INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES RENNES

Academic year 2022/2023

Courses offered by the programme

Informatique (INFO)
Computer Science

Semester(s) : 5-6-7-8-9-10

Curricula are organized in groups of courses (Unités d'Enseignement (UE)), consisting of several courses (Eléments Constitutifs (EC)). An EC is a teaching module including lectures (cours magistraux (CM)), tutorials (travaux dirigés (TD)), laboratory work (travaux pratiques (TP)), projects (PR), conferences (CONF), personal work (TA) and possibly other pedagocial activities (DIV). Some internships (stages (ST)) are compulsory

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

Code	Libelle
INFT1-SPECIF	Formal Specification
INF06-SECU	Computer system vulnerabilities
INF06-TALEO	Speech and Natural Language Processing
INF07-CRYPTO	Cryptography Engineering
INF07-PERF	Performance evaluation
INF07-PP	Parallel programming
INF07-PROJ1	Project: Preliminary Study and Specifications
INF08-CLOUDS	Clouds
INF08-CONTR	Constraint Programming
INF08-PRGSECU	Secure programming
INF08-PROJ2	Project: Design and Implementation
INF08-TALIL	NLP and language-based interactions
INF09-BDASW	Advanced Databases and Semantic Web
INF09-CP	Competitive programming
INF09-DATA	Big Data Storage and Processing
INF09-DevOps	DevOps
INF09-SECU	Side channel attacks

List of courses with handout in English or that can be taught in English

Semestre 5

Parcours FISP1

1	**INF05-1**		**Mathematics for computer**	**4.00**
	INF05-PROBA	O	Probability	1.50
	INF05-ADFD	O	Data analysis and data mining	2.50
2	**INF05-2**		**Software and hardware architecture**	**6.00**
	INF05-CLP	O	Concepts from logic to programming	3.00
	ESM05-INFOC	O	C language	1.50
	INF05-HI	O	Computer Hygiene	1.50
3	**INF05-3**		**Programming paradigms**	**6.50**
	INF05-PL	O	Logic Programming	2.00
	INF05-FUS	O	Use and functionalities of an operating system	2.50
	INF05-PF	O	Functional Programming	2.00
4	**INF05-4**		**Software design**	**6.50**
	INF05-EP	O	Theoretical and pratical study	2.00
	INF05-CPOO1	O	Object-oriented design and programming #1	1.50
	INF05-SDD	O	Data Structures	3.00
5	**HUM05-ISP/RISQ**		**ENSEIGNEMENTS D'HUMANITE S5 - FISP / RISQ**	**6.00**
	HUM05-ANGL	O	English	2.00
	HUM05-RISQ	O	Risk Management. Sustainable Development	1.50
	HUM05-EPS	O	Sport and physical Education	1.00
	HUMF1-ALL	C	German: Confirmed Level	1.50
	HUMF1-ESP	C	Spanish	1.50
	HUMF1-CHI	C	Chinese	1.50
	HUMF1-ITA	C	Italian	1.50
	HUMF1-JAP	C	Japanese	1.50
	HUMF1-RUS	C	Russian	1.50

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

Probability	INF05-PROBA
Number of hours : 20.00 h	1.50 ECTS credit
CM : 10.00 h, TP : 10.00 h	
Reference Teacher(s) : BABEL Marie	

Objectives :
This module is an introduction to probabilistic methods and models useful in computer science.

Content :
The course covers the following topics:
- Reminders: random variables, discrete and continuous laws
- Law of large numbers, central limit theorem
- Confidence intervals, mean tests, chi-square test
- Random Vectors
- Applications

Bibliography :
- H. Stöcker, «Toutes les mathématiques et les bases de l'informatique», Coll. Sciences Sup, Ed. Dunod. 2002.
- Christine Decaestecker & Marco Saerens, « Probabilités et Statistiques: Quelques petits rappels », Université Libre de Bruxelles
- A. Perrut, « Cours de probabilités et statistiques », Université Claude Bernard Lyon 1, 2010
- B. Jourdain, « Probabilités et statistique pour l'ingénieur », Ecole des Ponts ParisTech, 2018
- A. Zemmari, « Probabilités et Statistiques pour l'Informatique », Université de Bordeaux, 2020
- M. Métivier, « Notions fondamentales de la théorie des probabilités, maîtrises de mathématiques », Dunod, 1968
- L. Wehenkel, « Eléments du Calcul des Probabilités », Université de Liège, 2013
- R. Chachura, «Course: Probability Theory and Statistics for Programmers », https://geekrodion.medium.com/course-probability-theory-and-statistics-forprogrammers-353e20202620, 2018
- M. Maumy-Bertrand, « Probabilités pour Statistique », Univ. Strasbourg, 2011
- J-P. Delmas. Introduction aux probabilités. Ellipses, 1993.
- D. Foata, J. Franchi, A. Fuchs. Calcul des probabilités. Dunod, 2012.

Requirements :
* L1 and L2 Undergraduate Mathematics Program

Organisation :
Practical woks will be done in R.

Evaluation :
* Evaluation on practical work

Target :

Data analysis and data mining	INF05-ADFD
Number of hours : 28.00 h	2.50 ECTS credit
CM : 20.00 h, TP : 8.00 h	
Reference Teacher(s) : CELLIER-BELLINA Peggy	

Objectives :
The aim of this course is to present and put in practice data analysis and data mining methods.

Content :
- Mathematics and statistics (review)

- Data analysis
* Principal component analysis
* Simple factorial analysis of correspondence

- Data mining
* Clustering (k-means, hierarchical, density)
* Pattern mining (formal concept analysis, association rules, sequential patterns, graph patterns)

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
- M. Bramer. Principles of Data Mining. Springer. 2007

Requirements :
- Bachelor level linear algebra
- Basic probability tools

Organisation :
- Hand-out in English and course possibly taught in English
- Need for deepening of the courses, and preparation of practical work

Evaluation :
- A two-hour written examination

Target :
- Licence 3 (Computer Science)

Concepts from logic to programming	INF05-CLP
Number of hours : 38.00 h	3.00 ECTS credit
CM : 16.00 h, TD : 16.00 h, TP : 4.00 h	
Reference Teacher(s) : ARNALDI Bruno	

Objectives :
The objective of this course is to provide the basics necessary to understand how a computer works. Combinatorial and sequential logic plays a fundamental role in computer science in program construction and system architecture. These concepts are therefore studied in order to analyze the behavior of processors with respect to hardware implementation.

Content :
* Understanding basic mechanisms used for executing an instruction
* Understanding performance issues
* Understanding data sizes, data access, execution cycles
* Understanding data and address buses, UAL, UC, UT
* Make the link with the fundamental concepts of computer science
* Coding / decoding
* Number / representation of information
* PLC / program / language: provide the concepts and methods used in functional programming
* understand the interaction mechanisms between a processor (its architecture) and a "low-level" language (assembly language)

Bibliography :
* Claude Brie, "Logique combinatoire et séquentielle",Ellipses, Paris, 2002.
* David Patterson, John Hennessy, "Computer Architecture, The hardware/software interface", 4ème édition, Morgan Kaufman
* John F. Wakerly, "Digital Design: Principles And Practices", Prentice Hall, 2000.

Requirements :

Organisation :
Revision of lecture notes. Preparation for laboratory sessions.

Evaluation :
1 written examination of 2 hours.

Target :
3INFO

C language	ESM05-INFOC
Number of hours : 22.00 h	1.50 ECTS credit
CM : 6.00 h, TD : 4.00 h, TP : 12.00 h	
Reference Teacher(s) : ARNALDI Bruno	

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.
6 hours of course, 4 hours of directed work and 12 hours of practical work

Evaluation :
2-hour written examination at the middle of the first semester (documents allowed).

Target :

Computer Hygiene	INF05-HI
Number of hours : 26.00 h	1.50 ECTS credit
CM : 26.00 h	
Reference Teacher(s) : AVOINE Gildas	

Objectives :
This course aims to present the major security problems that we all face every day in our professional or personal environment. Among the topics covered, viruses, spam, passwords, information leakage, geolocation, certificates, etc. Countermeasures and best practices to keep your computer system in good health will also be presented.

Content :
* Security Primer
* Information Leakage 1
* Information Leakage 2
* Fraud on Internet
* Darkweb / Tor / Tail
* Spam and antispam software
* Malware and antivirus software
* Introduction to cryptography
* Passwords
* Disk encryption
* TLS and Certificates
* Secure mailing
* Geolocation / Competitive intelligence

Bibliography :
Guide d'hygiène informatique, https://www.ssi.gouv.fr/uploads/2017/01/guide_hygiene_informatique_anssi.pdf

Requirements :
* Motivated and good spirit.

Organisation :
* For the year 2020-2021, this teaching will consist exclusively of ex cathedra distance-learning lectures.

Evaluation :
* A two-hour written examination at the end of the semester. Documents, personal notes, and electronic devices are not allowed during the examination.

Target :

Logic Programming	INF05-PL
Number of hours : 28.00 h	2.00 ECTS credit
CM : 12.00 h, TP : 16.00 h	
Reference Teacher(s) : ROZE MARCHAND Laurence	

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, 2003

Requirements :
None

Organisation :
- Need for deepening of the courses, and preparation of lab work
- Every 2 sessions of practical work, a distant practical work, supervised by a lecturer, allows to answer the students' questions about the two previous practical works (support).

Evaluation :
One 1.5 hour written examination at the end of the semester.

Target :

Use and functionalities of an operating system	INF05-FUS
Number of hours : 40.00 h	2.50 ECTS credit
CM : 14.00 h, TP : 26.00 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 :

Functional Programming	INF05-PF
Number of hours : 26.00 h	2.00 ECTS credit
CM : 8.00 h, TP : 18.00 h	
Reference Teacher(s) : FILA Barbara	

Objectives :
Introduce the functional programming paradigm.
Provide methods for 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

Bibliography :
"Apprendre à programmer avec OCaml - Algorithmes et structures de données",
Sylvain Conchon, Jean-Christophe, Eyrolles, 2014

"Développement d'applications avec Objective Caml",
Emmanuel CHAILLOUX, Pascal MANOURY, Bruno PAGANO, O'REILLY 2000,
http://www.pps.univ-paris-diderot.fr/Livres/ora/DA-OCAML/

Requirements :
None.

Organisation :
Revision of lecture notes. Preparation for laboratory sessions.

Evaluation :
9 laboratory sessions (coefficient 1/4) + 1 written examination of 2 hours (coefficient 3/4).

Target :
3INFO

Theoretical and pratical study	INF05-EP
Number of hours : 16.00 h	2.00 ECTS credit
DIV : 7.50 h, EP : 8.00 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 :

Object-oriented design and programming #1	INF05-CPOO1
Number of hours : 20.00 h	1.50 ECTS credit
CM : 6.00 h, TD : 8.00 h, TP : 6.00 h	
Reference Teacher(s) : BLOUIN Arnaud	

Objectives :
This software engineering class introduces the core concepts of object-oriented design and programming.

This class focuses on three points: object-oriented programming, using Java; object-oriented modeling, using UML; object-oriented code testing, using JUnit and Mockito.

Content :
* Object-oriented modelling
* Objet-oriented programming
* SOftware testing

Bibliography :

Requirements :

Organisation :
* Practical sessions and class sessions

Evaluation :
* 2-hours exam.

Target :

Data Structures	INF05-SDD
Number of hours : 46.00 h	3.00 ECTS credit
CM : 16.00 h, TA : 6.00 h, TD : 6.00 h, TP : 18.00 h	
Reference Teacher(s) : RICQUEBOURG Yann	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

English	HUM05-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : LE VOT Philippe	

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 :
A 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.(2/3)
Individual oral presentation in class.(1/3)

Target :

Risk Management. Sustainable Development	HUM05-RISQ
Number of hours : 22.00 h	1.50 ECTS credit
CM : 22.00 h, CM : 22.00 h	
Reference Teacher(s) : GALL Philippe	

Objectives :
To create awareness that the environment in which the engineer works is full of uncertainties and risks. The engineer must nevertheless be in control of his choices and actions within the limits that are defined by acceptable risk in the contemporary context of sustainable development
How do you position yourself as a scientist in relation to the 17 Sustainable Development Goals (SDGs)
Acquire the basics of risk prevention, in particular for healt
Learn about occupational risk prevention
Understand the links between work and health
Understand types of work accident
Professional risk assessment
Application of an occupational health and safety approach
Awareness of the impact of decisions
Talks given by Professionals

Content :
How do you position yourself as a scientist in relation to the 17 Sustainable Development Goals (SDGs)
Acquire the basics of risk prevention, in particular for healt
Learn about occupational risk prevention
Understand the links between work and health
Understand types of work accident
Professional risk assessment
Application of an occupational health and safety approach
Awareness of the impact of decisions
Talks given by Professionals

Bibliography :

Requirements :

Organisation :
Sulitest
2 Modules by distance learning (INRS)
Face to face meetings with professionals
MOOC – OpenClassroom: develop an OHS strategy
Hybrid training alternating face-to-face training and distance learning with validation tests and peer work evaluation

Evaluation :
Tests upon completion of each training module
Grade out of 20 is derived from the Sulitest test, 2 grades out of 10
A module is validated if the grade is superior or equal to 10/20for INRS modules and one grade out of for the MOOC (combining 3 quizzes and a peer evaluation)
_ Le rattrapage ne concerne que l'élément de module ayant une note inférieure à 10/20. La note du module après rattrapage ne peut en aucun cas excéder 10/20.
_ La note de rattrapage est prise en compte dans le calcul de la nouvelle note finale du module uniquement si elle améliore cette note.
Un module non validé (Moyenne finale inférieure à 10/20) peut être acquis par compensation à la fin du semestre si la moyenne générale du semestre (moyenne de tous les modules du semestre en cours) est supérieure ou égale à 10/20.

Target :

Sport and physical Education	HUM05-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h, TD : 24.00 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 :

German: Confirmed Level	HUMF1-ALL
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : HOLZNER-JACQUES Cecile	

Objectives :
Targeted skills :
- to master a foreign language
- ability to communicate/progress/ work in an interntaional and intercultural context
- cultural openness
- to communicate / interact with others, work in a team
- to work autonomously

To consolidate secondary school level learning outcomes
To attain, as a basic minimum, the B1 level by the end of the first cycle
To practise written and oral comprehension through the use of contemporary supports and multimedia To develop level of oral expression through exercises in small groups and class discussions
To demonstrate and perfect your skills in German through project work
Support for foreign exchange and work placements

Content :
- Exercises to practise spoken German for everyday situations and professional life
- Study of newspaper articles, broadcasts, videos
- Study of current affairs (politics, economics, sociology and culture) in Germanophone countries
- Introduction to economic and professional German
- Grammar revision
- Cultural openness (film studies, exhibitions, music)

Bibliography :
- DUDEN Bilingual Dictionary (German-French/French-German)
Grammatik Aktiv A1-B1, Cornelsen (mit Audio CD)_- Schritte-Ubungsgrammatik A1-B1, Hueber-Verlag
- Übungsgrammatik für die Grundstufe, Hueber-Verlag (Moodle) - Na also!
Waltraud Legros, Ellipses_- Manuel : Menschen hier, Hueber-Verlag
- Deutsch perfekt (periodical) -
Deutsche Welle/ ZDF logo (web) -
multimedia supports (web)

Requirements :
Intermediate German: B1 level

Organisation :
1h30 per week; 21h face-to-face lessons per semester
Personal Study time: 14h
Total: 35 h

Students are encouraged to regularly read news articles in German and to view videos and film series in addition to work assigned between lessons.

Evaluation :
Basic level : continuous assessment
Intermediate level : continuous assessment
Advanced level : continouous assessment

Target :
S1: Final Grade

Spanish	HUMF1-ESP
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : AMARGOS GUILLERAY Marine	

Objectives :
-Practising and strengthening of one's knowledge in the Spanish language and culture (Spanish culture, Spanish and
Latin-American civilizations, societal developments).
- How to manage team projects
- Adapting to multicultural environments
- Understanding social, technological and economical challenges in Spanish-speaking countries.

Content :
Written and oral expression and comprehension.

Bibliography :
1. PASTOR Enrique and PROST Gisèle : "La grammaire active de l'espagnol", Le livre de poche, collection Les Langues modernes.
2. BECHERELLE, "El arte de conjugar en espanol", Hatier.
3. Larousse bilingual dictionary, Le Grand Dictionnaire de Garcia y Pelayo et Testas, Dictionary Hispano Bordas.
4. "Passez-moi l'expression en espagnol", Belin.
5. "El espanol en la prensa", Belin.

Requirements :
B1 level

Organisation :
- Reinforcing grammar / conjugation
- Reading and oral comprehension
- Writing and speaking (debates, drama).

Advice : Read in Spanish : contemporary novels, comics (Tintin, Astérix, Mafalda), magazines (Cambio 16, Epoca, Vocable) available at the library.
Visit the Internet pages of the Spanish and Latin-American newspapers (lavanguardia.es, elpais.es...)
Listen to Spanish National Radio programmes (RNE) on Internet.
Watch TV programmes on RTVE.es.
Read tourist guides on Spanish-speaking countries available at the library.

Evaluation :
Continuous assessment

Target :
3rd, 4th, 5th year

Chinese	HUMF1-CHI
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 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
exercises (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. Le chinois comme en Chine, Bernard Allanic, Presses Universitaires de Rennes, 2009
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 :
Final mark

Target :

Italian	HUMF1-ITA
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : KERSUSAN Sylvia	

Objectives :
Targeted skills :
- to master a foreign language
- ability to communicate/progress/ work in an interntaional and intercultural context
- cultural openness
- to communicate / interact with others, work in a team
- to work autonomously

Level 1 Beginner :
To introduce the Italian langugae and Italian culture, to express the fundamentals in writing and orally

Level 2 Advanced Beginner:
By the end of the course, students should be able to converse and write in Italian

Level 3 Intermediate:
To enable students to develop further on themes relating to art, civilisation, literature and cinema

Content :
Oral expression and comprehension:
reading with the teacher's guidance on phonetic and grammatical corrections
reading situations in the text, viewing films and reading literary texts and press articles

Written expression and Comprehension:
completing text-based exercises with particular attention to difficulties
summarising situations in available texts and films studied in class

Bibliography :
La lingua italiana per Stranieri 1°, 2°, 3°P K.Katerinov
La prova orale 1,2,3 T.Marin
Texts taken from newspapers and Italian magasines, films by famous film directors

Requirements :
Level 1 Beginner: none
Level 2 Advanced Beginner : to have attended the Italian Beginner lessons
Level3 Intermediate: to have a good knowledge of the Italian language

Organisation :
1h30 of face-face lessons per week; 21h per semester
Personal Study: 14h
To read the photocopied texts provided

Evaluation :
Final grade.

Target :
S1: Final Grade

Japanese	HUMF1-JAP
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : HOLZNER-JACQUES Cecile	

Objectives :
Targeted skills :
- to master a foreign language
- ability to communicate/progress/ work in an interntaional and intercultural context
- cultural openness
- to communicate / interact with others, work in a team
- to work autonomously

Niveau débutant (A1):
- awareness of particularities (phonetics, syntax)
- discovery of Japanese culture, traditions, customs
- learning the two systems of writing (Hiragana and Katakana)
- to be able to use spoken Japanese in everyday situations

Intermediate level (A2):
- introduction ideogrammes (60 kanji)
- reading simple texts (with Manga, etc...)
- writing simple texts
- to be able to use spoken Japanese in everyday situations

Advanced level (B1, B2):
- learning kanji (60-200)
- acquiring the four skills (written and oral comprehension, written and oral expression) for travel or study in Japan

Content :
Level 1 Beginner (A1):
- Perfecting Hiragana et Katakana - reading Manga
- Lesson 5: speaking about pastimes
- Lesson 6: using transport
- Lesson 7: shopping
- Lesson 8: expressing feelings

Level 2 Beginner (A2):
- learning 30 kanji - reading Manga
- basic Grammar
- reading and writing simple texts
- learning how to communicate in everyday situations

Intermediate level (B1, B2) :
- learning to use more than 30 kanji
- reading Manga
- acquiring the four skills (written and oral comprehension, written and oral expression)

Bibliography :
Level 1 Beginner (A1): Margot, 3A Network, to be published, Japan.
Level 2 Beginner (A2): Daichi, 1, 3A Network, 2008, Japan.
Level 3 Intermediate (B1, B2): Minna no Nihongo, I et II, 3A Network, 1998, Japan.
+ Satoru Koyama, J. Bridge, Bonjinsha, 2007, Japan.

Requirements :
Level 1: none.
Level 2: to have taken Level A1 Beginner course
Level 3: to have taken Beginner Levels A1 and A2

Organisation :
The teaching follows the TU format.

In each session there is an explanation of the structures which are then illustrated by examples and by exercises and conversation which the students participate in.

Evaluation :
S1: Final Grade

Target :

Russian	HUMF1-RUS
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : HOLZNER-JACQUES Cecile	

Objectives :
Russian beginner : acquire A1 level
Russian intermediary : acquire A2/B1 level

Content :
Acquisition of grammatical basis and commonplace vocabulary.
Training of the 5 skills, oral and written comprehension, oral and written expression, interaction.
The stress is put on written and oral communication, firstly in the frame of daily situations, then with a progressive introduction of other themes and opening on the professional communication.
Training with varied media (written, audio, video)
Individual exercices and works in groups, talks from the intermediate level on.
Grammar program depending on the level.
(Inter) cultural opening

Bibliography :
To be seen with the teacher

Requirements :

Organisation :
one hour -and-a-half courses per week in SUPELEc

Evaluation :
Final grade (overseen by SUPELEC).

