM09-opMO7
Number of hours : 20.00 h	2.00 ECTS credit
CM : 12.00 h, TP : 8.00 h	
Reference Teacher(s) : MENARD DANIEL	

Objectives :
Familiarisation with standard and high level Hardware Description Languages (HDL) such as VHDL and VLSI. HDL enables
the establishment of a model of complex numeric systems and a synthesis with ASIC or a programmable device. Synthesis of
different approaches to conception. Manufacturing and market for integrated circuits.

Content :
VHDL circuits.
1. Utilisation context.
2. Lexical and syntactic basics of the language.
3. Execution of behaviour description.
4. Execution of flow of information description.
5. Execution of structural descriptions.
6. Establishment of a time model.
VLSI circuits.
1. Evolution of these process technologies: CMOS, bipolar and BiCMOS (state of the art), fields concerning these technologies.
2. Various conception modes, tools, library structure and the approach of the inventor. Constraints and rules to observe.
3. Overview of integrated sensors.

Bibliography :
- AUMIAUX M., ""Initiation au langage VHDL"", Masson, 1996.
- DUTRIEUX L., DEMIGNY D., ""Logique programmable"", Eyrolles, 1997.
- PERRY D. L., ""VHDL"", McGraw-Hill Series on Computer Engineering, 1994.
- Principal site web : http://www.vhdl.org/

Requirements :
Combinatory logic.
Sequential logic.

Organisation :
Two to three hours per week.

Evaluation :
Mark for Practical Work report.

Target :

English S9 Conversation	HUMT1-ANGL/CONV
Number of hours : 10.00 h	1.50 ECTS credit
TD : 10.00 h	
Reference Teacher(s) : LE TINNIER ANNE	

Objectives :
- Improving communication skills in everyday life situations as well as in a professional or social context.
- Obtaining or reinforcing C1 level, strongly advised/recommended by the CTI. t.

Content :
- Learning by doing: students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
- Expressing oneself accurately and fluently: students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
1. English Grammar in Use (Cambridge University Press)
2. Dictionnaire Collins Cobuild
3. Polycopié de l' INSA

Requirements :
Having taken and passed the TOEIC test during the previous two years (800 required)
or any other B2 certification recognized by the CTI.

Organisation :
- Each class lasts one hour and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
- Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet.

Evaluation :
Continuous assessment: The final mark (out of 20) will be based on the attendance rate and the personal implication of the student during the class.

Target :

TOEIC 5th year	HUMT1-ANGL/TOEIC
Number of hours : 20.00 h	1.50 ECTS credit
TD : 20.00 h	
Reference Teacher(s) : LE VOT PHILIPPE	

Objectives :
- Improving communication skills in everyday life situations as well as in company and business context.
- Obtaining or reinforcing the B2 level requested by the CTI.
- Obtaining 800 score at the final TOEIC test.

Content :
Learning by doing : students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
Expressing oneself accurately and fluently : students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :
- English grammar in Use, Intermediate Edition (CUP)
- Robert and Collins bilingual dictionary or Collins Cobuild

Requirements :
Not having already taken and passed the TOEIC test during the previous two years
B1/B2 level advised

Organisation :
Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet. B2 level tests are also taken throughout the course.

Evaluation :
Final mark based on :
TOEIC score at final exam + attendance (more than 4 non justified absences result in 0/20 mark).

Target :
5th year students who haven't already passed their TOEIC

Economics, Law and Business Studies A (serious game)	HUMT1-PGE-A
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
-Establishing a strong, specific vocabulary base
-Understanding the main issues that industrial companies deal with (in a specific management field).
-Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Business Simulation (serious game) (24h / in English)
The business simulation ¿Global Challenge¿ (a CESIM product) has been designed to improve the understanding and knowledge of the complexity of global business operations in a dynamic, competitive environment. It focuses on strategic management, international management and business policy.
The task for the student teams is to manage a global mobile telecommunications company through technological and market evolution. Students will develop and execute strategies for their simulated company operating in the USA, Asia, and Europe.
The simulation is based on an online platform that allows students to play in their own language (many languages available: English, Spanish, Portuguese, Chinese,¿).

* Law (8h / in French)
Main principles of the French legal system

* Patents (4h / in French)

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies B (Lean six sigma)	HUMT1-PGE-B
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
* Lean Six Sigma (28h / in French)
Lean Six Sigma is a methodology that enables firms to make their processes more effective and efficient. It¿s the current industry standard for process improvement designed to reduce waste and enhance output quality.

* Law (8h / in French)
Main principles of the French legal system

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies C (human resource management)	HUMT1-PGE-C
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field)
- Understanding the importance of teamwork: making collective decisions and producing the expected work in time

Content :
* Human Resource Management (20h / in French)
    - Main current challenges of Human Resource Management
    - Human Resource Management¿s tools and organization
    - Focus on how team managers deal with Human Resource Management

* Law (8h / in French)
    Main principles of the French legal system

* Social legislation (8h / in French)

* Main principles of French social legislation

* Employment contract

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies D (Marketing for ICT Companies)	HUMT1-PGE-D
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This module is designed to equip students with the knowledge and analytical techniques required for effective strategic marketing management in ICT companies. Through this course, students are faced with a real case study provided by a marketing director of an international ICT company. Students are placed in a decision-making situation and should emerge with a 3 years strategic program.

ICT : Information and Communications Technology

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies E (Industrial design and innovation)	HUMT1-PGE-E
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time.

Content :
The program¿s main objective is to provide a multidisciplinary approach to the field of innovation, strategy and industrial design. This course will give an overview of the innovative process.
During this program, participants will have the opportunity to explore a business case covering the first stage of a product development project.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advice to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies F (Mangement and decision making)	HUMT1-PGE-F
Number of hours : 36.00 h	2.00 ECTS credit
TD : 36.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
This course is about how to improve decision making as a future manager.
In addition to calling for academic insights and existing literature, this module provides practical improvement strategies to avoid costly decision making errors.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Conferences and 4 th year Work Placement / Presentation	SGM09-SPEC
Number of hours : 24.00 h	2.00 ECTS credit
CONF : 24.00 h	
Reference Teacher(s) : BERTRU NICOLAS	

Objectives :
Professionals from a wide range of companies hold conferences on the various career options open to students in the SGM department. The guest speakers describe their companies' engineering work and market structure. The aim is to help students in their choice of career. This fourth year placement is followed by an oral presentation during the fifth year, in front of a jury
composed of three teachers from the SGM department. This oral presentation must be validated by the jury. Validation of the module gives 2 ECTS credits. A total mark will be awarded on completion and validation of both the fourth year placement
report and the oral presentation.

Content :
- Career guidance through conferences.
- Report on the fourth year placement written either in English or in French.
- Poster.
- Oral presentation (Done in 5th year).

Bibliography :

Requirements :

Organisation :

Evaluation :
Conferences: Signed attendance sheets.
Placement: Evaluation takes into account the Supervisor's assessment (given with the report).
The placement report may be written in French or in English.
An Oral presentation is conducted in front of a jury composed of three teachers from the MNT department.
Final valuation will be given in terms of a mark scaled from 0 to 20 following the oral presentation.

Target :