Target :

Semestre 5

Parcours Formation Initiale INFO

1	**INF05-1**		**Mathematics for computer**	**4.00**
	INF05-PROBA	O	Probability	1.50
	INF05-ADFD	O	Data analysis and data mining	2.50
2	**INF05-2**		**Software and hardware architecture**	**6.00**
	INF05-CLP	O	Concepts from logic to programming	3.00
	ESM05-INFOC	O	C language	1.50
	INF05-HI	O	Computer Hygiene	1.50
3	**INF05-3**		**Programming paradigms**	**6.50**
	INF05-PL	O	Logic Programming	2.00
	INF05-FUS	O	Use and functionalities of an operating system	2.50
	INF05-PF	O	Functional Programming	2.00
4	**INF05-4**		**Software design**	**6.50**
	INF05-EP	O	Theoretical and pratical study	2.00
	INF05-CPOO1	O	Object-oriented design and programming #1	1.50
	INF05-SDD	O	Data Structures	3.00
5	**HUM05**		**Non-scientific syllabus S5**	**7.00**
	HUM05-RISQ	O	Risk Management. Sustainable Development	1.50
	HUM05-ANGL	O	English	2.00
	HUM05-PSH	O	Human sciences project	2.50
	HUM05-EPS	O	Sport and physical Education	1.00
6	**INF05-REM BD**		**Remedial course : databases**	**1.00**
	INF05-RBD	F	Remedial course : Databases	1.00
7	**INF05-REM JAVA1**		**Remedial course : java1**	**1.00**
	INF05-RJ1	F	Remedial course : Java 1	1.00
8	**INF05-REM JAVA2**		**Remedial course : java2**	**1.00**
	INF05-RJ2	F	Remedial course : Java 2	1.00
9	**INF05-REM MATHS**		**Remedial course : mathematics**	**2.00**
	INF05-RM	F	Remedial course : mathematics	2.00
11	**HUMF1-RIE**		**RIE : Recherche Innovation Entrepreneuriat**	**1.00**
	HUMF1- RI	F	Recherche Innovation	1.00
	HUMF1- IE	F	INNOVATION & ENTREPRENEURSHIP	1.00

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

Probability	INF05-PROBA
Number of hours : 20.00 h	1.50 ECTS credit
CM : 10.00 h, TP : 10.00 h	
Reference Teacher(s) : BABEL Marie	

Objectives :
This module is an introduction to probabilistic methods and models useful in computer science.

Content :
The course covers the following topics:
- Reminders: random variables, discrete and continuous laws
- Law of large numbers, central limit theorem
- Confidence intervals, mean tests, chi-square test
- Random Vectors
- Applications

Bibliography :
- H. Stöcker, «Toutes les mathématiques et les bases de l'informatique», Coll. Sciences Sup, Ed. Dunod. 2002.
- Christine Decaestecker & Marco Saerens, « Probabilités et Statistiques: Quelques petits rappels », Université Libre de Bruxelles
- A. Perrut, « Cours de probabilités et statistiques », Université Claude Bernard Lyon 1, 2010
- B. Jourdain, « Probabilités et statistique pour l'ingénieur », Ecole des Ponts ParisTech, 2018
- A. Zemmari, « Probabilités et Statistiques pour l'Informatique », Université de Bordeaux, 2020
- M. Métivier, « Notions fondamentales de la théorie des probabilités, maîtrises de mathématiques », Dunod, 1968
- L. Wehenkel, « Eléments du Calcul des Probabilités », Université de Liège, 2013
- R. Chachura, «Course: Probability Theory and Statistics for Programmers », https://geekrodion.medium.com/course-probability-theory-and-statistics-forprogrammers-353e20202620, 2018
- M. Maumy-Bertrand, « Probabilités pour Statistique », Univ. Strasbourg, 2011
- J-P. Delmas. Introduction aux probabilités. Ellipses, 1993.
- D. Foata, J. Franchi, A. Fuchs. Calcul des probabilités. Dunod, 2012.

Requirements :
* L1 and L2 Undergraduate Mathematics Program

Organisation :
Practical woks will be done in R.

Evaluation :
* Evaluation on practical work

Target :

Data analysis and data mining	INF05-ADFD
Number of hours : 28.00 h	2.50 ECTS credit
CM : 20.00 h, TP : 8.00 h	
Reference Teacher(s) : CELLIER-BELLINA Peggy	

Objectives :
The aim of this course is to present and put in practice data analysis and data mining methods.

Content :
- Mathematics and statistics (review)

- Data analysis
* Principal component analysis
* Simple factorial analysis of correspondence

- Data mining
* Clustering (k-means, hierarchical, density)
* Pattern mining (formal concept analysis, association rules, sequential patterns, graph patterns)

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
- M. Bramer. Principles of Data Mining. Springer. 2007

Requirements :
- Bachelor level linear algebra
- Basic probability tools

Organisation :
- Hand-out in English and course possibly taught in English
- Need for deepening of the courses, and preparation of practical work

Evaluation :
- A two-hour written examination

Target :
- Licence 3 (Computer Science)

Concepts from logic to programming	INF05-CLP
Number of hours : 38.00 h	3.00 ECTS credit
CM : 16.00 h, TD : 16.00 h, TP : 4.00 h	
Reference Teacher(s) : ARNALDI Bruno	

Objectives :
The objective of this course is to provide the basics necessary to understand how a computer works. Combinatorial and sequential logic plays a fundamental role in computer science in program construction and system architecture. These concepts are therefore studied in order to analyze the behavior of processors with respect to hardware implementation.

Content :
* Understanding basic mechanisms used for executing an instruction
* Understanding performance issues
* Understanding data sizes, data access, execution cycles
* Understanding data and address buses, UAL, UC, UT
* Make the link with the fundamental concepts of computer science
* Coding / decoding
* Number / representation of information
* PLC / program / language: provide the concepts and methods used in functional programming
* understand the interaction mechanisms between a processor (its architecture) and a "low-level" language (assembly language)

Bibliography :
* Claude Brie, "Logique combinatoire et séquentielle",Ellipses, Paris, 2002.
* David Patterson, John Hennessy, "Computer Architecture, The hardware/software interface", 4ème édition, Morgan Kaufman
* John F. Wakerly, "Digital Design: Principles And Practices", Prentice Hall, 2000.

Requirements :

Organisation :
Revision of lecture notes. Preparation for laboratory sessions.

Evaluation :
1 written examination of 2 hours.

Target :
3INFO

C language	ESM05-INFOC
Number of hours : 22.00 h	1.50 ECTS credit
CM : 6.00 h, TD : 4.00 h, TP : 12.00 h	
Reference Teacher(s) : ARNALDI Bruno	

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.
6 hours of course, 4 hours of directed work and 12 hours of practical work

Evaluation :
2-hour written examination at the middle of the first semester (documents allowed).

Target :

Computer Hygiene	INF05-HI
Number of hours : 26.00 h	1.50 ECTS credit
CM : 26.00 h	
Reference Teacher(s) : AVOINE Gildas	

Objectives :
This course aims to present the major security problems that we all face every day in our professional or personal environment. Among the topics covered, viruses, spam, passwords, information leakage, geolocation, certificates, etc. Countermeasures and best practices to keep your computer system in good health will also be presented.

Content :
* Security Primer
* Information Leakage 1
* Information Leakage 2
* Fraud on Internet
* Darkweb / Tor / Tail
* Spam and antispam software
* Malware and antivirus software
* Introduction to cryptography
* Passwords
* Disk encryption
* TLS and Certificates
* Secure mailing
* Geolocation / Competitive intelligence

Bibliography :
Guide d'hygiène informatique, https://www.ssi.gouv.fr/uploads/2017/01/guide_hygiene_informatique_anssi.pdf

Requirements :
* Motivated and good spirit.

Organisation :
* For the year 2020-2021, this teaching will consist exclusively of ex cathedra distance-learning lectures.

Evaluation :
* A two-hour written examination at the end of the semester. Documents, personal notes, and electronic devices are not allowed during the examination.

Target :

Logic Programming	INF05-PL
Number of hours : 28.00 h	2.00 ECTS credit
CM : 12.00 h, TP : 16.00 h	
Reference Teacher(s) : ROZE MARCHAND Laurence	

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, 2003

Requirements :
None

Organisation :
- Need for deepening of the courses, and preparation of lab work
- Every 2 sessions of practical work, a distant practical work, supervised by a lecturer, allows to answer the students' questions about the two previous practical works (support).

Evaluation :
One 1.5 hour written examination at the end of the semester.

Target :

Use and functionalities of an operating system	INF05-FUS
Number of hours : 40.00 h	2.50 ECTS credit
CM : 14.00 h, TP : 26.00 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 :

Functional Programming	INF05-PF
Number of hours : 26.00 h	2.00 ECTS credit
CM : 8.00 h, TP : 18.00 h	
Reference Teacher(s) : FILA Barbara	

Objectives :
Introduce the functional programming paradigm.
Provide methods for 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

Bibliography :
"Apprendre à programmer avec OCaml - Algorithmes et structures de données",
Sylvain Conchon, Jean-Christophe, Eyrolles, 2014

"Développement d'applications avec Objective Caml",
Emmanuel CHAILLOUX, Pascal MANOURY, Bruno PAGANO, O'REILLY 2000,
http://www.pps.univ-paris-diderot.fr/Livres/ora/DA-OCAML/

Requirements :
None.

Organisation :
Revision of lecture notes. Preparation for laboratory sessions.

Evaluation :
9 laboratory sessions (coefficient 1/4) + 1 written examination of 2 hours (coefficient 3/4).

Target :
3INFO

Theoretical and pratical study	INF05-EP
Number of hours : 16.00 h	2.00 ECTS credit
DIV : 7.50 h, EP : 8.00 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 :

Object-oriented design and programming #1	INF05-CPOO1
Number of hours : 20.00 h	1.50 ECTS credit
CM : 6.00 h, TD : 8.00 h, TP : 6.00 h	
Reference Teacher(s) : BLOUIN Arnaud	

Objectives :
This software engineering class introduces the core concepts of object-oriented design and programming.

This class focuses on three points: object-oriented programming, using Java; object-oriented modeling, using UML; object-oriented code testing, using JUnit and Mockito.

Content :
* Object-oriented modelling
* Objet-oriented programming
* SOftware testing

Bibliography :

Requirements :

Organisation :
* Practical sessions and class sessions

Evaluation :
* 2-hours exam.

Target :

Data Structures	INF05-SDD
Number of hours : 46.00 h	3.00 ECTS credit
CM : 16.00 h, TA : 6.00 h, TD : 6.00 h, TP : 18.00 h	
Reference Teacher(s) : RICQUEBOURG Yann	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Risk Management. Sustainable Development	HUM05-RISQ
Number of hours : 22.00 h	1.50 ECTS credit
CM : 22.00 h, CM : 22.00 h	
Reference Teacher(s) : GALL Philippe	

Objectives :
To create awareness that the environment in which the engineer works is full of uncertainties and risks. The engineer must nevertheless be in control of his choices and actions within the limits that are defined by acceptable risk in the contemporary context of sustainable development
How do you position yourself as a scientist in relation to the 17 Sustainable Development Goals (SDGs)
Acquire the basics of risk prevention, in particular for healt
Learn about occupational risk prevention
Understand the links between work and health
Understand types of work accident
Professional risk assessment
Application of an occupational health and safety approach
Awareness of the impact of decisions
Talks given by Professionals

Content :
How do you position yourself as a scientist in relation to the 17 Sustainable Development Goals (SDGs)
Acquire the basics of risk prevention, in particular for healt
Learn about occupational risk prevention
Understand the links between work and health
Understand types of work accident
Professional risk assessment
Application of an occupational health and safety approach
Awareness of the impact of decisions
Talks given by Professionals

Bibliography :

Requirements :

Organisation :
Sulitest
2 Modules by distance learning (INRS)
Face to face meetings with professionals
MOOC – OpenClassroom: develop an OHS strategy
Hybrid training alternating face-to-face training and distance learning with validation tests and peer work evaluation

Evaluation :
Tests upon completion of each training module
Grade out of 20 is derived from the Sulitest test, 2 grades out of 10
A module is validated if the grade is superior or equal to 10/20for INRS modules and one grade out of for the MOOC (combining 3 quizzes and a peer evaluation)
_ Le rattrapage ne concerne que l'élément de module ayant une note inférieure à 10/20. La note du module après rattrapage ne peut en aucun cas excéder 10/20.
_ La note de rattrapage est prise en compte dans le calcul de la nouvelle note finale du module uniquement si elle améliore cette note.
Un module non validé (Moyenne finale inférieure à 10/20) peut être acquis par compensation à la fin du semestre si la moyenne générale du semestre (moyenne de tous les modules du semestre en cours) est supérieure ou égale à 10/20.

Target :

English	HUM05-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : LE VOT Philippe	

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 :
A 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.(2/3)
Individual oral presentation in class.(1/3)

Target :

Human sciences project	HUM05-PSH
Number of hours : 26.00 h	2.50 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : ECHARD Philippe	

Objectives :
Conduct a rigorous and synthetic reflection on a given topic dealing with one subject of interest developped by the Specialty Department. .
Learning outcomes expected:
- Knowing how to define a study subject and associate a relevant problematic.
- Knowing how to find relevant information by using the resources available from the Internet
- Knowing how to produce quality communication events and documents (written report, pwpt or prezi presentation, organization of professional meeting)
Knowing how to manage a collective project: planning and coordinating actions to produce documents to be delivered within a given time-limit.

Content :
The students will make up teams and choose a topic that will be approved by the teacher. Their documentary research shall lead to the definition of a problematic and a written report (comprising a synthetic note + commented bibliography + abstract/summary) in accordance with academic requirements.
Methodological gain :
- documentary search on the net. Acquisition of ZOTERO software
- brainstorming techniques and heuristic approach
- problematic definition
- academic-type writing of report or bibiography
- project management technique

Bibliography :
available on-line through the teacher

Requirements :

Organisation :
Alternately methodology courses and progress report sessions of the team projects

Evaluation :
Continuous assessment :
- 1 written report comprising : 1 synthetic note + 1 commented bibliography + abstract/summary)
- 1 oral submission (with pwpt or prezi presentation)

Target :

Sport and physical Education	HUM05-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h, TD : 24.00 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 :

Remedial course : Databases	INF05-RBD
Number of hours : 12.00 h	1.00 ECTS credit
TD : 12.00 h	
Reference Teacher(s) : SEBILLOT Pascale	

Objectives :
To give the opportunity to students who have not attend any database classe to understand the usefulness of database management systems (DBMSs), and to be able to create and manipulate relational databases (DBs).

Content :
Each 2-hour session of the module is generally divided into a theoretical part and a practical one, either composed of exercices or of pratical work. The following notions are studied.

1) Querying of databases in relational algebra
- relation
- relational and set operators
- exercises

2) Querying of databases in SQL
- translation of relational and set operators into SQL
- exemplification with practical work on simple interrogations of a provided DB

3) Creation and modifications of a DB
- instructions to create database relations
- data insertions, deletions, and updates
- access rights
- exemplification with practical work on the creation and manipulation of a DB with a known structure

4) Competitive use and functional dependencies
- transaction
- locking
- first notions of DB conception: functional dependencies
- exercises on functional dependencies

5) Conceptual data model and logic data model
- conceptual modeling: entity-relationship
- transformation of an entity-relationship model into a relational model
- exercises on the production of conceptual data models and their transformation

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
- Polycopié du module Bases de données, 2e année, INSA de Rennes

Requirements :
Notions of set theory and predicate calculus

Organisation :
- Need for deepening of the courses

Evaluation :
- The active participation of the student during the sessions allows to validate the course

Target :

Remedial course : Java 1	INF05-RJ1
Number of hours : 12.00 h	1.00 ECTS credit
TD : 12.00 h	
Reference Teacher(s) : ROZE MARCHAND Laurence	

Objectives :
The objective of this module is to familiarize itself with java in order to help the comprehension of lessons using this language. This first remediation makes it possible to be accustomed to the eclipse environment and to discover the basic syntax of the language. Very quickly we pass to the basic concepts of object programming (class, objects and heritage).

Content :
- Variable, type, sequentiality, functions
- itération, condition
- class, object
- generalisation

Bibliography :
* java, a beginner¿s guide, herbert schildt

Requirements :
None

Organisation :

Evaluation :
Students who have not learned java or have not sufficiently assimilated these basic concepts of object-oriented

Target :

Remedial course : Java 2	INF05-RJ2
Number of hours : 12.00 h	1.00 ECTS credit
TD : 12.00 h	
Reference Teacher(s) : RICQUEBOURG Yann	

Objectives :
This module aims to do an upgrade on the basic concepts of object-oriented programming in JAVA.

Content :
The program for this module includes: Memory management, Inheritance, Abstract class, Interface, Collection, Exception, Cloning, Inner Class, GUI: AWT, Graphics, Paint and Repaint, Applets, Generics.

Bibliography :
Thinking in Java, 3rd Edition, Bruce Eckel.

Requirements :
The requirements of this module are: knowledge of basic algorithms and the basic concepts of JAVA language (see Java Remediation Module 1).

Organisation :
The module will be divided into a part of the course and a practical part performed on machine. The practical part will be formalize by a small tutored project.

Evaluation :
The evaluation will be based on attendance at meetings for the calculation of a final grade.

Target :

Remedial course : mathematics	INF05-RM
Number of hours : 25.50 h	2.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : BABEL Marie	

Objectives :
The objective of this module is to provide mathematical bases that are required for any computer science engineer. Notions from analysis, probability and algebra fields will be addressed.

Intended skills are:
-> Master the mathematical tools required for computer science
-> Model and formalize a mathematical problem
-> Realize related mathematical calculus

Content :
1. Analysis: integrals, multiple integrals, convergence of integrals, finite differences, recurrence relations and sequences.
2. Probabilities: definition, random variables
3. Algebra: matrices, determinants, eigenvalues, eigenvectors, inversion, scalar and vector product

Bibliography :
1. KREYSZIG E., "Advanced engineering mathematics", Wiley, 1992
2. SWOKOWSKI, "Analyse", De Boeck Supérieur, 1993.
3. STOCKER H., "Toutes les mathématiques et les bases de l'informatique", Dunod, 2013.
4. ANTON H., RORRES C., "Elementary linear algebra with applications", Wiley, 2010

Requirements :
None

Organisation :
Revision of lecture notes. Preparation of exercises and practical work.

Evaluation :
Validation

Target :
3INFO

Recherche Innovation	HUMF1- RI
Number of hours : 8.00 h	1.00 ECTS credit
TD : 8.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

INNOVATION & ENTREPRENEURSHIP	HUMF1- IE
Number of hours : 8.00 h	1.00 ECTS credit
TD : 8.00 h	
Reference Teacher(s) :	

Objectives :
The aim of this module is to inspire future engineers and stimulate their creativity and initiative, by instilling a spirit of entrepreneurship.
Expected skills:
- observe and consider what exists to generate new ideas,
- make the most of the environment to challenge new concepts,
- communicate and federate around an innovative project.

Content :
Using a list of preselected events, the students build their exploration program and choose to attend 1 to 2 events over semester 5.
Students have an academic coach and regularly report on their progress.

Bibliography :
Provided during the course.

Requirements :
None.

Organisation :
Students are encouraged to identify technologies or inspiring trends by taking advantage of events dealing with innovation and entrepreneurship (tradeshows, conferences, etc.).

Evaluation :
Students write post-event reports focusing on inspiring aspects of their experiences.

Target :

Semestre 6

Parcours FISP1

1	**INF06-1**		**Engineering and network**	**5.50**
	INF06-RES	O	Computer networks	1.50
	INF06-BDWEB	O	Databases and web development	4.00
2	**INF06-2**		**Theoretical computer**	**8.50**
	INF06-GA	O	Graphs and Algorithms	3.00
	INF06-COMPX	O	Complexity	2.00
	INF06-PRED	O	Proposal and predicats	1.50
	INF06-APPR	O	Data Analysis	2.00
3	**INF06-3**		**Projects and opening course**	**4.00**
	INF06-EP	O	Practical Studies	1.50
	INF06-CONF	O	Industrial conference S6	0.50
	INFT2-IAJ	C	IA for the game	2.00
	INFT2-PM	C	Mobile programming	2.00
	INFT2-ROBO	C	Robotics	2.00
	INFT2-IOT	C	Internet of Things	2.00
4	**INF06-4**		**Options**	**5.00**
	INF06-TALEO	C	Speech and Natural Language Processing	2.50
	INF06-SD	C	Statistics	2.50
	INF06-CHP	C	Multi-core architectures	2.50
	INF06-SECU	C	Computer system vulnerabilities	2.50
5	**HUM06-ISP**		**Non-scientific syllabus S6**	**4.00**
	HUM06-ANGL-ISP	O	English	1.00
	HUM06-ALL-ISP	C	German: Confirmed Level	1.00
	HUM06-ESP-ISP	C	Spanish (upper-intermediate)	1.00
	HUM06-RUS-ISP	C	Russian S6 (LV2)	1.00
	HUM06-IMO-ISP	C	Introduction to Operational Management	1.00
	HUM06-SIM-ISP	C	BUSINESS SIMULATION GAME	1.00
	HUM06-EPS	O	Sport and physical Education	1.00
	HUM06-JAP-ISP	C	Japonese S6 (LV2)	1.00
	HUM06-CHI-ISP	C	Chinese S6 (LV2)	1.00

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

Computer networks	INF06-RES
Number of hours : 24.00 h	1.50 ECTS credit
CM : 10.00 h, TD : 4.00 h, TP : 10.00 h	
Reference Teacher(s) : BERTIER Marin	

Objectives :
Addendum to the course "Networks" for software engineers

Content :
- OSI model, IP (Internet Protocol)
- UDP/TCP, sockets
- SNMP, FTP, POP, IMAP, SMTP protocols
- HTTP protocol

Bibliography :

Requirements :
Basics in networks, knowledge of the Java language

Organisation :
lectures + practical works

Evaluation :
writen examination

Target :
3rd year students in computer science (undergraduate level)

Databases and web development	INF06-BDWEB
Number of hours : 46.00 h	4.00 ECTS credit
CM : 14.00 h, TD : 14.00 h, TP : 18.00 h	
Reference Teacher(s) : CELLIER-BELLINA Peggy	

Objectives :
The goal of the course is twofold. The first objective is to give an introduction to the design and implementation of databases. Request optimization is also address in this part. The second objective is to provide the basic notions of web development according to databases.

Content :
1/ 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)

2/ Classic implementations of relational memories
- algorithm complexity and organisation
- study of basic organisations: Heap, hash tables, B-trees
- primary and secondary indexes

3/ Request optimisation
4/ Web application development
- Web architecture (REST, client / server)
- Java Persistence API (JPA)
- Javascript, HTML5, CSS
- Software testing
- Software testing

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). M. Molnar et V. Gouranton, Insa de Rennes, 2008

Requirements :
The 2nd year Databases course unit, or at least:
- modelisation, creation, interrogation of databases
- relational algebra and SQL
- imperative programming
- Programming skills in Java

Remark:
- Before the beginning of the course, remedial courses are organized for external students.

Organisation :
- Need for deepening of the courses, and preparation of practical work.

Evaluation :
Two one-hour written examinations

Target :
- Licence 3 (Computer science)

Graphs and Algorithms	INF06-GA
Number of hours : 36.00 h	3.00 ECTS credit
CM : 18.00 h, TD : 18.00 h	
Reference Teacher(s) : QUICHAUD Daniele	

Objectives :
* Graphs are a very useful model in many fields, specially in computer sciences. In this course, we sea the fundamentals of graph theory. Common types of graph problems and their classic resolution algorithms are seen.
* the 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 :

Complexity	INF06-COMPX
Number of hours : 26.00 h	2.00 ECTS credit
CM : 8.00 h, TD : 18.00 h	
Reference Teacher(s) : MARCHAL Maud	

Objectives :
* Introduction to the concepts of algorithms complexity;
* Evaluation of the complexity of algorithms and use appropriate paradigms;
* Computation of the exact or approximate resolution of linear or simple nonlinear recurrences;
* Understanding complexity classes.

Content :
* Resolution of linear recurrence relations using the characteristic equation method;
* Resolution of non-linear recurrence relations using series;
* Design of algorithms with different paradigms: divide and conquer, dynamic programming, greedy algorithms;
* Metaheuristics and optimization problems;
* 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 notions of algorithmics

Organisation :
Revision of class notes (two hours per week).

Evaluation :
Two-hours exam (documents allowed)

Target :

Proposal and predicats	INF06-PRED
Number of hours : 20.00 h	1.50 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.
* The essential basics in first-order logic.
* Introduction of formal systems of proof.
* Control formal system.
* Resolution.

Organisation :
Revision of lecture notes (one hour per week).

Evaluation :
one-hour 30 minutes written examination with documents at mid-term.

Target :

Data Analysis	INF06-APPR
Number of hours : 26.00 h	2.00 ECTS credit
CM : 18.00 h, TP : 8.00 h	
Reference Teacher(s) : RAYMOND Christian	

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
* Decision trees
* Bagging, boosting
* 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 :

Practical Studies	INF06-EP
Number of hours : 14.00 h	1.50 ECTS credit
DIV : 6.00 h, EP : 8.00 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 :

Industrial conference S6	INF06-CONF
Number of hours : 12.00 h	0.50 ECTS credit
CONF : 12.00 h	
Reference Teacher(s) : BLOUIN Arnaud	

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 :

IA for the game	INFT2-IAJ
Number of hours : 26.00 h	2.00 ECTS credit
CM : 8.00 h, TD : 0.00 h, TP : 18.00 h	
Reference Teacher(s) : GARCIA Pascal	

Objectives :
Solving complex problems with application to game.

Content :
Uninformed search
Minimax alpha beta with transposition tables Monte-Carlo Tree Search
Genetic algorithms
Neural networks

Bibliography :
Articles

Requirements :
Java

Organisation :

Evaluation :
Project

Target :
3INFO et 4INFO

Mobile programming	INFT2-PM
Number of hours : 26.00 h	2.00 ECTS credit
TD : 4.00 h, TP : 22.00 h	
Reference Teacher(s) : ROZE MARCHAND Laurence	

Objectives :
The objective of this module is to practice Android programming to the development of mobile applications that can run on various devices. The core concepts of Android programming will be discussed, such as activity, life cycle of an activity, intention, services, fragments¿

Content :
- the Android mobile programming
- activities
- fragments
- data storage, database
- peripheral, sensors
- service, notification, security
- muli-platform development

Bibliography :
https://developer.android.com/index.html

Requirements :
Object-oriented programming
Knowledge in GUI
The eclipse environment

Organisation :

Evaluation :
* 4-hour practical session

Target :
* L3-M1

Robotics	INFT2-ROBO
Number of hours : 26.00 h	2.00 ECTS credit
CM : 6.00 h, TD : 4.00 h, TP : 16.00 h	
Reference Teacher(s) : BABEL Marie	

Objectives :
This module aims at introducing basic notions related to robotics and computer science thanks to the manipulation of a mobile platform. The software design of such a robotic application relies on mathematical notions dedicated to robot control. In addition, the targeted robotic platform will allow computer science students to discover essential mechatronics elements (odometry, electronic control board, motors…).

Content :
-Introduction to robotics : sensors and actuators, control frameworks, servoing, robust algorithms
-Mobile robotics: software development with GOPIGO mobile platform
-Software design : software platform ROS (Robotic Operating System)
-Sensor-based servoing: line follower, camera, ultrasonic sensors, odometry

Bibliography :
[1] Gregory Dudek and Michael Jenkin. Computational Principles of Mobile Robotics. Cambridge University Press, New York, NY, USA. 2000.
[2] Roland Siegwart and Illah R. Nourbakhsh. Introduction to Autonomous Mobile Robots. Bradford Co., Scituate, MA, USA. 2004.
Several educational materials are available onto GDR Robotique website:
http://www.gdr-robotique.org/cours_de_robotique/

Requirements :
Object-oriented programming
Notions of architecture
Linear algebra

Organisation :
This module is organized as follows: 8h of plenary lectures and 18h of practical sessions. The first lab will be devoted to the assembly of the GOPIGO robot. The last lab session will be as a challenge session where all the robotic systems designed by students will compete in order to realize successive navigation tasks ranging from simple (line following) to complex tasks (collision avoidance).

Evaluation :
Pratical work (project)

Target :

Internet of Things	INFT2-IOT
Number of hours : 26.00 h	2.00 ECTS credit
CM : 4.00 h, EP : 22.00 h	
Reference Teacher(s) : PAZAT Jean-Louis	

Objectives :
Overview of the Internet of Things

Content :
(subject to change)
- Introduction to the Internet of Things
- Networks for IoT
- Ssecurity and privacy
- IoT and Clouds
- Ethics, legal aspects of IoT

Bibliography :

Requirements :
Basic knowledge in operating systems, networks and algorithms

Organisation :
Course, conferences and lab works in small groups for working with innovative devices

Evaluation :
Continuous review

Target :

Speech and Natural Language Processing	INF06-TALEO
Number of hours : 26.00 h	2.50 ECTS credit
CM : 14.00 h, TP : 12.00 h	handout in English
Reference Teacher(s) : SEBILLOT Pascale	

Objectives :
Language, in its written or oral form, is the most common modality for interaction and information exchange. The ever increasing amount, whether on the web or in companies, of texts, and audio and video materials containing speech, makes it necessary to master techniques to access the content of these data. The course aims at providing the students with the skills necessary to analyze the information present in those documents. On the one hand methods to transform into text the speech signal contained in audio or video recordings are presented. On the other hand fundamentals of automatic processing of written text (potentially resulting from the transcription of speech) required to access the content of documents are described. Moreover some key applications of natural language processing are introduced.

Content :
1) Introduction to natural language processing (NLP)
- Specifics of natural languages
- Treatment levels
- Overview of NLP applications

2) Information retrieval
- Representation, indexing
- Search engines

3) Introduction to speech processing
- Automatic speech recognition
- Language modeling

4) Syntactic parsing
- Part-of-Speech tagging
- Chunking
- Constituent/dependency parsing

5) Corpus-based information extraction
- Term extraction
- Relation extraction

Bibliography :
- P. Bouillon. Traitement automatique des langues naturelles, Éditions Duculot. 1998
- É. Gaussier, F. Yvon. Modèles statistiques pour l'accès à l'information textuelle, Paris, Lavoisier. 2011
- F. Jelinek. Statistical methods for speech recognition, Cambridge, Massachusetts, The MIT Press. 1998
- C.D. Manning, H. Schütze. Foundations of statistical natural language processing. Cambridge, Massachusetts, The MIT Press. 1999

Requirements :
The 3rd year Data Analysis course unit, or at least, knowledge about statistical machine learning techniques

Organisation :
Organisation:
- Hand-out in English and course possibly taught in English
- Need for deepening of the courses, and preparation of practical work

Evaluation :
One 1 hour written examination at the end of the semester, and one practical work.

Target :

Statistics	INF06-SD
Number of hours : 28.00 h	2.50 ECTS credit
CM : 12.00 h, TD : 4.00 h, TP : 12.00 h	
Reference Teacher(s) : CHAGNEAU Pierrette	

Objectives :
At the end of the course the student should be able
* to master the statistical inference tools used in the linear models,
* to build a model of linear regression or ANOVA,
* to implement these models using the R software,
* to interpret the results.

Content :
* Introduction to inferential statistics
o Parameter estimation
o Statistical tests (t-test, F-test)
* Simple linear regression
* Multiple linear regression
* One-way ANOVA
* Two-way ANOVA

Bibliography :
* Azaïs, J.M et Bardet, J.M. le modèle linéaire par l¿exemple. DUNOD, 2005.
* Cornillon, P.A et Matzner-Lober, E. Régression avec R. Springer, 2011
* Daudin, J.J. et al. Statistique inférentielle : Idées, démarches, exemples. PUR, 2001.
* Husson, F et Pagès, J. Statistiques générales pour utilisateur 2- Exercices et corrigés. PUR, 2005.
* Lejeune, M. Statistique : la théorie et ses applications. Springer, 2005.
* Pagès, J. Statistiques générales pour utilisateurs 1- Méthodologie. PUR, 2005.

Requirements :
Introduction to probability (STP04-PROBA)
Probability Tools for Engineers (TCM05-PROB)

Organisation :
Lectures and practical exercises with the R Software.

Evaluation :
One written examination of 2h (50%) and a practical examination and/or project (50%).

Target :

Multi-core architectures	INF06-CHP
Number of hours : 26.00 h	2.50 ECTS credit
CM : 14.00 h, TD : 0.00 h, TP : 12.00 h	
Reference Teacher(s) : PAZAT Jean-Louis	

Objectives :
Introduction to parallel computing for numerical computing

Content :
Introduction to parallel computer architecture
Performance, speedup, Amdahl's law
Dependencies
Multicore and multiprocessor parallelization with openMP
Computation and Data Distribution
Cluster programming with MPI

Bibliography :

Requirements :
C-programming
Linux basic knowldge

Organisation :
Course and exercices, lab works with workstations and cluster

Evaluation :
Written examination (2hours)

Target :
students 3rd year computer science

Computer system vulnerabilities	INF06-SECU
Number of hours : 26.00 h	2.50 ECTS credit
CM : 22.00 h, TP : 4.00 h	hand-out in English and course taught in English
Reference Teacher(s) : FILA Barbara	

Objectives :
* Securing a system requires to first learn about its weak points (vulnerabilities) and understand how they can be exploited (attacks). This course deals with the security of systems, data and communication. An overview of main vulnerabilities and related attacks will be given. We will also talk about classical solutions to counter them.

Teachers : Barbara Fila, Olivier Heen (Technicolor)

Content :
- Fundamentals and historical facts
- Web and cloud security
- SQL injections
- XSS attacks
- Secure messaging with PGP
- Cryptographic protocols for confidentiality, authentication and privacy
- Man in the middle attack
- Security of electronic passports
- Cryptographic time-memory trade offs
- Risk analysis methods (e.g., EBIOS) and related formal methods
(attack trees, Bow-tie diagrams, etc.)

Bibliography :
Computer System Security, Gildas Avoine, Pascal Junod et Philippe Oechslin, 2009, 260 pages, CRC Press/EPFL Press.
Cryptography: Theory and Practice, Third Edition, D. Stinson, Chapman & Hall, 2005. Security engineering, Ross Anderson, 2008, 1080 pages, Wiley
Computer Security: Principles and Practice, Second Edition, W. Stallings, l. Brown, Pearson, 2012.
Introduction to Computer Security, M. Bishop, Addison-Wesley Professional, 2004.
Operational Semantics and Verification of Security Protocols, Cas Cremers and Sjouke Mauw, Springer 2012.

Requirements :
* Validation of the Computer Hygiene course during S5

Organisation :
* Revision of the lecture notes. Preparation for laboratory sessions.
* The teaching language is French and English. This course is given by two teachers: a researcher from INSA and an industrial contributor from Technicolor.

Evaluation :
* A two-hour written examination at the end of the semester, based on the content of the lectures and laboratory sessions.

Target :
3INFO (Security & Cloud tracks)

English	HUM06-ANGL-ISP
Number of hours : 28.00 h	1.00 ECTS credit
TD : 21.00 h	
Reference Teacher(s) :	

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 :
A 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 (50%)
Individual oral presentation (50%)

Target :
Engineering students

German: Confirmed Level	HUM06-ALL-ISP
Number of hours : 21.00 h	1.00 ECTS credit
TD : 21.00 h	
Reference Teacher(s) :	

Objectives :
Targeted skills :
- to master a foreign language
- ability to communicate/progress/ work in an interntaional and intercultural context
- cultural openness
- to communicate / interact with others, work in a team
- to work autonomously

Practice in written and oral comprehension through the use of contemporary supports and multimedia
To develop level of oral expression through exercises in small groups and class discussions
To demonstrate and perfect your skills in German through project work
Support for foreign exchange and work placements

Content :
- Exercises to practise spoken German for everyday situations and professional life
- Study of newspaper articles, broadcasts, videos
- Study of current affairs (politics, economics, sociology and culture) in Germanophone countries
- Introduction to economic and professional German
- Grammar revision
- Cultural openness (film studies, exhibitions, music, litterature, theatre...)
- Projects: Course themes

Bibliography :
- Deutsch für Ingenieure, Maria Steinmetz/Heiner Dintera, VDI/Springer Vieweg, 2014
- Deutsch Perfekt (periodical)
- Online : Deutsche Welle, ARD, Der Spiegel, FAZ, die Zeit, das Handelsblatt, VDI (Verein Deutscher Ingenieure), Nachrichten, ZDF Logo
- Visual French-German Dictionary, Editions de la Martinière -
Übungsgrammatik für die Mittelstufe Hueber-Verlag
- Na also! Waltraud Legros, Ellipses multimedia supports

Requirements :
Confirmed/Higher Intermediate level of German: B2 level

Organisation :
1h30 per week; 21h face-to-face lessons per semester
Personal Study time: 14h
Total: 35 h

Students are encouraged to read news articles in German regularly and to view videos and film series in addition to work given between lessons.

Evaluation :
S2 : Oral

Target :
Engineering students

Spanish (upper-intermediate)	HUM06-ESP-ISP
Number of hours : 21.00 h	1.00 ECTS credit
TD : 21.00 h	
Reference Teacher(s) :	

Objectives :
- Practising and strengthening of one's knowledge in the Spanish language and culture (Spanish culture, Spanish and
Latin-American civilizations, societal developments).
- How to manage team projects
- Acquiring, developing know-how and knowledge in a professional and multicultural environment
- Understanding social, technological and economical challenges in Spanish-speaking countries.

Content :
Written and oral expression and comprehension.

Bibliography :
1. PASTOR Enrique and PROST Gisèle : "La grammaire active de l'espagnol", Le livre de poche, collection Les Langues modernes.
2. BECHERELLE, "El arte de conjugar en espanol", Hatier.
3. Larousse bilingual dictionary, Le Grand Dictionnaire de Garcia y Pelayo et Testas, Dictionary Hispano Bordas.
4. "Passez-moi l'expression en espagnol", Belin.
5. "El espanol en la prensa", Belin.

Requirements :
B1 level

Organisation :
- Reinforcing grammar / conjugation
- Reading and oral comprehension
- Writing and speaking (debates, drama).
Advice : Read in Spanish : contemporary novels, comics (Tintin, Astérix, Mafalda), magazines (Cambio 16, Epoca, Vocable) available at the library.
Visit the Internet pages of the Spanish and Latin-American newspapers (lavanguardia.es, elpais.es...)
Listen to Spanish National Radio programmes (RNE) on Internet.
Watch TV programmes on RTVE.es.
Read tourist guides on Spanish-speaking countries available at the library.

Evaluation :
15 mn face-to-face oral

Target :
3rd, 4th, 5th year

Russian S6 (LV2)	HUM06-RUS-ISP
Number of hours : 21.00 h	1.00 ECTS credit
TD : 21.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Introduction to Operational Management	HUM06-IMO-ISP
Number of hours : 24.00 h	1.00 ECTS credit
CM : 10.00 h, TD : 10.00 h, TP : 4.00 h	
Reference Teacher(s) :	

Objectives :
A company in its field of application must adopt methods associated with tools, allowing it to manage value creation. This module is an introduction to the notion of operational management (produiction management, quality management, continuous improvement process). This module should enable students to develop a systematic overview of company organisation

Content :
I - INTRODUCTION:
The aim of a company, changes in socio-economic context, operational excellence, typological analysis, notion of flow and process.

II - PERMANENT PROGRESS:
Notion of waste, the basic tools, processes of problem solving, management of materials.

III – PLANNING AND PILOTING FLOWS:
Planning for component requirement needs, principles of MRP2 (SOP / PIC, MPS / PDP, MRP / CBN), load-capacity management, Concept of ERP.

IV – PLANNING IN THE WORLD OF VUCA: Presentation of DDMRP methodology.

V – OPERATIONAL MANAGEMENT:
Operations Management, Theory of Constraints, Kanban Methods

VI - NOTION OF QUALITY :
Quality tools; statistical control of processes

Bibliography :
Gestion de la production - Blondel - DUNOD
La gestion de production - Bénassy - HERMES
Contrôle de la qualité - Jaupi - DUNOD
Lean Management - Hohmann - Eyrolles

Requirements :

Organisation :

Evaluation :
1 written test (2h) – continuous assessment in PR

Target :

BUSINESS SIMULATION GAME	HUM06-SIM-ISP
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Sport and physical Education	HUM06-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 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 :

Japonese S6 (LV2)	HUM06-JAP-ISP
Number of hours : 21.00 h	1.00 ECTS credit
TD : 0.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Chinese S6 (LV2)	HUM06-CHI-ISP
Number of hours : 21.00 h	1.00 ECTS credit
TD : 21.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Semestre 6

Parcours Formation Initiale INFO

1	**INF06-1**		**Engineering and network**	**5.50**
	INF06-RES	O	Computer networks	1.50
	INF06-BDWEB	O	Databases and web development	4.00
2	**INF06-2**		**Theoretical computer**	**8.50**
	INF06-GA	O	Graphs and Algorithms	3.00
	INF06-COMPX	O	Complexity	2.00
	INF06-PRED	O	Proposal and predicats	1.50
	INF06-APPR	O	Data Analysis	2.00
3	**INF06-3**		**Projects and opening course**	**4.00**
	INF06-EP	O	Practical Studies	1.50
	INF06-CONF	O	Industrial conference S6	0.50
	INFT2-IAJ	C	IA for the game	2.00
	INFT2-PM	C	Mobile programming	2.00
	INFT2-ROBO	C	Robotics	2.00
	INFT2-IOT	C	Internet of Things	2.00
4	**INF06-4**		**Options**	**5.00**
	INF06-TALEO	C	Speech and Natural Language Processing	2.50
	INF06-SD	C	Statistics	2.50
	INF06-CHP	C	Multi-core architectures	2.50
	INF06-SECU	C	Computer system vulnerabilities	2.50
5	**HUM06**		**Non-scientific syllabus S6**	**7.00**
	HUM06-IMO	O	Introduction to Operational Management	1.50
	HUM06-ANGL	O	English	2.00
	HUM06-SIM	O	BUSINESS SIMULATION GAME	1.50
	HUM06-EPS	O	Sport and physical Education	1.00
	HUM06-PPI	O	Professional Project	1.00
9	**HUMF2-ELSA Thea**		**Theatre with Studies**	**1.00**
	HUMF2-THEA	C	Study & Theater	1.00

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

Computer networks	INF06-RES
Number of hours : 24.00 h	1.50 ECTS credit
CM : 10.00 h, TD : 4.00 h, TP : 10.00 h	
Reference Teacher(s) : BERTIER Marin	

Objectives :
Addendum to the course "Networks" for software engineers

Content :
- OSI model, IP (Internet Protocol)
- UDP/TCP, sockets
- SNMP, FTP, POP, IMAP, SMTP protocols
- HTTP protocol

Bibliography :

Requirements :
Basics in networks, knowledge of the Java language

Organisation :
lectures + practical works

Evaluation :
writen examination

Target :
3rd year students in computer science (undergraduate level)

Databases and web development	INF06-BDWEB
Number of hours : 46.00 h	4.00 ECTS credit
CM : 14.00 h, TD : 14.00 h, TP : 18.00 h	
Reference Teacher(s) : CELLIER-BELLINA Peggy	

Objectives :
The goal of the course is twofold. The first objective is to give an introduction to the design and implementation of databases. Request optimization is also address in this part. The second objective is to provide the basic notions of web development according to databases.

Content :
1/ 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)

2/ Classic implementations of relational memories
- algorithm complexity and organisation
- study of basic organisations: Heap, hash tables, B-trees
- primary and secondary indexes

3/ Request optimisation
4/ Web application development
- Web architecture (REST, client / server)
- Java Persistence API (JPA)
- Javascript, HTML5, CSS
- Software testing
- Software testing

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). M. Molnar et V. Gouranton, Insa de Rennes, 2008

Requirements :
The 2nd year Databases course unit, or at least:
- modelisation, creation, interrogation of databases
- relational algebra and SQL
- imperative programming
- Programming skills in Java

Remark:
- Before the beginning of the course, remedial courses are organized for external students.

Organisation :
- Need for deepening of the courses, and preparation of practical work.

Evaluation :
Two one-hour written examinations

Target :
- Licence 3 (Computer science)

Graphs and Algorithms	INF06-GA
Number of hours : 36.00 h	3.00 ECTS credit
CM : 18.00 h, TD : 18.00 h	
Reference Teacher(s) : QUICHAUD Daniele	

Objectives :
* Graphs are a very useful model in many fields, specially in computer sciences. In this course, we sea the fundamentals of graph theory. Common types of graph problems and their classic resolution algorithms are seen.
* the 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 :

Complexity	INF06-COMPX
Number of hours : 26.00 h	2.00 ECTS credit
CM : 8.00 h, TD : 18.00 h	
Reference Teacher(s) : MARCHAL Maud	

Objectives :
* Introduction to the concepts of algorithms complexity;
* Evaluation of the complexity of algorithms and use appropriate paradigms;
* Computation of the exact or approximate resolution of linear or simple nonlinear recurrences;
* Understanding complexity classes.

Content :
* Resolution of linear recurrence relations using the characteristic equation method;
* Resolution of non-linear recurrence relations using series;
* Design of algorithms with different paradigms: divide and conquer, dynamic programming, greedy algorithms;
* Metaheuristics and optimization problems;
* 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 notions of algorithmics

Organisation :
Revision of class notes (two hours per week).

Evaluation :
Two-hours exam (documents allowed)

Target :

Proposal and predicats	INF06-PRED
Number of hours : 20.00 h	1.50 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.
* The essential basics in first-order logic.
* Introduction of formal systems of proof.
* Control formal system.
* Resolution.

Organisation :
Revision of lecture notes (one hour per week).

Evaluation :
one-hour 30 minutes written examination with documents at mid-term.

Target :

Data Analysis	INF06-APPR
Number of hours : 26.00 h	2.00 ECTS credit
CM : 18.00 h, TP : 8.00 h	
Reference Teacher(s) : RAYMOND Christian	

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
* Decision trees
* Bagging, boosting
* 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 :

Practical Studies	INF06-EP
Number of hours : 14.00 h	1.50 ECTS credit
DIV : 6.00 h, EP : 8.00 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 :

Industrial conference S6	INF06-CONF
Number of hours : 12.00 h	0.50 ECTS credit
CONF : 12.00 h	
Reference Teacher(s) : BLOUIN Arnaud	

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 :

IA for the game	INFT2-IAJ
Number of hours : 26.00 h	2.00 ECTS credit
CM : 8.00 h, TD : 0.00 h, TP : 18.00 h	
Reference Teacher(s) : GARCIA Pascal	

Objectives :
Solving complex problems with application to game.

Content :
Uninformed search
Minimax alpha beta with transposition tables Monte-Carlo Tree Search
Genetic algorithms
Neural networks

Bibliography :
Articles

Requirements :
Java

Organisation :

Evaluation :
Project

Target :
3INFO et 4INFO

Mobile programming	INFT2-PM
Number of hours : 26.00 h	2.00 ECTS credit
TD : 4.00 h, TP : 22.00 h	
Reference Teacher(s) : ROZE MARCHAND Laurence	

Objectives :
The objective of this module is to practice Android programming to the development of mobile applications that can run on various devices. The core concepts of Android programming will be discussed, such as activity, life cycle of an activity, intention, services, fragments¿

Content :
- the Android mobile programming
- activities
- fragments
- data storage, database
- peripheral, sensors
- service, notification, security
- muli-platform development

Bibliography :
https://developer.android.com/index.html

Requirements :
Object-oriented programming
Knowledge in GUI
The eclipse environment

Organisation :

Evaluation :
* 4-hour practical session

Target :
* L3-M1

Robotics	INFT2-ROBO
Number of hours : 26.00 h	2.00 ECTS credit
CM : 6.00 h, TD : 4.00 h, TP : 16.00 h	
Reference Teacher(s) : BABEL Marie	

Objectives :
This module aims at introducing basic notions related to robotics and computer science thanks to the manipulation of a mobile platform. The software design of such a robotic application relies on mathematical notions dedicated to robot control. In addition, the targeted robotic platform will allow computer science students to discover essential mechatronics elements (odometry, electronic control board, motors…).

Content :
-Introduction to robotics : sensors and actuators, control frameworks, servoing, robust algorithms
-Mobile robotics: software development with GOPIGO mobile platform
-Software design : software platform ROS (Robotic Operating System)
-Sensor-based servoing: line follower, camera, ultrasonic sensors, odometry

Bibliography :
[1] Gregory Dudek and Michael Jenkin. Computational Principles of Mobile Robotics. Cambridge University Press, New York, NY, USA. 2000.
[2] Roland Siegwart and Illah R. Nourbakhsh. Introduction to Autonomous Mobile Robots. Bradford Co., Scituate, MA, USA. 2004.
Several educational materials are available onto GDR Robotique website:
http://www.gdr-robotique.org/cours_de_robotique/

Requirements :
Object-oriented programming
Notions of architecture
Linear algebra

Organisation :
This module is organized as follows: 8h of plenary lectures and 18h of practical sessions. The first lab will be devoted to the assembly of the GOPIGO robot. The last lab session will be as a challenge session where all the robotic systems designed by students will compete in order to realize successive navigation tasks ranging from simple (line following) to complex tasks (collision avoidance).

Evaluation :
Pratical work (project)

Target :

Internet of Things	INFT2-IOT
Number of hours : 26.00 h	2.00 ECTS credit
CM : 4.00 h, EP : 22.00 h	
Reference Teacher(s) : PAZAT Jean-Louis	

Objectives :
Overview of the Internet of Things

Content :
(subject to change)
- Introduction to the Internet of Things
- Networks for IoT
- Ssecurity and privacy
- IoT and Clouds
- Ethics, legal aspects of IoT

Bibliography :

Requirements :
Basic knowledge in operating systems, networks and algorithms

Organisation :
Course, conferences and lab works in small groups for working with innovative devices

Evaluation :
Continuous review

Target :

Speech and Natural Language Processing	INF06-TALEO
Number of hours : 26.00 h	2.50 ECTS credit
CM : 14.00 h, TP : 12.00 h	handout in English
Reference Teacher(s) : SEBILLOT Pascale	

Objectives :
Language, in its written or oral form, is the most common modality for interaction and information exchange. The ever increasing amount, whether on the web or in companies, of texts, and audio and video materials containing speech, makes it necessary to master techniques to access the content of these data. The course aims at providing the students with the skills necessary to analyze the information present in those documents. On the one hand methods to transform into text the speech signal contained in audio or video recordings are presented. On the other hand fundamentals of automatic processing of written text (potentially resulting from the transcription of speech) required to access the content of documents are described. Moreover some key applications of natural language processing are introduced.

Content :
1) Introduction to natural language processing (NLP)
- Specifics of natural languages
- Treatment levels
- Overview of NLP applications

2) Information retrieval
- Representation, indexing
- Search engines

3) Introduction to speech processing
- Automatic speech recognition
- Language modeling

4) Syntactic parsing
- Part-of-Speech tagging
- Chunking
- Constituent/dependency parsing

5) Corpus-based information extraction
- Term extraction
- Relation extraction

Bibliography :
- P. Bouillon. Traitement automatique des langues naturelles, Éditions Duculot. 1998
- É. Gaussier, F. Yvon. Modèles statistiques pour l'accès à l'information textuelle, Paris, Lavoisier. 2011
- F. Jelinek. Statistical methods for speech recognition, Cambridge, Massachusetts, The MIT Press. 1998
- C.D. Manning, H. Schütze. Foundations of statistical natural language processing. Cambridge, Massachusetts, The MIT Press. 1999

Requirements :
The 3rd year Data Analysis course unit, or at least, knowledge about statistical machine learning techniques

Organisation :
Organisation:
- Hand-out in English and course possibly taught in English
- Need for deepening of the courses, and preparation of practical work

Evaluation :
One 1 hour written examination at the end of the semester, and one practical work.

Target :

Statistics	INF06-SD
Number of hours : 28.00 h	2.50 ECTS credit
CM : 12.00 h, TD : 4.00 h, TP : 12.00 h	
Reference Teacher(s) : CHAGNEAU Pierrette	

Objectives :
At the end of the course the student should be able
* to master the statistical inference tools used in the linear models,
* to build a model of linear regression or ANOVA,
* to implement these models using the R software,
* to interpret the results.

Content :
* Introduction to inferential statistics
o Parameter estimation
o Statistical tests (t-test, F-test)
* Simple linear regression
* Multiple linear regression
* One-way ANOVA
* Two-way ANOVA

Bibliography :
* Azaïs, J.M et Bardet, J.M. le modèle linéaire par l¿exemple. DUNOD, 2005.
* Cornillon, P.A et Matzner-Lober, E. Régression avec R. Springer, 2011
* Daudin, J.J. et al. Statistique inférentielle : Idées, démarches, exemples. PUR, 2001.
* Husson, F et Pagès, J. Statistiques générales pour utilisateur 2- Exercices et corrigés. PUR, 2005.
* Lejeune, M. Statistique : la théorie et ses applications. Springer, 2005.
* Pagès, J. Statistiques générales pour utilisateurs 1- Méthodologie. PUR, 2005.

Requirements :
Introduction to probability (STP04-PROBA)
Probability Tools for Engineers (TCM05-PROB)

Organisation :
Lectures and practical exercises with the R Software.

Evaluation :
One written examination of 2h (50%) and a practical examination and/or project (50%).

Target :

Multi-core architectures	INF06-CHP
Number of hours : 26.00 h	2.50 ECTS credit
CM : 14.00 h, TD : 0.00 h, TP : 12.00 h	
Reference Teacher(s) : PAZAT Jean-Louis	

Objectives :
Introduction to parallel computing for numerical computing

Content :
Introduction to parallel computer architecture
Performance, speedup, Amdahl's law
Dependencies
Multicore and multiprocessor parallelization with openMP
Computation and Data Distribution
Cluster programming with MPI

Bibliography :

Requirements :
C-programming
Linux basic knowldge

Organisation :
Course and exercices, lab works with workstations and cluster

Evaluation :
Written examination (2hours)

Target :
students 3rd year computer science

Computer system vulnerabilities	INF06-SECU
Number of hours : 26.00 h	2.50 ECTS credit
CM : 22.00 h, TP : 4.00 h	hand-out in English and course taught in English
Reference Teacher(s) : FILA Barbara	

Objectives :
* Securing a system requires to first learn about its weak points (vulnerabilities) and understand how they can be exploited (attacks). This course deals with the security of systems, data and communication. An overview of main vulnerabilities and related attacks will be given. We will also talk about classical solutions to counter them.

Teachers : Barbara Fila, Olivier Heen (Technicolor)

Content :
- Fundamentals and historical facts
- Web and cloud security
- SQL injections
- XSS attacks
- Secure messaging with PGP
- Cryptographic protocols for confidentiality, authentication and privacy
- Man in the middle attack
- Security of electronic passports
- Cryptographic time-memory trade offs
- Risk analysis methods (e.g., EBIOS) and related formal methods
(attack trees, Bow-tie diagrams, etc.)

Bibliography :
Computer System Security, Gildas Avoine, Pascal Junod et Philippe Oechslin, 2009, 260 pages, CRC Press/EPFL Press.
Cryptography: Theory and Practice, Third Edition, D. Stinson, Chapman & Hall, 2005. Security engineering, Ross Anderson, 2008, 1080 pages, Wiley
Computer Security: Principles and Practice, Second Edition, W. Stallings, l. Brown, Pearson, 2012.
Introduction to Computer Security, M. Bishop, Addison-Wesley Professional, 2004.
Operational Semantics and Verification of Security Protocols, Cas Cremers and Sjouke Mauw, Springer 2012.

Requirements :
* Validation of the Computer Hygiene course during S5

Organisation :
* Revision of the lecture notes. Preparation for laboratory sessions.
* The teaching language is French and English. This course is given by two teachers: a researcher from INSA and an industrial contributor from Technicolor.

Evaluation :
* A two-hour written examination at the end of the semester, based on the content of the lectures and laboratory sessions.

Target :
3INFO (Security & Cloud tracks)

Introduction to Operational Management	HUM06-IMO
Number of hours : 24.00 h	1.50 ECTS credit
CM : 10.00 h, TD : 10.00 h, TP : 4.00 h	
Reference Teacher(s) : SORRE Frederic	

Objectives :
A company in its field of application must adopt methods associated with tools, allowing it to manage value creation. This module is an introduction to the notion of operational management (produiction management, quality management, continuous improvement process). This module should enable students to develop a systematic overview of company organisation.

Content :
I - INTRODUCTION:
The aim of a company, changes in socio-economic context, operational excellence, typological analysis, notion of flow and process.

II - PERMANENT PROGRESS:
Notion of waste, the basic tools, processes of problem solving, management of materials.

III – PLANNING AND PILOTING FLOWS:
Planning for component requirement needs, principles of MRP2 (SOP / PIC, MPS / PDP, MRP / CBN), load-capacity management, Concept of ERP.

IV – PLANNING IN THE WORLD OF VUCA: Presentation of DDMRP methodology.

V – OPERATIONAL MANAGEMENT:
Operations Management, Theory of Constraints, Kanban Methods

VI - NOTION OF QUALITY :
Quality tools; statistical control of processes

Bibliography :
Gestion de la production - Blondel - DUNOD
La gestion de production - Bénassy - HERMES
Contrôle de la qualité - Jaupi - DUNOD
Lean Management - Hohmann - Eyrolles

Requirements :

Organisation :

Evaluation :
1 written test (2h) – continuous assessment in PR

Target :

English	HUM06-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : LE VOT Philippe	

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 :
A 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 (50%)
Individual oral presentation (50%)

Target :

BUSINESS SIMULATION GAME	HUM06-SIM
Number of hours : 16.00 h	1.50 ECTS credit
TD : 16.00 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, 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 make some decisions outside the classroom.

Bibliography :
Provided during the course

Requirements :
None

Organisation :
2 hours per week

Evaluation :
Continuous assessment (collective work)

Target :

Sport and physical Education	HUM06-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 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	HUM06-PPI
Number of hours : 6.00 h	1.00 ECTS credit
TD : 6.00 h	
Reference Teacher(s) :	

Objectives :
Third Year PPI aims at training students to the job interview, thanks to specialits in Human Ressources.

Content :

Bibliography :

Requirements :
Being able to write a CV and cover letter

Organisation :
The course is organised as follows :
First course PPI third year- group of 24 to 28 students
- The job interview as seen by the HR : goals, expectations, proceeding of the interviews, ...

Second course PPI third year-group of 12 to 14 students
How to get ready for an interview?
Tests
Trailer

Third course PPI third year-group of 4 or 5 students
mock job interviews

The contributors for this course are professionals in Human Resources
- Advisors in Human Resources in recruitment offices
- Responsible for Human Resources in companies

Evaluation :
A mark will be given by the contributor

Target :
All the 3rd-year-students

Study & Theater	HUMF2-THEA
Number of hours : 22.50 h	1.00 ECTS credit
TD : 22.50 h	
Reference Teacher(s) : MERIC Stephane	

Objectives :
Initiation and/or improvement of acting based on a theatrical artistic training which is built from the writing act to the stage.

Content :
In partnership with ADEC-House of amateur theater of Rennes, the "Study & Theater" section is dedicated to students who wish to learn or improve in dramatic play. The section offers training modules with professional artists. In line with its annual program, ADEC, in close collaboration with the head of the "Study & Theater" section, builds a theatrical artistic career, from writing to the stage along four successive semesters with four different artists.

The recruitment of "Study & Theater" section is carried out every two years to constitute a promotion of 15 students registering on an artistic journey of a duration of 2 years. The "Study & Theater" section is open to all engineering students, no prerequisites and enrolled at INSA Rennes between the first year and third year. Each student engineer registered in this section is committed to following the training provided over the term of 2 years. An evaluation at the end of each semester of the course is completed by the head of the section.

For the "September 2015" promotion of the 2015/2016 season : from February to April 2016, Benjamin Guyot, from the "Public Alea" theater company, built his theatrical journey around the discovery of North American playwrights. This second course ends with a public performance. In addition to this course, ADEC offers two interventions around the discovery of theatrical literature at the library of ADEC and some slight initiations to the light operations.

Bibliography :

Requirements :

Organisation :
On Thursday afternoon at the ADEC theater place

Evaluation :
based on the student's involvement

Target :
Registered students between the 1st and 3rd year

Semestre 7

Parcours FISP1

1	**INF07-1**		**Software Engineering**	**7.00**
	INF07-CPP	O	Object Oriented Programming	2.50
	INF07-CPOO2	O	Object-Oriented Design and Programmation #2	2.50
	INF07-PROJ-CPOO	O	Object-Oriented Design and Programming Project	2.00
2	**INF07-2**		**Logic and logic programming**	**6.50**
	INF07-SYST	O	Operating System	4.00
	INF07-MSTOC	O	Stochastic model	2.50
3	**INF07-3**		**Fundamentals of course**	**6.00**
	INFT1-SANTE	C	Conception d'applications innovantes pour la santé et la rééductaion	2.00
	INFT1-IOT	C	Internet of Things	2.00
	INFT1-OPT	C	Optimization	2.00
	INF07-TIV	C	Image and video analysis	2.00
	INF07-IG	C	Computer graphics	2.00
	INF07-SECU	C	Computer network security	2.00
	INF07-CRYPTO	C	Cryptography Engineering	2.00
	INF07-PP	C	Parallel programming	2.00
	INF07-PERF	C	Performance evaluation	2.00
4	**INF07-4**		**System and project**	**4.50**
	INF07-GEST	O	Project Management for computer science	1.00
	INF07-PROJ1	O	Project: Preliminary Study and Specifications	3.00
	INF07-CONF	O	Industrial conference S7	0.50
5	**HUM07-ISP**		**Non-scientific syllabus S7**	**4.50**
	HUM07-ANGL	O	English	2.00
	HUM07-EPS	O	Sport and physical education	1.00
	HUMF1-ALL	C	German: Confirmed Level	1.50
	HUMF1-ESP	C	Spanish	1.50
	HUMF1-CHI	C	Chinese	1.50
	HUMF1-JAP	C	Japanese	1.50
	HUMF1-RUS	C	Russian	1.50

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

Object Oriented Programming	INF07-CPP
Number of hours : 26.00 h	2.50 ECTS credit
CM : 16.00 h, TP : 10.00 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 :

Object-Oriented Design and Programmation #2	INF07-CPOO2
Number of hours : 16.00 h	2.50 ECTS credit
CM : 4.00 h, TD : 12.00 h	
Reference Teacher(s) : BLOUIN Arnaud	

Objectives :
The creation of software systems requires to consider in advance the development problems software engineers will face to limit development errors and cost.
Various object-oriented development problems have been already identified and generic solutions exist to speed up the development, limit errors, and ease the communication between software engineers. This is design patterns. In this class, we will study with a critical and modern point of view mainstream design patterns. Demonstrations in different programming languages will be done (Java, Scala) to study how the design patterns can be implemented, naturally or not, in different languages. We will introduce advanced object-oriented programming concepts (class vs prototype, typing systems, trait, object-oriented lambda expression, etc.). The class will use basic concepts of object-oriented modelling with UML.

Content :
* Object-oriented modelling, advanced object-oriented programming
* Design pattern

Bibliography :

Requirements :
Good knowledge in object-oriented programming (e.g. Java)
Good knowledge in object-oriented modelling (e.g. UML)

Organisation :
Class / demo, practical sessions

Evaluation :
Two-hour exam on table, documents allowed.

Target :
4INFO

Object-Oriented Design and Programming Project	INF07-PROJ-CPOO
Number of hours : 16.00 h	2.00 ECTS credit
CM : 4.00 h, EP : 12.00 h	
Reference Teacher(s) : BLOUIN Arnaud	

Objectives :
The concepts covered during the CPOO2 classes are used through a development project. This project focuses on developing technical skills in: software modelling; software development; DevOps; Web development. The project also aims at developing projects management skills.

Content :
* Object-oriented modelling, advanced object-oriented programming
* Design pattern
* Web development
* DevOps: continuous integration, automation, software testing, continuous deployment

Bibliography :

Requirements :
Good knowledge in object-oriented programming (e.g. Java)
Good knowledge in object-oriented modelling (e.g. UML)
Good knowledge in software testing (JUnit)
Good knowledge in Web development (backend, front-end, REST)

Organisation :
practical sessions (project)

Evaluation :
Development project

Target :
4INFO

Operating System	INF07-SYST
Number of hours : 54.00 h	4.00 ECTS credit
CM : 18.00 h, TD : 16.00 h, TP : 20.00 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 :

Stochastic model	INF07-MSTOC
Number of hours : 26.00 h	2.50 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 markov chains: Transition probability. The Chapman-Kolmogorov equations. Infinitesimal generator. Transitory regime. State classification. Asymptotic behaviour.

* Examples of processes: Birth and death process. Poisson process.

* Application to queuing 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 :
Mathematical courses from the undergraduate program of INSA (years 1-2) or equivalent skills

Organisation :
13 sessions of courses/directed work.

Evaluation :
Two-hour examination at the end of the semester.

Target :

Conception d'applications innovantes pour la santé et la rééductaion	INFT1-SANTE
Number of hours : 26.00 h	2.00 ECTS credit
CM : 6.00 h, TP : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Internet of Things	INFT1-IOT
Number of hours : 26.00 h	2.00 ECTS credit
CM : 14.00 h, TP : 12.00 h	
Reference Teacher(s) :	

Objectives :
Introduction to the Internet of Things

Content :
(subject to change)

* Introduction to the Internet of Things
* Networks for IoT
* Operating Systems for IoT
* IoT and Big Data
* IoT, security and privacy
* IoT and healthcare
* IoT and home automation

Bibliography :

Requirements :
Basic knowledge in operating systems, networks and algorithms

Organisation :
Course, conferences and lab works in small groups for working with innovative devices

Evaluation :
Continuous review

Target :
5th year students

Optimization	INFT1-OPT
Number of hours : 26.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 10.00 h, TP : 4.00 h	
Reference Teacher(s) :	

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 :

Evaluation :
Two-hour examination at the end of the semester.

Target :

Image and video analysis	INF07-TIV
Number of hours : 26.00 h	2.00 ECTS credit
CM : 12.00 h, TP : 14.00 h	
Reference Teacher(s) : BABEL Marie	

Objectives :
This module aims at introducing basic notions related to image and video analysis.
Image and Video Processing is a largely studied domain of Computer Science with various applications: computer vision, pattern recognition, indexation, robotics....
The lectures aims at giving a summary of this subject and particularly focuses on the main line of detecting objects or symbols in images and videos. Therefore, the main knowledge leading to this end are exposed: from early vision given by basic digital processing, via features extraction from images, and segmentation.

Content :
- Introduction to image and video processing : acquisition, HVS
- Basic image processing tools: filtering, spectral analysis, histograms
- Image segmentation and visual feature extraction
- Video segmentation: application to object tracking

Bibliography :

Requirements :
Object-oriented programming
Linear algebra
Data analysis

Organisation :
This module is organized as follows: 12h of plenary lectures and 14h of practical sessions including 8h of project session.

Evaluation :
Pratical work (project)

Target :
4INFO

Computer graphics	INF07-IG
Number of hours : 28.00 h	2.00 ECTS credit
CM : 10.00 h, TD : 2.00 h, TP : 16.00 h	
Reference Teacher(s) : MARCHAL Maud	

Objectives :
* Learning the basic operations to design 2D and 3D interactive graphic scenes
* Modeling, animating and interacting with 3D virtual worlds

Content :
* Modeling: data structures to represent 2D and 3D scenes (meshes, curves and surfaces)
* Rendering: designing 2D images from 3D models, rendering methods, illumination and textures
* Animation: dynamic simulation of 3D objects, procedural animation and introduction to physics-based models.

Bibliography :
* OpenGL Programming Guide. J. Kessenich, G. Sellers, D. Shreiner. Ed. Addison Wesley.
* Fundamentals of Computer Graphics. P. Shirley, M. Ashikhmin, S. Marschner. Ed. AK Peters/CRC Press.
* Computer Graphics: Principles and Practice. J. Hughes, A. van Dam, M. McGuire, D. Sklar, J. Foley, S. Feiner, K. Akeley. Ed. Addison Wesley.

Requirements :
* Basis of geometry
* C++ programming

Organisation :
The course combines both theoretical lectures illustrated through examples with practical courses and a project.

Evaluation :
Practical courses and project.

Target :
Engineer in Computer Science

Computer network security	INF07-SECU
Number of hours : 24.00 h	2.00 ECTS credit
CM : 18.00 h, TP : 6.00 h	
Reference Teacher(s) : AVOINE Gildas	

Objectives :
Understand in depth the security issues in computer networks and the technical countermeasures to consider to mitigate the issues.

* Teachers : Gildas Avoine, Marin Bertier, Manuel Lebas

Content :
* Network Attacks (TCP Hijacking, IP Spoofing, ARP Spoofing, SYN Flooding)
* Firewalls (Architectures, Rules, NAT,...) and proxies
* Intrusion Detection Systems
* Tunnels (SSH, SSL, IPSec)
* WiFi Security

Bibliography :
Sécurité informatique, Cours et exercices corrigés, Gildas Avoine, Pascal Junod, Philippe Oechslin, and Sylvain Pasini, 2015 (3è édition), 384 pages, ISBN : 978-2-311-40168-4. The second edition is outdated but available in English.

Requirements :
* Knowledge in computer networks (layered model, protocols ARP, IP, TCP/UDP, DHCP, DNS, router, switch, hub)

Organisation :
* Ex-cathedra lectures and hands-on sessions. A teacher from the École des transmissions (ETRS) of the ministery of defense will teach the firewalls during 10 hours.

Evaluation :
A two-hour written examination based on the content of the lectures, exercises, and practices. Documents, personal notes, and electronic devices are not allowed during the examination.

Target :

Cryptography Engineering	INF07-CRYPTO
Number of hours : 28.00 h	2.00 ECTS credit
CM : 22.00 h, TP : 6.00 h	handout in English
Reference Teacher(s) : AVOINE Gildas	

Objectives :
Introduction to cryptography, presentation of fundamentals, and study of current standards.

Content :
* Cryptography History
* Basics of cryptography
* Certificates
* Authentication protocols
* Examples of poor designs
* Implementation of cryptographic building blocks according to current standards.
* Generation of randomness on a computer

Bibliography :
* Handbook of Applied Cryptography, A. Menezes, P. van Oorschot, and S. Vanstone, CRC Press, 1996.
* Cryptography: Theory and Practice, Third Edition, D. Stinson, Chapman & Hall, 2005.
* Protocols for authentication and key establishment, Colin Boyd and Anish Mathuria, Springer, 2003.
* The Codebreakers - The Story of Secret Writing, David Kahn, 1967.
* The Code Book: The Secret History of Codes and Code-breaking, Simon Singh, 1999.

Requirements :

Organisation :
Ex-cathedra lectures

Evaluation :
A two-hour written examination at the end of the semester. Documents, personal notes, and electronic devices are not allowed during the examination.

Target :

Parallel programming	INF07-PP
Number of hours : 28.00 h	2.00 ECTS credit
CM : 12.00 h, TP : 16.00 h	course taught in English
Reference Teacher(s) : PAZAT Jean-Louis	

Objectives :
Acquire knowledge in Parallel and Distributed Computing methodologies

Content :
- Introduction to parallel computing
- Tools and methodologies for synchronization of mufti-threaded programs
- Data Parallelism and GPU
- Distributed Computing
- Workflows

Bibliography :

Requirements :
- C-programming
- Basic knowledge on multithreading and synchronization
- Linux basic knowledge

Organisation :
Course and exercices, lab works with workstations and cluster

Evaluation :
Written examination (2hours)

Target :
4th year students computer science/software engineering (graduate level)

Performance evaluation	INF07-PERF
Number of hours : 26.00 h	2.00 ECTS credit
CM : 12.00 h, TP : 14.00 h	hand-out in English and course taught in English
Reference Teacher(s) : PARLAVANTZAS Nikolaos	

Objectives :
This course aims to present the key concepts and methods for evaluating the performance of computer systems. The course focuses on practical techniques and tools that help resolve common performance-related issues, such as avoiding bottlenecks, predicting the performance of different configurations, optimising and sizing systems.

Content :
* Performance modelling (queueing theory, operational analysis, simulation)
* Performance measurement (experiment design, monitoring tools, analysis of results)

Bibliography :
R. Jain, "The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation, and Modeling," Wiley- Interscience, New York, NY, April 1991, ISBN:0471503361.

Requirements :
Basic understanding of operating systems

Organisation :

Evaluation :
Written examination and project

Target :

Project Management for computer science	INF07-GEST
Number of hours : 16.00 h	1.00 ECTS credit
CM : 10.00 h, DIV : 4.00 h, EP : 2.00 h	
Reference Teacher(s) : ANQUETIL Eric	

Objectives :
"There can be no project without project management ". This is an important part of the engineer activity. With the increasing of responsibilities, this activity becomes even preponderant. It is therefore essential to know what it covers.
We will study who the players are, what the project steering activities are: communication aspects, management, risk, quality ... We will include a focus on:
* Identification of activities;
* The product/project life cycle...
* The Agile methods used on innovative projects ...
* The estimation and project planning process

Content :
Speakers: Industrial specialist in project management

We study in this module methods and approaches by declining them on each student project (INF07-PROJ1 module). Among the studied axes we will address in particular:
The communications aspects: meeting organization (daily, weekly ...), handling objections, conflicts and negotiations ...
The product life cycles: determining the "product" cycle of the projects, subprojects, tasks (expected deadlines), workflow identification (incoming, outgoing), critical path / margin, deterministic strategy, level of confidence, evaluation approaches...
The risk management, product requirements ...
Time management

Bibliography :
A Bibliography is proposed by industrial speaker.

Requirements :
To attend to the INF07-PROJ1 module.

Organisation :
This module consists of both theoretical and practical work applied directly on each project of each student groups (see INF07-PROJ1 module). This module will help students to build a robust detailed planning of their project.
We will also take in hand the MS Project management software to develop the initial project planning.

Evaluation :
Students have to make several deliverables (reports and oral presentations) which are evaluated by the teachers of this module. These report and oral presentation will be based directly on the specific project of each student group:
Identification of resources: Human or others in the team or outside
Identification and risk management, confidence level
Organization in phases / projects
Life cycle presentation
Product/Project/Subproject overview (WBS Decomposition - PERT scheduling ...)
Planning from MS Project: workload estimate, duration ...

Target :

Project: Preliminary Study and Specifications	INF07-PROJ1
Number of hours : 33.00 h	3.00 ECTS credit
DIV : 1.00 h, EP : 30.00 h	course taught in English
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 :

Industrial conference S7	INF07-CONF
Number of hours : 15.00 h	0.50 ECTS credit
CONF : 6.00 h	
Reference Teacher(s) : BLOUIN Arnaud	

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 :

English	HUM07-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : RANNOU Isabelle	

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 :

Sport and physical education	HUM07-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 :

German: Confirmed Level	HUMF1-ALL
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : HOLZNER-JACQUES Cecile	

Objectives :
Targeted skills :
- to master a foreign language
- ability to communicate/progress/ work in an interntaional and intercultural context
- cultural openness
- to communicate / interact with others, work in a team
- to work autonomously

To consolidate secondary school level learning outcomes
To attain, as a basic minimum, the B1 level by the end of the first cycle
To practise written and oral comprehension through the use of contemporary supports and multimedia To develop level of oral expression through exercises in small groups and class discussions
To demonstrate and perfect your skills in German through project work
Support for foreign exchange and work placements

Content :
- Exercises to practise spoken German for everyday situations and professional life
- Study of newspaper articles, broadcasts, videos
- Study of current affairs (politics, economics, sociology and culture) in Germanophone countries
- Introduction to economic and professional German
- Grammar revision
- Cultural openness (film studies, exhibitions, music)

Bibliography :
- DUDEN Bilingual Dictionary (German-French/French-German)
Grammatik Aktiv A1-B1, Cornelsen (mit Audio CD)_- Schritte-Ubungsgrammatik A1-B1, Hueber-Verlag
- Übungsgrammatik für die Grundstufe, Hueber-Verlag (Moodle) - Na also!
Waltraud Legros, Ellipses_- Manuel : Menschen hier, Hueber-Verlag
- Deutsch perfekt (periodical) -
Deutsche Welle/ ZDF logo (web) -
multimedia supports (web)

Requirements :
Intermediate German: B1 level

Organisation :
1h30 per week; 21h face-to-face lessons per semester
Personal Study time: 14h
Total: 35 h

Students are encouraged to regularly read news articles in German and to view videos and film series in addition to work assigned between lessons.

Evaluation :
Basic level : continuous assessment
Intermediate level : continuous assessment
Advanced level : continouous assessment

Target :
S1: Final Grade

Spanish	HUMF1-ESP
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : AMARGOS GUILLERAY Marine	

Objectives :
-Practising and strengthening of one's knowledge in the Spanish language and culture (Spanish culture, Spanish and
Latin-American civilizations, societal developments).
- How to manage team projects
- Adapting to multicultural environments
- Understanding social, technological and economical challenges in Spanish-speaking countries.

Content :
Written and oral expression and comprehension.

Bibliography :
1. PASTOR Enrique and PROST Gisèle : "La grammaire active de l'espagnol", Le livre de poche, collection Les Langues modernes.
2. BECHERELLE, "El arte de conjugar en espanol", Hatier.
3. Larousse bilingual dictionary, Le Grand Dictionnaire de Garcia y Pelayo et Testas, Dictionary Hispano Bordas.
4. "Passez-moi l'expression en espagnol", Belin.
5. "El espanol en la prensa", Belin.

Requirements :
B1 level

Organisation :
- Reinforcing grammar / conjugation
- Reading and oral comprehension
- Writing and speaking (debates, drama).

Advice : Read in Spanish : contemporary novels, comics (Tintin, Astérix, Mafalda), magazines (Cambio 16, Epoca, Vocable) available at the library.
Visit the Internet pages of the Spanish and Latin-American newspapers (lavanguardia.es, elpais.es...)
Listen to Spanish National Radio programmes (RNE) on Internet.
Watch TV programmes on RTVE.es.
Read tourist guides on Spanish-speaking countries available at the library.

Evaluation :
Continuous assessment

Target :
3rd, 4th, 5th year

Chinese	HUMF1-CHI
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 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
exercises (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. Le chinois comme en Chine, Bernard Allanic, Presses Universitaires de Rennes, 2009
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 :
Final mark

Target :

Japanese	HUMF1-JAP
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : HOLZNER-JACQUES Cecile	

Objectives :
Targeted skills :
- to master a foreign language
- ability to communicate/progress/ work in an interntaional and intercultural context
- cultural openness
- to communicate / interact with others, work in a team
- to work autonomously

Niveau débutant (A1):
- awareness of particularities (phonetics, syntax)
- discovery of Japanese culture, traditions, customs
- learning the two systems of writing (Hiragana and Katakana)
- to be able to use spoken Japanese in everyday situations

Intermediate level (A2):
- introduction ideogrammes (60 kanji)
- reading simple texts (with Manga, etc...)
- writing simple texts
- to be able to use spoken Japanese in everyday situations

Advanced level (B1, B2):
- learning kanji (60-200)
- acquiring the four skills (written and oral comprehension, written and oral expression) for travel or study in Japan

Content :
Level 1 Beginner (A1):
- Perfecting Hiragana et Katakana - reading Manga
- Lesson 5: speaking about pastimes
- Lesson 6: using transport
- Lesson 7: shopping
- Lesson 8: expressing feelings

Level 2 Beginner (A2):
- learning 30 kanji - reading Manga
- basic Grammar
- reading and writing simple texts
- learning how to communicate in everyday situations

Intermediate level (B1, B2) :
- learning to use more than 30 kanji
- reading Manga
- acquiring the four skills (written and oral comprehension, written and oral expression)

Bibliography :
Level 1 Beginner (A1): Margot, 3A Network, to be published, Japan.
Level 2 Beginner (A2): Daichi, 1, 3A Network, 2008, Japan.
Level 3 Intermediate (B1, B2): Minna no Nihongo, I et II, 3A Network, 1998, Japan.
+ Satoru Koyama, J. Bridge, Bonjinsha, 2007, Japan.

Requirements :
Level 1: none.
Level 2: to have taken Level A1 Beginner course
Level 3: to have taken Beginner Levels A1 and A2

Organisation :
The teaching follows the TU format.

In each session there is an explanation of the structures which are then illustrated by examples and by exercises and conversation which the students participate in.

Evaluation :
S1: Final Grade

Target :

Russian	HUMF1-RUS
Number of hours : 21.00 h	1.50 ECTS credit
TD : 21.00 h	
Reference Teacher(s) : HOLZNER-JACQUES Cecile	

Objectives :
Russian beginner : acquire A1 level
Russian intermediary : acquire A2/B1 level

Content :
Acquisition of grammatical basis and commonplace vocabulary.
Training of the 5 skills, oral and written comprehension, oral and written expression, interaction.
The stress is put on written and oral communication, firstly in the frame of daily situations, then with a progressive introduction of other themes and opening on the professional communication.
Training with varied media (written, audio, video)
Individual exercices and works in groups, talks from the intermediate level on.
Grammar program depending on the level.
(Inter) cultural opening

Bibliography :
To be seen with the teacher

Requirements :

Organisation :
one hour -and-a-half courses per week in SUPELEc

Evaluation :
Final grade (overseen by SUPELEC).

Target :

Semestre 7

Parcours Formation Initiale INFO

1	**INF07-1**		**Software Engineering**	**7.00**
	INF07-CPP	O	Object Oriented Programming	2.50
	INF07-CPOO2	O	Object-Oriented Design and Programmation #2	2.50
	INF07-PROJ-CPOO	O	Object-Oriented Design and Programming Project	2.00
2	**INF07-2**		**Logic and logic programming**	**6.50**
	INF07-SYST	O	Operating System	4.00
	INF07-MSTOC	O	Stochastic model	2.50
3	**INF07-3**		**Fundamentals of course**	**6.00**
	INFT1-SANTE	C	Conception d'applications innovantes pour la santé et la rééductaion	2.00
	INFT1-IOT	C	Internet of Things	2.00
	INFT1-OPT	C	Optimization	2.00
	INF07-TIV	C	Image and video analysis	2.00
	INF07-IG	C	Computer graphics	2.00
	INF07-SECU	C	Computer network security	2.00
	INF07-CRYPTO	C	Cryptography Engineering	2.00
	INF07-PP	C	Parallel programming	2.00
	INF07-PERF	C	Performance evaluation	2.00
4	**INF07-4**		**System and project**	**4.50**
	INF07-GEST	O	Project Management for computer science	1.00
	INF07-PROJ1	O	Project: Preliminary Study and Specifications	3.00
	INF07-CONF	O	Industrial conference S7	0.50
5	**HUM07**		**Non-scientific syllabus S7**	**6.00**
	HUM07-ANGL	O	English	2.00
	HUM07-EI	C	Entrepreneurship and Innovation	3.00
	HUM07-IE	C	INNOVATION & ENTREPRENEURSHIP (RIE)	3.00
	HUM07-EPS	O	Sport and physical education	1.00
7	**HUMF1-SAMSTINF3**		**3rd year industrial Placement**	**3.00**
	INF07-STA3 3CR	F	3rd year industrial Placement	3.00

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

Object Oriented Programming	INF07-CPP
Number of hours : 26.00 h	2.50 ECTS credit
CM : 16.00 h, TP : 10.00 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 :

Object-Oriented Design and Programmation #2	INF07-CPOO2
Number of hours : 16.00 h	2.50 ECTS credit
CM : 4.00 h, TD : 12.00 h	
Reference Teacher(s) : BLOUIN Arnaud	

Objectives :
The creation of software systems requires to consider in advance the development problems software engineers will face to limit development errors and cost.
Various object-oriented development problems have been already identified and generic solutions exist to speed up the development, limit errors, and ease the communication between software engineers. This is design patterns. In this class, we will study with a critical and modern point of view mainstream design patterns. Demonstrations in different programming languages will be done (Java, Scala) to study how the design patterns can be implemented, naturally or not, in different languages. We will introduce advanced object-oriented programming concepts (class vs prototype, typing systems, trait, object-oriented lambda expression, etc.). The class will use basic concepts of object-oriented modelling with UML.

Content :
* Object-oriented modelling, advanced object-oriented programming
* Design pattern

Bibliography :

Requirements :
Good knowledge in object-oriented programming (e.g. Java)
Good knowledge in object-oriented modelling (e.g. UML)

Organisation :
Class / demo, practical sessions

Evaluation :
Two-hour exam on table, documents allowed.

Target :
4INFO

Object-Oriented Design and Programming Project	INF07-PROJ-CPOO
Number of hours : 16.00 h	2.00 ECTS credit
CM : 4.00 h, EP : 12.00 h	
Reference Teacher(s) : BLOUIN Arnaud	

Objectives :
The concepts covered during the CPOO2 classes are used through a development project. This project focuses on developing technical skills in: software modelling; software development; DevOps; Web development. The project also aims at developing projects management skills.

Content :
* Object-oriented modelling, advanced object-oriented programming
* Design pattern
* Web development
* DevOps: continuous integration, automation, software testing, continuous deployment

Bibliography :

Requirements :
Good knowledge in object-oriented programming (e.g. Java)
Good knowledge in object-oriented modelling (e.g. UML)
Good knowledge in software testing (JUnit)
Good knowledge in Web development (backend, front-end, REST)

Organisation :
practical sessions (project)

Evaluation :
Development project

Target :
4INFO

Operating System	INF07-SYST
Number of hours : 54.00 h	4.00 ECTS credit
CM : 18.00 h, TD : 16.00 h, TP : 20.00 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 :

Stochastic model	INF07-MSTOC
Number of hours : 26.00 h	2.50 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 markov chains: Transition probability. The Chapman-Kolmogorov equations. Infinitesimal generator. Transitory regime. State classification. Asymptotic behaviour.

* Examples of processes: Birth and death process. Poisson process.

* Application to queuing 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 :
Mathematical courses from the undergraduate program of INSA (years 1-2) or equivalent skills

Organisation :
13 sessions of courses/directed work.

Evaluation :
Two-hour examination at the end of the semester.

Target :

Conception d'applications innovantes pour la santé et la rééductaion	INFT1-SANTE
Number of hours : 26.00 h	2.00 ECTS credit
CM : 6.00 h, TP : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Internet of Things	INFT1-IOT
Number of hours : 26.00 h	2.00 ECTS credit
CM : 14.00 h, TP : 12.00 h	
Reference Teacher(s) :	

Objectives :
Introduction to the Internet of Things

Content :
(subject to change)

* Introduction to the Internet of Things
* Networks for IoT
* Operating Systems for IoT
* IoT and Big Data
* IoT, security and privacy
* IoT and healthcare
* IoT and home automation

Bibliography :

Requirements :
Basic knowledge in operating systems, networks and algorithms

Organisation :
Course, conferences and lab works in small groups for working with innovative devices

Evaluation :
Continuous review

Target :
5th year students

Optimization	INFT1-OPT
Number of hours : 26.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 10.00 h, TP : 4.00 h	
Reference Teacher(s) :	

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 :

Evaluation :
Two-hour examination at the end of the semester.

Target :

Image and video analysis	INF07-TIV
Number of hours : 26.00 h	2.00 ECTS credit
CM : 12.00 h, TP : 14.00 h	
Reference Teacher(s) : BABEL Marie	

Objectives :
This module aims at introducing basic notions related to image and video analysis.
Image and Video Processing is a largely studied domain of Computer Science with various applications: computer vision, pattern recognition, indexation, robotics....
The lectures aims at giving a summary of this subject and particularly focuses on the main line of detecting objects or symbols in images and videos. Therefore, the main knowledge leading to this end are exposed: from early vision given by basic digital processing, via features extraction from images, and segmentation.

Content :
- Introduction to image and video processing : acquisition, HVS
- Basic image processing tools: filtering, spectral analysis, histograms
- Image segmentation and visual feature extraction
- Video segmentation: application to object tracking

Bibliography :

Requirements :
Object-oriented programming
Linear algebra
Data analysis

Organisation :
This module is organized as follows: 12h of plenary lectures and 14h of practical sessions including 8h of project session.

Evaluation :
Pratical work (project)

Target :
4INFO

Computer graphics	INF07-IG
Number of hours : 28.00 h	2.00 ECTS credit
CM : 10.00 h, TD : 2.00 h, TP : 16.00 h	
Reference Teacher(s) : MARCHAL Maud	

Objectives :
* Learning the basic operations to design 2D and 3D interactive graphic scenes
* Modeling, animating and interacting with 3D virtual worlds

Content :
* Modeling: data structures to represent 2D and 3D scenes (meshes, curves and surfaces)
* Rendering: designing 2D images from 3D models, rendering methods, illumination and textures
* Animation: dynamic simulation of 3D objects, procedural animation and introduction to physics-based models.

Bibliography :
* OpenGL Programming Guide. J. Kessenich, G. Sellers, D. Shreiner. Ed. Addison Wesley.
* Fundamentals of Computer Graphics. P. Shirley, M. Ashikhmin, S. Marschner. Ed. AK Peters/CRC Press.
* Computer Graphics: Principles and Practice. J. Hughes, A. van Dam, M. McGuire, D. Sklar, J. Foley, S. Feiner, K. Akeley. Ed. Addison Wesley.

Requirements :
* Basis of geometry
* C++ programming

Organisation :
The course combines both theoretical lectures illustrated through examples with practical courses and a project.

Evaluation :
Practical courses and project.

Target :
Engineer in Computer Science

Computer network security	INF07-SECU
Number of hours : 24.00 h	2.00 ECTS credit
CM : 18.00 h, TP : 6.00 h	
Reference Teacher(s) : AVOINE Gildas	

Objectives :
Understand in depth the security issues in computer networks and the technical countermeasures to consider to mitigate the issues.

* Teachers : Gildas Avoine, Marin Bertier, Manuel Lebas

Content :
* Network Attacks (TCP Hijacking, IP Spoofing, ARP Spoofing, SYN Flooding)
* Firewalls (Architectures, Rules, NAT,...) and proxies
* Intrusion Detection Systems
* Tunnels (SSH, SSL, IPSec)
* WiFi Security

Bibliography :
Sécurité informatique, Cours et exercices corrigés, Gildas Avoine, Pascal Junod, Philippe Oechslin, and Sylvain Pasini, 2015 (3è édition), 384 pages, ISBN : 978-2-311-40168-4. The second edition is outdated but available in English.

Requirements :
* Knowledge in computer networks (layered model, protocols ARP, IP, TCP/UDP, DHCP, DNS, router, switch, hub)

Organisation :
* Ex-cathedra lectures and hands-on sessions. A teacher from the École des transmissions (ETRS) of the ministery of defense will teach the firewalls during 10 hours.

Evaluation :
A two-hour written examination based on the content of the lectures, exercises, and practices. Documents, personal notes, and electronic devices are not allowed during the examination.

Target :

Cryptography Engineering	INF07-CRYPTO
Number of hours : 28.00 h	2.00 ECTS credit
CM : 22.00 h, TP : 6.00 h	handout in English
Reference Teacher(s) : AVOINE Gildas	

Objectives :
Introduction to cryptography, presentation of fundamentals, and study of current standards.

Content :
* Cryptography History
* Basics of cryptography
* Certificates
* Authentication protocols
* Examples of poor designs
* Implementation of cryptographic building blocks according to current standards.
* Generation of randomness on a computer

Bibliography :
* Handbook of Applied Cryptography, A. Menezes, P. van Oorschot, and S. Vanstone, CRC Press, 1996.
* Cryptography: Theory and Practice, Third Edition, D. Stinson, Chapman & Hall, 2005.
* Protocols for authentication and key establishment, Colin Boyd and Anish Mathuria, Springer, 2003.
* The Codebreakers - The Story of Secret Writing, David Kahn, 1967.
* The Code Book: The Secret History of Codes and Code-breaking, Simon Singh, 1999.

Requirements :

Organisation :
Ex-cathedra lectures

Evaluation :
A two-hour written examination at the end of the semester. Documents, personal notes, and electronic devices are not allowed during the examination.

Target :

Parallel programming	INF07-PP
Number of hours : 28.00 h	2.00 ECTS credit
CM : 12.00 h, TP : 16.00 h	course taught in English
Reference Teacher(s) : PAZAT Jean-Louis	

Objectives :
Acquire knowledge in Parallel and Distributed Computing methodologies

Content :
- Introduction to parallel computing
- Tools and methodologies for synchronization of mufti-threaded programs
- Data Parallelism and GPU
- Distributed Computing
- Workflows

Bibliography :

Requirements :
- C-programming
- Basic knowledge on multithreading and synchronization
- Linux basic knowledge

Organisation :
Course and exercices, lab works with workstations and cluster

Evaluation :
Written examination (2hours)

Target :
4th year students computer science/software engineering (graduate level)

Performance evaluation	INF07-PERF
Number of hours : 26.00 h	2.00 ECTS credit
CM : 12.00 h, TP : 14.00 h	hand-out in English and course taught in English
Reference Teacher(s) : PARLAVANTZAS Nikolaos	

Objectives :
This course aims to present the key concepts and methods for evaluating the performance of computer systems. The course focuses on practical techniques and tools that help resolve common performance-related issues, such as avoiding bottlenecks, predicting the performance of different configurations, optimising and sizing systems.

Content :
* Performance modelling (queueing theory, operational analysis, simulation)
* Performance measurement (experiment design, monitoring tools, analysis of results)

Bibliography :
R. Jain, "The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation, and Modeling," Wiley- Interscience, New York, NY, April 1991, ISBN:0471503361.

Requirements :
Basic understanding of operating systems

Organisation :

Evaluation :
Written examination and project

Target :

Project Management for computer science	INF07-GEST
Number of hours : 16.00 h	1.00 ECTS credit
CM : 10.00 h, DIV : 4.00 h, EP : 2.00 h	
Reference Teacher(s) : ANQUETIL Eric	

Objectives :
"There can be no project without project management ". This is an important part of the engineer activity. With the increasing of responsibilities, this activity becomes even preponderant. It is therefore essential to know what it covers.
We will study who the players are, what the project steering activities are: communication aspects, management, risk, quality ... We will include a focus on:
* Identification of activities;
* The product/project life cycle...
* The Agile methods used on innovative projects ...
* The estimation and project planning process

Content :
Speakers: Industrial specialist in project management

We study in this module methods and approaches by declining them on each student project (INF07-PROJ1 module). Among the studied axes we will address in particular:
The communications aspects: meeting organization (daily, weekly ...), handling objections, conflicts and negotiations ...
The product life cycles: determining the "product" cycle of the projects, subprojects, tasks (expected deadlines), workflow identification (incoming, outgoing), critical path / margin, deterministic strategy, level of confidence, evaluation approaches...
The risk management, product requirements ...
Time management

Bibliography :
A Bibliography is proposed by industrial speaker.

Requirements :
To attend to the INF07-PROJ1 module.

Organisation :
This module consists of both theoretical and practical work applied directly on each project of each student groups (see INF07-PROJ1 module). This module will help students to build a robust detailed planning of their project.
We will also take in hand the MS Project management software to develop the initial project planning.

Evaluation :
Students have to make several deliverables (reports and oral presentations) which are evaluated by the teachers of this module. These report and oral presentation will be based directly on the specific project of each student group:
Identification of resources: Human or others in the team or outside
Identification and risk management, confidence level
Organization in phases / projects
Life cycle presentation
Product/Project/Subproject overview (WBS Decomposition - PERT scheduling ...)
Planning from MS Project: workload estimate, duration ...

Target :

Project: Preliminary Study and Specifications	INF07-PROJ1
Number of hours : 33.00 h	3.00 ECTS credit
DIV : 1.00 h, EP : 30.00 h	course taught in English
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 :

Industrial conference S7	INF07-CONF
Number of hours : 15.00 h	0.50 ECTS credit
CONF : 6.00 h	
Reference Teacher(s) : BLOUIN Arnaud	

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 :

English	HUM07-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : RANNOU Isabelle	

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 :

Entrepreneurship and Innovation	HUM07-EI
Number of hours : 48.00 h	3.00 ECTS credit
CM : 24.00 h, TD : 24.00 h	
Reference Teacher(s) : GOURRET Fanny	

Objectives :
The aim of this module is to assemble a team of students 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 work 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 :
Provided during the course

Requirements :
management simulation module S6

Organisation :
4 hours per week

Evaluation :
Oral defense and written deliverable

Target :

INNOVATION & ENTREPRENEURSHIP (RIE)	HUM07-IE
Number of hours : 54.00 h	3.00 ECTS credit
TD : 54.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Sport and physical education	HUM07-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 :

3rd year industrial Placement	INF07-STA3 3CR
Number of hours : 120.00 h	3.00 ECTS credit
ST : 1.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Semestre 8

Parcours FISP1

1	**INF08-ISP**		**PROJECT S8**	**3.00**
	INF08-PROJ2	O	Project: Design and Implementation	3.00
2	**HUM08-ISP**		**Non-scientific syllabus S8**	**3.00**
	HUM08-ANGL-ISP	O	English S8	2.00
	HUM08-ALL-ISP	C	German S8 (LV2)	1.00
	HUM08-ESP-ISP	C	Spanish S8 (LV2)	1.00
	HUM08-RUS-ISP	C	Russians S8 (LV2)	1.00

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

Project: Design and Implementation	INF08-PROJ2
Number of hours : 60.00 h	3.00 ECTS credit
DIV : 1.00 h, EP : 30.00 h	course taught in English
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 :

English S8	HUM08-ANGL-ISP
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

German S8 (LV2)	HUM08-ALL-ISP
Number of hours : 21.00 h	1.00 ECTS credit
TD : 21.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Spanish S8 (LV2)	HUM08-ESP-ISP
Number of hours : 21.00 h	1.00 ECTS credit
TD : 21.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Russians S8 (LV2)	HUM08-RUS-ISP
Number of hours : 21.00 h	1.00 ECTS credit
TD : 21.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Semestre 8

Parcours Formation Initiale INFO

1	**INF08-1**		**Software Engineering**	**6.50**
	INF08-GRL	O	Grammars and Languages	2.50
	INF08-COMPIL	O	Compilation	2.00
	INF08-CONTR	O	Constraint Programming	2.00
2	**INF08-2**		**Projects and opening course**	**5.50**
	INF08-PROJ2	O	Project: Design and Implementation	3.00
	INF08-CONF	O	Industrial conference S8	0.50
	INFT2-IAJ	C	IA for the game	2.00
	INFT2-PM	C	Mobile programming	2.00
	INFT2-ROBO	C	Robotics	2.00
	INFT2-IOT	C	Internet of Things	2.00
3	**INF08-3**		**Options**	**4.00**
	INF08-RIV	C	Recognition and interpretation of images and videos	2.00
	INF08-TALIL	C	NLP and language-based interactions	2.00
	INF08-PRGSECU	C	Secure programming	2.00
	INF08-CLOUDS	C	Clouds	2.00
4	**INF-STAGE08**		**Work placement**	**8.00**
	INF08-STAGE	O	Summer Work Placement	8.00
5	**HUM08**		**Non-scientific syllabus S8**	**6.00**
	HUM08-ANGL	O	English	2.00
	HUM08-TEJS	C	ECONOMIC, LEGAL AND SOCIAL ISSUES	1.00
	HUM08-SHES1	O	Engineer & Society - M1	1.00
	HUM08-SHES2	C	Engineer & Society - M2	1.00
	HUM08-EPS	O	Sport and Physical Education	1.00
	HUM08-IE	C	INNOVATION & ENTREPRENEURSHIP (RIE)	2.00

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

Grammars and Languages	INF08-GRL
Number of hours : 32.00 h	2.50 ECTS credit
CM : 16.00 h, TD : 16.00 h	
Reference Teacher(s) : FILA Barbara	

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
* Synthesis

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 written examination

Target :
4INFO

Compilation	INF08-COMPIL
Number of hours : 30.00 h	2.00 ECTS credit
CM : 10.00 h, TD : 0.00 h, TP : 20.00 h	
Reference Teacher(s) : GARCIA Pascal	

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 :

Constraint Programming	INF08-CONTR
Number of hours : 26.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 0.00 h, TP : 14.00 h	hand-out in English and course taught in English
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 :

Project: Design and Implementation	INF08-PROJ2
Number of hours : 60.00 h	3.00 ECTS credit
DIV : 1.00 h, EP : 30.00 h	course taught in English
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 :

Industrial conference S8	INF08-CONF
Number of hours : 12.00 h	0.50 ECTS credit
TD : 10.50 h	
Reference Teacher(s) : BLOUIN Arnaud	

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 :

IA for the game	INFT2-IAJ
Number of hours : 26.00 h	2.00 ECTS credit
CM : 8.00 h, TD : 0.00 h, TP : 18.00 h	
Reference Teacher(s) : GARCIA Pascal	

Objectives :
Solving complex problems with application to game.

Content :
Uninformed search
Minimax alpha beta with transposition tables Monte-Carlo Tree Search
Genetic algorithms
Neural networks

Bibliography :
Articles

Requirements :
Java

Organisation :

Evaluation :
Project

Target :
3INFO et 4INFO

Mobile programming	INFT2-PM
Number of hours : 26.00 h	2.00 ECTS credit
TD : 4.00 h, TP : 22.00 h	
Reference Teacher(s) : ROZE MARCHAND Laurence	

Objectives :
The objective of this module is to practice Android programming to the development of mobile applications that can run on various devices. The core concepts of Android programming will be discussed, such as activity, life cycle of an activity, intention, services, fragments¿

Content :
- the Android mobile programming
- activities
- fragments
- data storage, database
- peripheral, sensors
- service, notification, security
- muli-platform development

Bibliography :
https://developer.android.com/index.html

Requirements :
Object-oriented programming
Knowledge in GUI
The eclipse environment

Organisation :

Evaluation :
* 4-hour practical session

Target :
* L3-M1

Robotics	INFT2-ROBO
Number of hours : 26.00 h	2.00 ECTS credit
CM : 6.00 h, TD : 4.00 h, TP : 16.00 h	
Reference Teacher(s) : BABEL Marie	

Objectives :
This module aims at introducing basic notions related to robotics and computer science thanks to the manipulation of a mobile platform. The software design of such a robotic application relies on mathematical notions dedicated to robot control. In addition, the targeted robotic platform will allow computer science students to discover essential mechatronics elements (odometry, electronic control board, motors…).

Content :
-Introduction to robotics : sensors and actuators, control frameworks, servoing, robust algorithms
-Mobile robotics: software development with GOPIGO mobile platform
-Software design : software platform ROS (Robotic Operating System)
-Sensor-based servoing: line follower, camera, ultrasonic sensors, odometry

Bibliography :
[1] Gregory Dudek and Michael Jenkin. Computational Principles of Mobile Robotics. Cambridge University Press, New York, NY, USA. 2000.
[2] Roland Siegwart and Illah R. Nourbakhsh. Introduction to Autonomous Mobile Robots. Bradford Co., Scituate, MA, USA. 2004.
Several educational materials are available onto GDR Robotique website:
http://www.gdr-robotique.org/cours_de_robotique/

Requirements :
Object-oriented programming
Notions of architecture
Linear algebra

Organisation :
This module is organized as follows: 8h of plenary lectures and 18h of practical sessions. The first lab will be devoted to the assembly of the GOPIGO robot. The last lab session will be as a challenge session where all the robotic systems designed by students will compete in order to realize successive navigation tasks ranging from simple (line following) to complex tasks (collision avoidance).

Evaluation :
Pratical work (project)

Target :

Internet of Things	INFT2-IOT
Number of hours : 26.00 h	2.00 ECTS credit
CM : 4.00 h, EP : 22.00 h	
Reference Teacher(s) : PAZAT Jean-Louis	

Objectives :
Overview of the Internet of Things

Content :
(subject to change)
- Introduction to the Internet of Things
- Networks for IoT
- Ssecurity and privacy
- IoT and Clouds
- Ethics, legal aspects of IoT

Bibliography :

Requirements :
Basic knowledge in operating systems, networks and algorithms

Organisation :
Course, conferences and lab works in small groups for working with innovative devices

Evaluation :
Continuous review

Target :

Recognition and interpretation of images and videos	INF08-RIV
Number of hours : 28.00 h	2.00 ECTS credit
CM : 12.00 h, DIV : 2.00 h, TP : 14.00 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 aim at focusing on the main line of recognizing symbols in images. Therefore, the main knowledge leading to this end are progressively exposed: based on basic notions from prior lectures (image representation and early vision), it begins with features extraction from images, and finally ends with recognition performed by classifiers.

Content :
The documents are in English.

Part 1: 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. Feature selection
* Distances, Selection

Part 2: 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 :
* Basic knowledge on image representation and early vision are advantageous.

Organisation :
* Techniques are exposed in lectures, and are practised during the project along with exploration of new ideas.

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 students in groups, to have their systems competing each other. Results of each group are presented and evaluated at the end of this module.

Target :
4INFO

NLP and language-based interactions	INF08-TALIL
Number of hours : 26.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 0.00 h, TP : 12.00 h	handout in English
Reference Teacher(s) : SEBILLOT Pascale	

Objectives :
Language, whether written or spoken, is the most commonly used mode for interaction and information transmission.

The goal of this course is to provide students with the necessary knowledge to apprehend how to implement a human-computer interface using natural language and how to access information carried by language within large content repositories.
The course first presents the fundamentals of language understanding in the framework of dialogue interaction. Fundamental notions for speech synthesis and text generation are also apprehended.

Finally, key applications in natural language processing are presented, with the goal of managing, exploring and mining large volumes of language data.

Content :
1) Neural language modeling
- Lexical representation
- Sentence representation
- Language modeling

2) Dialogue and comprehension
- Concept extraction
- Semantic representations
- Dialogue management

3) Synthesis
- Text generation
- Speech synthesis

4) Automatic summarization
5) Structuring documents and collections
- Topic segmentation
- Implicit and explicit linking

6) Analytics
- Sentiment analysis
- Data journalism
- Fact checking

Bibliography :
- M. Agosti, J. Allan. Special issue on methods and tools for the automatic construction of hypertext, Information Processing and Retrieval, Vol. 33(2), 1997
- D. Das, A.F.T. Martins. A survey on automatic text summarization, Rapport technique, Literature Survey for the Language and Statistics II course at Carnegie Mellon University, 2007
- T. Dutoit. An introduction to text-to-speech synthesis, Springer Science & Business Media, 2013
- C. Guinaudeau, G. Gravier, P. Sébillot. Enhancing lexical cohesion measure with confidence measures, semantic relations and language model interpolation for multimedia spoken content topic segmentation, Computer Speech and Language, Vol. 26(2), p. 90-104, 2012
- J. Gray, L. Bounegru, L. Chambers, N. Kayser-Bril (Dir.). Guide du Datajournalisme : collecter, analyser et visualiser les données, sur http://jplusplus.github.io/guide-du-datajournalisme/. Consulté le 3 nov. 2015
- G. Tur, R. De Mori. Spoken language understanding: Systems for extracting semantic information from speech, Wiley Online Library, 2011

Requirements :
Knowledge about machine learning techniques; the 3rd year NLP module

Organisation :
- Hand-out in English and course possibly taught in English
- Need for deepening of the courses, and preparation of practical work

Evaluation :
One 1 hour written examination at the end of the semester, and one practical work.

Target :

Secure programming	INF08-PRGSECU
Number of hours : 26.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 0.00 h, TP : 14.00 h	handout in English
Reference Teacher(s) : FILA Barbara	

Objectives :
Reference Teacher(s): Barbara Fila (administrative responsible)
François Foyer (ETRS, teacher)
Olivier Levillain (Telecom-Sudparis, teacher)

At the end of this course, the students will understand the stakes of secure development, as well as common threats, with a special focus on web security. They should also learn how to apply several tools and methodologies related to software engineering. Moreover, they should develop a critical eye allowing them to adapt their knowledge to new threats.

Content :
This course aims at describing the main categories of software vulnerabilities, at detailing their impact on the security, and at
explaining how to fix the problems. Beyond testing and bug-fixing, the course will also explain how to be proactive to improve the
security during software development, using current tools (git, GitLab) and methodologies (test-driven development).

The course covers the theoretical description of vulnerabilities, concrete examples of software flaws and the presentation of specific and generic countermeasures. Furthermore, the students have several TP sessions, including two graded sessions.

The 26h will be roughly divided as follows:
- 8h on classical vulnerabilities and best practices
- 8h on web development security
- 6h on tools and methodologies (git, TDD)
- 4h on the parsers (graded TP + retex)

Bibliography :
There is no required reading before the course, but here are some useful links for the interested students.
- oss-security (http://www.openwall.com/lists/oss-security/) is a mailing list where vulnerabilities and patches concerning open source software are published;
- the CERT-FR web site (http://www.cert.ssi.gouv.fr/) or the corresponding mailing list publishes information on current vulnerabilities, as well as broader documents on cybersecurity news;
- [Memory management flaws] Smashing Stack For Fun and Profit, the historical article describing how to exploit a buffer overflow (http://insecure.org/stf/smashstack.html);
- [Langages] The studies led by ANSSI on programming languages: JavaSec (http://www.ssi.gouv.fr/agence/publication/securite-et-langage-java/) et LaFoSec (http://www.ssi.gouv.fr/agence/publication/lafosec-securite-et-langages-fonctionnels/);
- [Langages] The Mind Your Languages article describing traps in programming languages (http://spw14.langsec.org/abstracts.html#mind). The corresponding course will present examples from the article, as well as new ones.
- [Tools] Pro Git book, by Scott Chacon and Ben Straub;
- [Tools] Test-Driven Development: By example, by Kent Beck

Requirements :
Basis in programming are required. For the graded TP, the students need to know how to program in a language of their choice (this choice must be validated). Notions of computer architecture will also be useful.

Organisation :
- "cours magistraux" to present theoretical aspects, examples, countermeasures and best practice;
- "TP" to test how flaws work in practice and to learn how to fix them;

Evaluation :
- a graded TP in programming (coefficient 1);
- a graded TP in web security (coefficient 1).

Target :
4INFO (options: Security and Cloud)

Clouds	INF08-CLOUDS
Number of hours : 26.00 h	2.00 ECTS credit
CM : 12.00 h, TP : 14.00 h	hand-out in English and course taught in English
Reference Teacher(s) : PARLAVANTZAS Nikolaos	

Objectives :
This course aims to present the main concepts of cloud computing and to allow students to gain practical experience with modern cloud technologies.

Content :
* Overview of cloud computing
* Virtualisation
* Types of clouds
* Programming models
* Example cloud platforms

Bibliography :
* The Cloud at Your Service, Jothy Rosenberg and Arthur Mateos, Manning Publications, 2010
* Cloud Computing: Concepts, Technology & Architecture, Thomas Erl, Ricardo Puttini, Zaigham Mahmood, Prentice Hall, 2013

Requirements :

Organisation :

Evaluation :
Written examination

Target :

Summer Work Placement	INF08-STAGE
Number of hours : 240.00 h	8.00 ECTS credit
ES : 1.00 h	
Reference Teacher(s) : COSTAN Alexandru	

Objectives :
The summer internship takes place in companies or in research laboratories for a period of two or three months. For many students this represents their first job experience. The internship 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 during their internship.

Content :
Examples of previous internship 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 the report.

Target :

English	HUM08-ANGL
Number of hours : 24.00 h	2.00 ECTS credit
TD : 24.00 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. 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 :

ECONOMIC, LEGAL AND SOCIAL ISSUES	HUM08-TEJS
Number of hours : 10.00 h	1.00 ECTS credit
TD : 10.00 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
- Establishing a specific-vocabulary base
- Develop their curiosity and critical thinking

Content :
The topics covered may vary depending on the speakers and the the current events, however attention will be paid to two subjects in particular: the financial and monetary system (MSM), climate change (STIC).

Bibliography :
Provided during the course

Requirements :
None

Organisation :

Evaluation :
Continuous assessment (collective work)

Target :

Engineer & Society - M1	HUM08-SHES1
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h	
Reference Teacher(s) : ECHARD Philippe	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Engineer & Society - M2	HUM08-SHES2
Number of hours : 14.00 h	1.00 ECTS credit
CM : 14.00 h	
Reference Teacher(s) : ECHARD Philippe	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Sport and Physical Education	HUM08-EPS
Number of hours : 20.00 h	1.00 ECTS credit
TD : 20.00 h, TD : 20.00 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 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 :

INNOVATION & ENTREPRENEURSHIP (RIE)	HUM08-IE
Number of hours : 48.00 h	2.00 ECTS credit
TD : 48.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Semestre 9

Parcours Contrat de professionalisation

1	**INF09-1**		**Specialization**	**12.50**
	INF09-DevOps	O	DevOps	4.00
	INF09-BDASW	O	Advanced Databases and Semantic Web	3.00
	INF09-DSL	O	Domain-Specific language	3.50
	INF09-CP	O	Competitive programming	2.00
2	**INF09-2**		**Projects and implementation**	**6.00**
	INF09-SFFS	O	From Know-How to let know	2.00
	INF09-COM	O	Communication, savoir etre en entreprise et formation juridique	2.00
	INF09-IHM	O	IHM et UX	2.00
3	**INF09-3**		**Opening course and options**	**6.00**
	INFT1-SANTE	C	Conception d'applications innovantes pour la santé et la rééductaion	2.00
	INFT1-IOT	C	Internet of Things	2.00
	INFT1-OPT	C	Optimization	2.00
	INF09-RV	C	Virtual Reality	2.00
	INF09-AMRG	C	Motion Analysis and Gesture Recognition (2D / 3D)	2.00
	INF09-SECU	C	Side channel attacks	2.00
	INF09-PROTOCOL	C	Protocols verification	2.00
	INF09-ALGODATA	C	Big Data Algorithms	2.00
	INF09-DATA	C	Big Data Storage and Processing	2.00
	INF09-AD	C	Distributed Algorithms	2.00
4	**HUM09-INFO-PRO**		**Non-scientific syllabus S9 (professional management)**	**5.50**
	HUM09-ANGL-CONV	C	English S9 Conversation	1.50
	HUM09-ANGL-TOEIC	C	TOEIC 5th year	1.50
	INF09-STGDATING	O	Internship Dating	1.00
	INF09-ETHIQUE	O	Formation éthique de l'ingénieur	1.00
	HUM09-PM-PRO	O	Economics, Law and Business Studies (Professional management)	2.00

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

DevOps	INF09-DevOps
Number of hours : 38.00 h	4.00 ECTS credit
CM : 4.00 h, PR : 14.00 h, TD : 8.00 h, TP : 12.00 h	hand-out in English and course taught in English
Reference Teacher(s) : BLOUIN Arnaud	

Objectives :
Software quality a major concern of today's and future economy. The ability to increase the quality and the user experience of software systems while keeping the agility for constant evolutions is key to the viability and the sustainability of all industries.
DevOps has emerged, as a major cultural movement to handle this need for increased agility. This movement is essentially about bridging the gap between the developers (Dev) and the teams that ship and deploy the software systems (Ops).
The objective of this class is to understand the core concepts of DevOps and how it currently works in practice.

keywords:
software engineering, software testing, continuous integration, automation, continuous delivery

Content :
Classes detail the different steps of DevOps through a mix between classical lessons and practical sessions to work on a software project.

Bibliography :

Requirements :
A strong background in software testing and object-oriented programming.

Organisation :

Evaluation :
The project is evaluated.

Target :

Advanced Databases and Semantic Web	INF09-BDASW
Number of hours : 28.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 2.00 h, TP : 12.00 h	handout in English
Reference Teacher(s) : CELLIER-BELLINA Peggy	

Objectives :
This module has three main objectives: first, it provides an in-depth presentation of fundamental technical aspects of traditional Database Management Systems (DBMSs); second, it offers a study of the concepts of the NoSQL databases, and finally it introduces the semantic web concepts, in particular the representation of the linked data (RDF) and the query language (SPARQL).

Content :
1) In-depth presentation of fundamental aspects necessary for the practical management of relational DBMSs
- transactions. concurrency control. active DBMSs
- tuning

2) Presentation databases NoSQL
3) Introduction semantic web
- RDF, RDFS, OWL
- SPARQL- Master 2 (Computer science)

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
- Le web sémantique, F. Gandon, C. Faron-Zucker, O. Corby, Dunod, 2012

Requirements :
Basics of relational DBMSs
Basic of XML and XQuery

Organisation :
- Hand-out in English and course possibly taught in English
- Need for deepening of the courses, and preparation of practical work.

Evaluation :
A two-hour written examination

Target :
- Master 2 (Computer science)

Domain-Specific language	INF09-DSL
Number of hours : 34.00 h	3.50 ECTS credit
CM : 2.00 h, PR : 16.00 h, TD : 6.00 h, TP : 10.00 h	
Reference Teacher(s) :	

Objectives :
Software industry faces the constant increase of systems complexity. Modelling aims at mastering this complexity through the Model-Driven Engineering (MDE) domain. In MDE, models focus on specific problems for a specific audience to ease the software development process.

MDE tools help software engineers in developing and tooling languages that are designed to answer specific problems; we call such languages, domain-specific languages (DSL).

DSLs are widely used in the industry. You may have used them already without necessarily realizing it.

The objective of this class is to understand the core concepts for building DSLs.

keywords: software engineering, domain-specific languages, generative programming, code generation, software modelling, formal grammar

Content :
Practical and project sessions aim at manipulating DSL tools to build domain-specific languages and their associated tools.

Bibliography :

Requirements :
A strong background in software engineering.
A background in: software modelling (UML); formal grammar.

Organisation :

Evaluation :
The project is evaluated.

Target :

Competitive programming	INF09-CP
Number of hours : 20.00 h	2.00 ECTS credit
CM : 0.00 h, TD : 8.00 h, TP : 12.00 h	handout in English
Reference Teacher(s) : GARCIA Pascal	

Objectives :
Learning to solve algorithmic problems.

Content :
- How to solve it?
- Design of algorithms by induction.
- Practical complexity.
- Data structures (heap, union-find, binary search tree, segment tree, ...).
- Specific design methods (brute-force, greedy, divide and conquer, dynamic programming, ...).
- Specific domains (graphs, string processing, ...).

Bibliography :
* Competitive Programming 3. Steven Alim and Felix Alim.
* Looking for a Challenge? The Ultimate Problem Set from the University of Warsaw Programming Competitions.
* The Hitchhiker's Guide to the Programming Contests.
* How to Solve It. G. Polya.
* Principles of Mathematical Problem Solving. Martin J. Erickson and Joe Flowers.
* The Art and Craft of Problem Solving. Paul Zeitz.
* Introduction to Algorithms: A Creative Approach. Udi Manber.

Requirements :

Organisation :
Cours/TD/TP

Evaluation :
Written exam

Target :

From Know-How to let know	INF09-SFFS
Number of hours : 28.00 h	2.00 ECTS credit
CM : 2.00 h, DIV : 1.00 h, EP : 3.00 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 :

Communication, savoir etre en entreprise et formation juridique	INF09-COM
Number of hours : 20.00 h	2.00 ECTS credit
CM : 6.00 h, EP : 14.00 h	
Reference Teacher(s) : CELLIER-BELLINA Peggy	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

IHM et UX	INF09-IHM
Number of hours : 24.00 h	2.00 ECTS credit
CM : 8.00 h, TP : 16.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Conception d'applications innovantes pour la santé et la rééductaion	INFT1-SANTE
Number of hours : 26.00 h	2.00 ECTS credit
CM : 6.00 h, TP : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Internet of Things	INFT1-IOT
Number of hours : 26.00 h	2.00 ECTS credit
CM : 14.00 h, TP : 12.00 h	
Reference Teacher(s) :	

Objectives :
Introduction to the Internet of Things

Content :
(subject to change)

* Introduction to the Internet of Things
* Networks for IoT
* Operating Systems for IoT
* IoT and Big Data
* IoT, security and privacy
* IoT and healthcare
* IoT and home automation

Bibliography :

Requirements :
Basic knowledge in operating systems, networks and algorithms

Organisation :
Course, conferences and lab works in small groups for working with innovative devices

Evaluation :
Continuous review

Target :
5th year students

Optimization	INFT1-OPT
Number of hours : 26.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 10.00 h, TP : 4.00 h	
Reference Teacher(s) :	

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 :

Evaluation :
Two-hour examination at the end of the semester.

Target :

Virtual Reality	INF09-RV
Number of hours : 26.00 h	2.00 ECTS credit
CM : 4.00 h, EP : 22.00 h	
Reference Teacher(s) : GOURANTON Valerie	

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 :

Motion Analysis and Gesture Recognition (2D / 3D)	INF09-AMRG
Number of hours : 30.00 h	2.00 ECTS credit
CM : 16.00 h, DIV : 0.00 h, TP : 14.00 h	
Reference Teacher(s) : ANQUETIL Eric	

Objectives :
Speakers : Eric Anquetil (Insa Rennes, Manager) -Richard Kulpa (Rennes 2 University) - Ludovic Hoyet (Inria)

With the development of touchscreen and motion capture technology, new human-computer interaction gains in popularity in the recent years. These approaches have been designed to take advantage of the interaction potential offered by 2D and 3D action gestures recognition. These gestural controls allow the user to execute many actions simply by doing Gestures. Recognition of human actions (2D and 3D action gestures) has recently become an active research topic in Computer Vision, Pattern Recognition and Man-Machine Interaction.
In this course, we address this emerging topic: Motion Analysis, Interpretation and Recognition of 2D and 3D Gestures for new Man-Machine Interactions. Technically, an action is a sequence generated by a human subject during the performance of a task. Action recognition deals with the process of labelling such motion sequence with respect to the depicted motions.
The course will expose the specificity of the recognition process of these two kinds of actions (2D and 3D action gestures) but also the potential convergence of the scientific approaches used for each of them. We will also discuss in this course the notions of animations, field of application for which the gestural commands can be fully exploited.

Content :
First part: Signal acquisition, Preprocessing and Normalization (Richard Kulpa)
* Pen-based and (Multi-)Touch Capture on touch screen: smartphone, tablet PC and tangible surface which support simultaneous participation of multiple users.
* Motion capture (MoCap) systems to extract body postures based on 3D joint positions and orientations by using markers and high precision camera array.
* Microsoft Kinect or Leap Motion sensor.
* Morphology-independent pre-processing
* Human skeleton modelling

Second part: Gesture Recognition (2D / 3D) (Eric Anquetil)
* 2D and 3D feature extraction
* Temporal, spatial, shape and motion relation modeling
* Segmented gesture recognition (Skeleton-based human action recognition)
* Recognition and Machine Learning Approaches:
o Graph modelling, DTW, HMM, SVM, NN…
o Reject Option…
* Unsegmented stream of gesture recognition.
o Temporal segmentation methods.
o Sliding Window approach.
* Man-Machine Interaction : Eager and lazy Recognition, Direct manipulation and indirect commands

Third part: Animation (Ludovic Hoyet)
* Direct and Inverse Kinematics (analytical and numerical methods)
* Interpolations (linear, splines, etc.)
* Motion Editing (motion warping, motion blending, transplanting, motion cleaning, etc.)
* Controlling Motions
o Finite State Machines
o Motions Graphs

Bibliography :
[1] A. Delaye and E. Anquetil, “Hbf49 feature set: A first unified baseline for online symbol recognition,” Pattern Recognition, vol. 46, no. 1, pp. 117–130, 2013.
[2] Z. Chen, E. Anquetil, H. Mouchère, and C. Viard-Gaudin, “Recognize multi-touch gestures by graph modeling and matching,” in 17th Biennial Conference of the International Graphonomics Society, Pointe-a`-Pitre, France, Jun. 2015.
[3] D. Rubine, “Specifying gestures by example,” in Proceedings of the 18th Annual Conference on Computer Graphics and Interactive Techniques, ser. SIGGRAPH ’91. New York, NY, USA: ACM, 1991, pp. 329–337.
[4] S. Macé and E. Anquetil, “Eager interpretation of on-line hand-drawn structured documents: The dali methodology,” Pattern Recognition, vol. 42, no. 12, pp. 3202–3214, Dec. 2009.

[5] M. Mu¨ller, T. Ro¨der, M. Clausen, B. Eberhardt, B. Kru¨ger, and Weber, “Documentation mocap database hdm05,” 2007.
[6] Said Yacine Boulahia, Eric Anquetil, Richard Kulpa, Franck Multon, HIF3D: Handwriting-Inspired Features for 3D Skeleton-Based Action Recognition, IEEE. 23rd International Conference on Pattern Recognition (ICPR 2016), Dec 2016, Cancun, Mexico.
[7] Zhaoxin Chen, Eric Anquetil, Harold Mouchère, Christian Viard-Gaudin, The MUMTDB dataset for evaluating simultaneous composition of structured documents in a multi-user and multi-touch environment, 15th International Conference on Frontiers in Handwriting Recognition, Oct 2016, Shenzhen, China
[8] L. Xia, C.-C. Chen, and J. Aggarwal, “View invariant human action recognition using histograms of 3d joints,” in IEEE Computer Society Conference on Computer Vision and Pattern Recognition Workshops (CVPRW), pp. 20–27, 2012.
[9] M. A. Gowayyed, M. Torki, M. E. Hussein, and M. El-Saban, “Histogram of oriented displacements (hod): describing trajectories of human joints for action recognition,” in Proceedings of the International Joint Conference on Artificial Intelligence, pp. 1351–1357, 2013.
[10] R. Vemulapalli, F. Arrate, and R. Chellappa, “Human action recog- nition by representing 3d skeletons as points in a lie group,” in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, pp. 588–595, 2014.
[11] R. Chaudhry, F. Ofli, G. Kurillo, R. Bajcsy, and R. Vidal, “Bio- inspired dynamic 3d discriminative skeletal features for human action recognition,” in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops, pp. 471–478,2013.
[12] H. Zhang and L. E. Parker, “Bio-inspired predictive orientation decomposition of skeleton trajectories for real-time human activity prediction,” in Proceedings of the IEEE International Conference on Robotics and Automation, pp. 3053–3060, 2015.
[13] R. Kulpa, F. Multon, and B. Arnaldi, “Morphology-independent representation of motions for interactive human-like animation,” in Computer Graphics Forum, vol. 24, pp. 343–351, 2005.
[14] A. Sorel, R. Kulpa, E. Badier, and F. Multon, “Dealing with vari- ability when recognizing user’s performance in natural 3d gesture interfaces,” International Journal of Pattern Recognition and Artificial Intelligence, vol. 27, no. 08, 2013.
[15] M. E. Hussein, M. Torki, M. A. Gowayyed, and M. El-Saban, “Human action recognition using a temporal hierarchy of covariance descriptors on 3d joint locations,” in Proceedings of the International Joint Conference on Artificial Intelligence, vol. 13, pp. 2466–2472, 2013.
[16] G. Evangelidis, G. Singh, and R. Horaud, “Skeletal quads: Human action recognition using joint quadruples,” in Proceedings of the IEEE International Conference on Pattern Recognition, pp. 4513– 4518, 2014.
[17] V. Bloom, D. Makris, and V. Argyriou. Clustered spatio- temporal manifolds for online action recognition. In Pattern Recognition (ICPR), 2014 22nd International Conference on, pages 3963–3968. IEEE, 2014.
[18] Y. Li, C. Lan, J. Xing, W. Zeng, C. Yuan, and J. Liu. Online human action detection using joint classification-regression recurrent neural networks. arXiv preprint arXiv:1604.05633, 2016.
[19] finger-count interaction: Combining multitouch gestures and menus”, International Journal of Human-Computer Studies, v.70 n.10, p.673-689, October, 2012.
[20] Sriganesh Madhvanath, Dinesh Mandalapu, Tarun Madan, Naznin Rao, Ramesh Kozhissery, “GeCCo: Finger gesture-based command and control for touch interfaces”, IHCI 2012: 1-6.
[21] Armin Bruderlin and Lance Williams. 1995. Motion signal processing. In Proceedings of the 22nd annual conference on Computer graphics and interactive techniques (SIGGRAPH '95), Susan G. Mair and Robert Cook (Eds.). ACM, New York, NY, USA, 97-104.
[22] Andrew Witkin and Zoran Popovic. 1995. Motion warping. In Proceedings of the 22nd annual conference on Computer graphics and interactive techniques (SIGGRAPH '95), Susan G. Mair and Robert Cook (Eds.). ACM, New York, NY, USA, 105-108.
[23] Charles Rose, Brian Guenter, Bobby Bodenheimer, and Michael F. Cohen. 1996. Efficient generation of motion transitions using spacetime constraints. In Proceedings of the 23rd annual conference on Computer graphics and interactive techniques (SIGGRAPH '96). ACM, New York, NY, USA, 147-154.
[24] Charles Rose, Michael F. Cohen, and Bobby Bodenheimer. 1998. Verbs and Adverbs: Multidimensional Motion Interpolation. IEEE Comput. Graph. Appl. 18, 5 (September 1998), 32-40.
[25] Michael Gleicher. 1998. Retargetting motion to new characters. In Proceedings of the 25th annual conference on Computer graphics and interactive techniques (SIGGRAPH '98). ACM, New York, NY, USA, 33-42.
[26] Lucas Kovar, Michael Gleicher, and Frédéric Pighin. 2002. Motion graphs. ACM Trans. Graph. 21, 3 (July 2002), 473-482.
[27] Lucas Kovar, John Schreiner, and Michael Gleicher. 2002. Footskate cleanup for motion capture editing. In Proceedings of the 2002 ACM SIGGRAPH/Eurographics symposium on Computer animation (SCA '02). ACM, New York, NY, USA, 97-104.

Requirements :
Object-oriented programming

Organisation :
This module will be articulated on a course (16h) which will be supported by a TP (10h), applying the notions of the course through a practical realization dealing with the capture of the gesture, its recognition and its use in the context of an animation challenge.

Evaluation :
The evaluation is based on a defense of the TP / project developed during the module. The presentation support and the developed code will be part of the requested deliverables.

Target :

Side channel attacks	INF09-SECU
Number of hours : 26.00 h	2.00 ECTS credit
CM : 10.00 h, TP : 16.00 h	hand-out in English and course taught in English
Reference Teacher(s) : AVOINE Gildas	

Objectives :
Learn the fundamentals of hardware-based and software-based side channel attacks and their countermeasures.

Content :
The course on “Side-channel attacks” addresses the specificities of software and hardware systems that lead to side-channel attacks. To keep in touch with real-life concerns as well as state-of-the art research, the course is taught by an engineer-researcher from the French ministry of defense (DGA-MI) whose activities are related to embedded cryptography, and a full-time CNRS researcher whose research is related to micro-architectural attacks.

The course considers techniques for secure implementations, physical attacks on microcircuits (timing and power side-channel attacks, fault injection attacks, etc.), as well as software-based attacks on micro-architecture of modern CPUs (side-channel attacks on caches and fault attacks on DRAM, etc.).

Bibliography :

Requirements :
The courses “engineering cryptography” and “operating system” from INSA Rennes (4INFO), or any other equivalent courses.

Organisation :
A large part of the course is devoted to hands-on sessions.

Evaluation :
Theoretical examination in a computer room, with an additional (randomly chosen) lab presentation.

Target :
5 INFO

Protocols verification	INF09-PROTOCOL
Number of hours : 26.00 h	2.00 ECTS credit
CM : 24.00 h, EP : 2.00 h	
Reference Teacher(s) : FILA Barbara	

Objectives :
The objective of this course is to provide students with an in-depth knowledge regarding methods and tools for the specification, design, and symbolic verification of security protocols in various domains.

After a successful completion of this course, the students should be able to:
- Specify a protocol in a suitable formal framework;
- Formally define the security property against which the protocol should be checked;
- Select an appropriate verification tool to analyze the protocol;
- Detect logical flaws in improperly designed or implemented protocols.

Content :
The following topics will be covered in this course:
* Formal ways of specifying a protocol: Alice & Bob notation, message sequence charts, process algebra, Horn clauses, constraint systems, applied pi calculus;
* Attacker models: passive and active attackers, Dolev-Yao adversary, knowledge inference;
* Formal specification of security properties: trace properties, indistinguishability properties, equivalence properties, weak and strong secrecy, authentication (aliveness, agreement, synchronization), anonymity;
* Man-in-the-middle attacks;
* Protocol verification with a bounded number of sessions: constraint systems;
* Protocol verification with an unbounded number of sessions: Horn Clauses;
* Tools for automatic verification of security protocols: get started with Scyther, go deeper with ProVerif.

Bibliography :
- Cas Cremers and Sjouke Mauw. Operational Semantics and Verification of Security Protocols, Springer 2012, ISBN: 978-3-540-78635-1 (Print) 978-3-540-78636-8 (Online).
- Véronique Cortier, Steve Kremer. Formal Models and Techniques for Analyzing Security Protocols: A Tutorial. Foundations and Trends in Programming Languages 1(3): 151-267 (2014).

Requirements :
Introduction to security course 3INFO

Organisation :
Studying course work; personal work on the project.
This course will partially be taught in English.

Evaluation :
- Two-hour written examination (2/3 of teh final grade)
- Project (1/3 of teh final grade)

Target :
5info - Security track

Big Data Algorithms	INF09-ALGODATA
Number of hours : 26.00 h	2.00 ECTS credit
CM : 14.00 h, TP : 12.00 h	
Reference Teacher(s) : COSTAN Alexandru	

Objectives :
The goal of this course is to study the specific challenges of algorithms processing Big Data: how to reduce the data complexity, process the data deluge in real-time, propose new paradigms to allow the extraction of relevant knowledge. The course focuses on the main design principles of the fundamental algorithms for Big Data processing. In particular, we will study algorithms for stream processing, social networks, recommendation systems, classification, trend detection and sentiment analysis. We will implement and evaluate these algorithms using the Apache Flink Big Data processing framework.

Content :
- Graph theory and social networks
- Sentiment analysis and trend detection
- Stream processing
- Classification algorithms
- Recommandation algorithms
- Fake news detection
- Clustering algorithms

Bibliography :
B. Howe, Introduction to Data Science
R. Swan, J. Allan, Automatic Generation of Overview Timelines
H.R. Varian, H. Choi, Predic;ng the Present with Google Trends, Google Research Blog
J. Allan, R. Papka, V. Lavrenko, On-line New Event Detection and Tracking
R. Bandari, S. Asur, B. Huberman, The Pulse of News in Social Media: Forecasting Popularity

Requirements :
Database and systems (cloud, parallelism) concepts, Java programming skills.

Organisation :
7 Lectures (1,5h each)
6 Practical Labs (1,5h each)
4 Support Sessions – online (2 Lectures + 2 Practical Labs - 1,5h each)

Evaluation :
The grade of the course will be the grade of the practical sessions.

Target :
Students interested in becoming data scientists, big data analysts, social networks experts.

Big Data Storage and Processing	INF09-DATA
Number of hours : 26.00 h	2.00 ECTS credit
CM : 14.00 h, TP : 12.00 h	hand-out in English and course taught in English
Reference Teacher(s) : COSTAN Alexandru	

Objectives :
This course aims to provide the theoretical and practical bases for storing and effectively processing large volumes of data. It essentially aims to familiarize students with data storage and sharing at large scale (collecting, retrieving, accessing Big Data) and to introduce the concepts associated with these types of data (metadata, NoSQL, cloud storage).

We will first study how to analyze, organize and present Big Data in order to address their specific challenges: reduce the complexity, process the data deluge in real time, propose new paradigms to allow the extraction of relevant knowledge.

The course will then introduce the state-of-art Big Data computing platforms with the focus on how to utilize them in processing (managing and analyzing) massive datasets. Specifically, we will discuss the Apache Hadoop MapReduce and Apache Spark frameworks, which provide the most accessible and practical means of computing with large datasets in the Cloud.

We will also introduce the emerging distributed database and services, such as HBase/Cassandra etc.

Finally, we will utilize several key data processing tasks, including simple statistics, data aggregation, frequent pattern mining, data clustering, information retrieval, PageRank, and massive graph analytics as the real-life case study for large scale data processing in the fields of science and business.

Content :
- Unstructured and structured Big Data
- Consistency models
- Special contextual and ubiquitous data (sensors and mobile sensors, RFID readers, wireless sensor networks, etc.)
- Storage models for Cloud (Binary Large Objects: Amazon S3, Azure Blobs), NoSQL(Google BigTable, Cassandra), disk storage (GoogleFS, HDFS, PVFS, Lustre), in-memory storage (key-value stores, hybrid systems: memecached, mongoDB)
- Big Data processing platforms: Apache Hadoop, Apache Spark

Bibliography :
- Tom White, Hadoop: The Definitive Guide, 3rd Edition Storage and Analysis at Internet Scale, O'Reilly
- The Fourth Paradigm: Data-Intensive Scientific Discovery, Microsoft Research
- Jeffrey Dean, Sanjay Ghemawat, MapReduce: Simplified Data Processing on Large Clusters, Google Research
- Big Data Now, O'Reilly Media
- Q. Ethan McCallum, Bad Data Handbook: Cleaning Up The Data So You Can Get Back To Work, O'Reilly
- Pramod J. Sadalage, Martin Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley

Requirements :
Database and systems (cloud, parallelism) concepts, Java programming skills.

Organisation :
7 Lectures (1,5h each)
6 Practical Labs (1,5h each)
4 Support Sessions – online (2 Lectures + 2 Practical Labs - 1,5h each)

Evaluation :
The grade of the course will be the grade of the practical sessions.

Target :
Students pursuing a Big Data expert career, data analyst in science or industry, social networks expert etc.
5info - Option Data Science & Clouds

Distributed Algorithms	INF09-AD
Number of hours : 26.00 h	2.00 ECTS credit
CM : 14.00 h, TP : 12.00 h	
Reference Teacher(s) : BERTIER Marin	

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 :

English S9 Conversation	HUM09-ANGL-CONV
Number of hours : 10.00 h	1.50 ECTS credit
TD : 10.00 h	
Reference Teacher(s) : LE VOT Philippe	

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	HUM09-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

Internship Dating	INF09-STGDATING
Number of hours : 15.00 h	1.00 ECTS credit
CONF : 15.00 h	
Reference Teacher(s) : BLOUIN Arnaud	

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:
- data management, data science, big data
- introduction to the profession of IT architect

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 :

Formation éthique de l'ingénieur	INF09-ETHIQUE
Number of hours : 16.00 h	1.00 ECTS credit
CM : 12.00 h, TD : 4.00 h	
Reference Teacher(s) : CELLIER-BELLINA Peggy	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Economics, Law and Business Studies (Professional management)	HUM09-PM-PRO
Number of hours : 70.00 h	2.00 ECTS credit
TA : 70.00 h, TA : 70.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Semestre 9

Parcours Formation Initiale INFO

1	**INF09-1**		**Specialization**	**12.50**
	INF09-DevOps	O	DevOps	4.00
	INF09-BDASW	O	Advanced Databases and Semantic Web	3.00
	INF09-DSL	O	Domain-Specific language	3.50
	INF09-CP	O	Competitive programming	2.00
2	**INF09-2**		**Projects and implementation**	**6.00**
	INF09-SFFS	O	From Know-How to let know	2.00
	INF09-COM	O	Communication, savoir etre en entreprise et formation juridique	2.00
	INF09-IHM	O	IHM et UX	2.00
3	**INF09-3**		**Opening course and options**	**6.00**
	INFT1-SANTE	C	Conception d'applications innovantes pour la santé et la rééductaion	2.00
	INFT1-IOT	C	Internet of Things	2.00
	INFT1-OPT	C	Optimization	2.00
	INF09-RV	C	Virtual Reality	2.00
	INF09-AMRG	C	Motion Analysis and Gesture Recognition (2D / 3D)	2.00
	INF09-SECU	C	Side channel attacks	2.00
	INF09-PROTOCOL	C	Protocols verification	2.00
	INF09-ALGODATA	C	Big Data Algorithms	2.00
	INF09-DATA	C	Big Data Storage and Processing	2.00
	INF09-AD	C	Distributed Algorithms	2.00
4	**HUM09**		**Non-scientific syllabus S9**	**5.50**
	HUM09-ANGL-CONV	C	English S9 Conversation	1.50
	HUM09-ANGL-TOEIC	C	TOEIC 5th year	1.50
	HUM09-PM-A	C	Economics, Law and Business Studies A - LEAN MANAGEMENT	2.00
	HUM09-PM-B	C	Economics, Law and Business Studies B (Human Resources Management)	2.00
	HUM09-PM-C	C	Economics, Law and Business Studies C (Human Resources Management)	2.00
	HUM09-PM-D	C	Economics, Law and Business Studies D MANAGEMENT AND ETHICS FOR ENGINEERS	2.00
	HUM09-PM-E	C	Economics, Law and Business Studies E (INTERNATIONAL DEVELOPPEMENT & STRATEGIES)	2.00
	HUM09-PM-F	C	Economics, Law and Business Studies F (sustainable development)	2.00
	EII09-EVST	C	Internship evaluation	1.00
	HUM09-PM-G	C	Economics, Law and Business Studies G (serious game)	2.00
	EII09-HUMT	C	Societal responsibility of business	1.00
	EII09-EVST	C	Internship evaluation	1.00
	INF09-STGDATING	C	Internship Dating	1.00
	GCU09-SPEC-GPC	C	Management of construction project	1.00
	GCU09-SPEC-GPD	C	BIM Project Management	1.00
	DET09-CONF	C	SRC09-CONFERENCES	1.00
	INF09-ETHIQUE	C	Formation éthique de l'ingénieur	1.00

	HUM09-PM-PRO	C	Economics, Law and Business Studies (Professional management)	2.00
6	**HUMF1-ELSA Mus**		**Music with studies**	**1.00**
	HUMF1-MUS	F	Music Studies	1.00

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

DevOps	INF09-DevOps
Number of hours : 38.00 h	4.00 ECTS credit
CM : 4.00 h, PR : 14.00 h, TD : 8.00 h, TP : 12.00 h	hand-out in English and course taught in English
Reference Teacher(s) : BLOUIN Arnaud	

Objectives :
Software quality a major concern of today's and future economy. The ability to increase the quality and the user experience of software systems while keeping the agility for constant evolutions is key to the viability and the sustainability of all industries.
DevOps has emerged, as a major cultural movement to handle this need for increased agility. This movement is essentially about bridging the gap between the developers (Dev) and the teams that ship and deploy the software systems (Ops).
The objective of this class is to understand the core concepts of DevOps and how it currently works in practice.

keywords:
software engineering, software testing, continuous integration, automation, continuous delivery

Content :
Classes detail the different steps of DevOps through a mix between classical lessons and practical sessions to work on a software project.

Bibliography :

Requirements :
A strong background in software testing and object-oriented programming.

Organisation :

Evaluation :
The project is evaluated.

Target :

Advanced Databases and Semantic Web	INF09-BDASW
Number of hours : 28.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 2.00 h, TP : 12.00 h	handout in English
Reference Teacher(s) : CELLIER-BELLINA Peggy	

Objectives :
This module has three main objectives: first, it provides an in-depth presentation of fundamental technical aspects of traditional Database Management Systems (DBMSs); second, it offers a study of the concepts of the NoSQL databases, and finally it introduces the semantic web concepts, in particular the representation of the linked data (RDF) and the query language (SPARQL).

Content :
1) In-depth presentation of fundamental aspects necessary for the practical management of relational DBMSs
- transactions. concurrency control. active DBMSs
- tuning

2) Presentation databases NoSQL
3) Introduction semantic web
- RDF, RDFS, OWL
- SPARQL- Master 2 (Computer science)

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
- Le web sémantique, F. Gandon, C. Faron-Zucker, O. Corby, Dunod, 2012

Requirements :
Basics of relational DBMSs
Basic of XML and XQuery

Organisation :
- Hand-out in English and course possibly taught in English
- Need for deepening of the courses, and preparation of practical work.

Evaluation :
A two-hour written examination

Target :
- Master 2 (Computer science)

Domain-Specific language	INF09-DSL
Number of hours : 34.00 h	3.50 ECTS credit
CM : 2.00 h, PR : 16.00 h, TD : 6.00 h, TP : 10.00 h	
Reference Teacher(s) :	

Objectives :
Software industry faces the constant increase of systems complexity. Modelling aims at mastering this complexity through the Model-Driven Engineering (MDE) domain. In MDE, models focus on specific problems for a specific audience to ease the software development process.

MDE tools help software engineers in developing and tooling languages that are designed to answer specific problems; we call such languages, domain-specific languages (DSL).

DSLs are widely used in the industry. You may have used them already without necessarily realizing it.

The objective of this class is to understand the core concepts for building DSLs.

keywords: software engineering, domain-specific languages, generative programming, code generation, software modelling, formal grammar

Content :
Practical and project sessions aim at manipulating DSL tools to build domain-specific languages and their associated tools.

Bibliography :

Requirements :
A strong background in software engineering.
A background in: software modelling (UML); formal grammar.

Organisation :

Evaluation :
The project is evaluated.

Target :

Competitive programming	INF09-CP
Number of hours : 20.00 h	2.00 ECTS credit
CM : 0.00 h, TD : 8.00 h, TP : 12.00 h	handout in English
Reference Teacher(s) : GARCIA Pascal	

Objectives :
Learning to solve algorithmic problems.

Content :
- How to solve it?
- Design of algorithms by induction.
- Practical complexity.
- Data structures (heap, union-find, binary search tree, segment tree, ...).
- Specific design methods (brute-force, greedy, divide and conquer, dynamic programming, ...).
- Specific domains (graphs, string processing, ...).

Bibliography :
* Competitive Programming 3. Steven Alim and Felix Alim.
* Looking for a Challenge? The Ultimate Problem Set from the University of Warsaw Programming Competitions.
* The Hitchhiker's Guide to the Programming Contests.
* How to Solve It. G. Polya.
* Principles of Mathematical Problem Solving. Martin J. Erickson and Joe Flowers.
* The Art and Craft of Problem Solving. Paul Zeitz.
* Introduction to Algorithms: A Creative Approach. Udi Manber.

Requirements :

Organisation :
Cours/TD/TP

Evaluation :
Written exam

Target :

From Know-How to let know	INF09-SFFS
Number of hours : 28.00 h	2.00 ECTS credit
CM : 2.00 h, DIV : 1.00 h, EP : 3.00 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 :

Communication, savoir etre en entreprise et formation juridique	INF09-COM
Number of hours : 20.00 h	2.00 ECTS credit
CM : 6.00 h, EP : 14.00 h	
Reference Teacher(s) : CELLIER-BELLINA Peggy	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

IHM et UX	INF09-IHM
Number of hours : 24.00 h	2.00 ECTS credit
CM : 8.00 h, TP : 16.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Conception d'applications innovantes pour la santé et la rééductaion	INFT1-SANTE
Number of hours : 26.00 h	2.00 ECTS credit
CM : 6.00 h, TP : 20.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Internet of Things	INFT1-IOT
Number of hours : 26.00 h	2.00 ECTS credit
CM : 14.00 h, TP : 12.00 h	
Reference Teacher(s) :	

Objectives :
Introduction to the Internet of Things

Content :
(subject to change)

* Introduction to the Internet of Things
* Networks for IoT
* Operating Systems for IoT
* IoT and Big Data
* IoT, security and privacy
* IoT and healthcare
* IoT and home automation

Bibliography :

Requirements :
Basic knowledge in operating systems, networks and algorithms

Organisation :
Course, conferences and lab works in small groups for working with innovative devices

Evaluation :
Continuous review

Target :
5th year students

Optimization	INFT1-OPT
Number of hours : 26.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 10.00 h, TP : 4.00 h	
Reference Teacher(s) :	

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 :

Evaluation :
Two-hour examination at the end of the semester.

Target :

Virtual Reality	INF09-RV
Number of hours : 26.00 h	2.00 ECTS credit
CM : 4.00 h, EP : 22.00 h	
Reference Teacher(s) : GOURANTON Valerie	

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 :

Motion Analysis and Gesture Recognition (2D / 3D)	INF09-AMRG
Number of hours : 30.00 h	2.00 ECTS credit
CM : 16.00 h, DIV : 0.00 h, TP : 14.00 h	
Reference Teacher(s) : ANQUETIL Eric	

Objectives :
Speakers : Eric Anquetil (Insa Rennes, Manager) -Richard Kulpa (Rennes 2 University) - Ludovic Hoyet (Inria)

With the development of touchscreen and motion capture technology, new human-computer interaction gains in popularity in the recent years. These approaches have been designed to take advantage of the interaction potential offered by 2D and 3D action gestures recognition. These gestural controls allow the user to execute many actions simply by doing Gestures. Recognition of human actions (2D and 3D action gestures) has recently become an active research topic in Computer Vision, Pattern Recognition and Man-Machine Interaction.
In this course, we address this emerging topic: Motion Analysis, Interpretation and Recognition of 2D and 3D Gestures for new Man-Machine Interactions. Technically, an action is a sequence generated by a human subject during the performance of a task. Action recognition deals with the process of labelling such motion sequence with respect to the depicted motions.
The course will expose the specificity of the recognition process of these two kinds of actions (2D and 3D action gestures) but also the potential convergence of the scientific approaches used for each of them. We will also discuss in this course the notions of animations, field of application for which the gestural commands can be fully exploited.

Content :
First part: Signal acquisition, Preprocessing and Normalization (Richard Kulpa)
* Pen-based and (Multi-)Touch Capture on touch screen: smartphone, tablet PC and tangible surface which support simultaneous participation of multiple users.
* Motion capture (MoCap) systems to extract body postures based on 3D joint positions and orientations by using markers and high precision camera array.
* Microsoft Kinect or Leap Motion sensor.
* Morphology-independent pre-processing
* Human skeleton modelling

Second part: Gesture Recognition (2D / 3D) (Eric Anquetil)
* 2D and 3D feature extraction
* Temporal, spatial, shape and motion relation modeling
* Segmented gesture recognition (Skeleton-based human action recognition)
* Recognition and Machine Learning Approaches:
o Graph modelling, DTW, HMM, SVM, NN…
o Reject Option…
* Unsegmented stream of gesture recognition.
o Temporal segmentation methods.
o Sliding Window approach.
* Man-Machine Interaction : Eager and lazy Recognition, Direct manipulation and indirect commands

Third part: Animation (Ludovic Hoyet)
* Direct and Inverse Kinematics (analytical and numerical methods)
* Interpolations (linear, splines, etc.)
* Motion Editing (motion warping, motion blending, transplanting, motion cleaning, etc.)
* Controlling Motions
o Finite State Machines
o Motions Graphs

Bibliography :
[1] A. Delaye and E. Anquetil, “Hbf49 feature set: A first unified baseline for online symbol recognition,” Pattern Recognition, vol. 46, no. 1, pp. 117–130, 2013.
[2] Z. Chen, E. Anquetil, H. Mouchère, and C. Viard-Gaudin, “Recognize multi-touch gestures by graph modeling and matching,” in 17th Biennial Conference of the International Graphonomics Society, Pointe-a`-Pitre, France, Jun. 2015.
[3] D. Rubine, “Specifying gestures by example,” in Proceedings of the 18th Annual Conference on Computer Graphics and Interactive Techniques, ser. SIGGRAPH ’91. New York, NY, USA: ACM, 1991, pp. 329–337.
[4] S. Macé and E. Anquetil, “Eager interpretation of on-line hand-drawn structured documents: The dali methodology,” Pattern Recognition, vol. 42, no. 12, pp. 3202–3214, Dec. 2009.

[5] M. Mu¨ller, T. Ro¨der, M. Clausen, B. Eberhardt, B. Kru¨ger, and Weber, “Documentation mocap database hdm05,” 2007.
[6] Said Yacine Boulahia, Eric Anquetil, Richard Kulpa, Franck Multon, HIF3D: Handwriting-Inspired Features for 3D Skeleton-Based Action Recognition, IEEE. 23rd International Conference on Pattern Recognition (ICPR 2016), Dec 2016, Cancun, Mexico.
[7] Zhaoxin Chen, Eric Anquetil, Harold Mouchère, Christian Viard-Gaudin, The MUMTDB dataset for evaluating simultaneous composition of structured documents in a multi-user and multi-touch environment, 15th International Conference on Frontiers in Handwriting Recognition, Oct 2016, Shenzhen, China
[8] L. Xia, C.-C. Chen, and J. Aggarwal, “View invariant human action recognition using histograms of 3d joints,” in IEEE Computer Society Conference on Computer Vision and Pattern Recognition Workshops (CVPRW), pp. 20–27, 2012.
[9] M. A. Gowayyed, M. Torki, M. E. Hussein, and M. El-Saban, “Histogram of oriented displacements (hod): describing trajectories of human joints for action recognition,” in Proceedings of the International Joint Conference on Artificial Intelligence, pp. 1351–1357, 2013.
[10] R. Vemulapalli, F. Arrate, and R. Chellappa, “Human action recog- nition by representing 3d skeletons as points in a lie group,” in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, pp. 588–595, 2014.
[11] R. Chaudhry, F. Ofli, G. Kurillo, R. Bajcsy, and R. Vidal, “Bio- inspired dynamic 3d discriminative skeletal features for human action recognition,” in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops, pp. 471–478,2013.
[12] H. Zhang and L. E. Parker, “Bio-inspired predictive orientation decomposition of skeleton trajectories for real-time human activity prediction,” in Proceedings of the IEEE International Conference on Robotics and Automation, pp. 3053–3060, 2015.
[13] R. Kulpa, F. Multon, and B. Arnaldi, “Morphology-independent representation of motions for interactive human-like animation,” in Computer Graphics Forum, vol. 24, pp. 343–351, 2005.
[14] A. Sorel, R. Kulpa, E. Badier, and F. Multon, “Dealing with vari- ability when recognizing user’s performance in natural 3d gesture interfaces,” International Journal of Pattern Recognition and Artificial Intelligence, vol. 27, no. 08, 2013.
[15] M. E. Hussein, M. Torki, M. A. Gowayyed, and M. El-Saban, “Human action recognition using a temporal hierarchy of covariance descriptors on 3d joint locations,” in Proceedings of the International Joint Conference on Artificial Intelligence, vol. 13, pp. 2466–2472, 2013.
[16] G. Evangelidis, G. Singh, and R. Horaud, “Skeletal quads: Human action recognition using joint quadruples,” in Proceedings of the IEEE International Conference on Pattern Recognition, pp. 4513– 4518, 2014.
[17] V. Bloom, D. Makris, and V. Argyriou. Clustered spatio- temporal manifolds for online action recognition. In Pattern Recognition (ICPR), 2014 22nd International Conference on, pages 3963–3968. IEEE, 2014.
[18] Y. Li, C. Lan, J. Xing, W. Zeng, C. Yuan, and J. Liu. Online human action detection using joint classification-regression recurrent neural networks. arXiv preprint arXiv:1604.05633, 2016.
[19] finger-count interaction: Combining multitouch gestures and menus”, International Journal of Human-Computer Studies, v.70 n.10, p.673-689, October, 2012.
[20] Sriganesh Madhvanath, Dinesh Mandalapu, Tarun Madan, Naznin Rao, Ramesh Kozhissery, “GeCCo: Finger gesture-based command and control for touch interfaces”, IHCI 2012: 1-6.
[21] Armin Bruderlin and Lance Williams. 1995. Motion signal processing. In Proceedings of the 22nd annual conference on Computer graphics and interactive techniques (SIGGRAPH '95), Susan G. Mair and Robert Cook (Eds.). ACM, New York, NY, USA, 97-104.
[22] Andrew Witkin and Zoran Popovic. 1995. Motion warping. In Proceedings of the 22nd annual conference on Computer graphics and interactive techniques (SIGGRAPH '95), Susan G. Mair and Robert Cook (Eds.). ACM, New York, NY, USA, 105-108.
[23] Charles Rose, Brian Guenter, Bobby Bodenheimer, and Michael F. Cohen. 1996. Efficient generation of motion transitions using spacetime constraints. In Proceedings of the 23rd annual conference on Computer graphics and interactive techniques (SIGGRAPH '96). ACM, New York, NY, USA, 147-154.
[24] Charles Rose, Michael F. Cohen, and Bobby Bodenheimer. 1998. Verbs and Adverbs: Multidimensional Motion Interpolation. IEEE Comput. Graph. Appl. 18, 5 (September 1998), 32-40.
[25] Michael Gleicher. 1998. Retargetting motion to new characters. In Proceedings of the 25th annual conference on Computer graphics and interactive techniques (SIGGRAPH '98). ACM, New York, NY, USA, 33-42.
[26] Lucas Kovar, Michael Gleicher, and Frédéric Pighin. 2002. Motion graphs. ACM Trans. Graph. 21, 3 (July 2002), 473-482.
[27] Lucas Kovar, John Schreiner, and Michael Gleicher. 2002. Footskate cleanup for motion capture editing. In Proceedings of the 2002 ACM SIGGRAPH/Eurographics symposium on Computer animation (SCA '02). ACM, New York, NY, USA, 97-104.

Requirements :
Object-oriented programming

Organisation :
This module will be articulated on a course (16h) which will be supported by a TP (10h), applying the notions of the course through a practical realization dealing with the capture of the gesture, its recognition and its use in the context of an animation challenge.

Evaluation :
The evaluation is based on a defense of the TP / project developed during the module. The presentation support and the developed code will be part of the requested deliverables.

Target :

Side channel attacks	INF09-SECU
Number of hours : 26.00 h	2.00 ECTS credit
CM : 10.00 h, TP : 16.00 h	hand-out in English and course taught in English
Reference Teacher(s) : AVOINE Gildas	

Objectives :
Learn the fundamentals of hardware-based and software-based side channel attacks and their countermeasures.

Content :
The course on “Side-channel attacks” addresses the specificities of software and hardware systems that lead to side-channel attacks. To keep in touch with real-life concerns as well as state-of-the art research, the course is taught by an engineer-researcher from the French ministry of defense (DGA-MI) whose activities are related to embedded cryptography, and a full-time CNRS researcher whose research is related to micro-architectural attacks.

The course considers techniques for secure implementations, physical attacks on microcircuits (timing and power side-channel attacks, fault injection attacks, etc.), as well as software-based attacks on micro-architecture of modern CPUs (side-channel attacks on caches and fault attacks on DRAM, etc.).

Bibliography :

Requirements :
The courses “engineering cryptography” and “operating system” from INSA Rennes (4INFO), or any other equivalent courses.

Organisation :
A large part of the course is devoted to hands-on sessions.

Evaluation :
Theoretical examination in a computer room, with an additional (randomly chosen) lab presentation.

Target :
5 INFO

Protocols verification	INF09-PROTOCOL
Number of hours : 26.00 h	2.00 ECTS credit
CM : 24.00 h, EP : 2.00 h	
Reference Teacher(s) : FILA Barbara	

Objectives :
The objective of this course is to provide students with an in-depth knowledge regarding methods and tools for the specification, design, and symbolic verification of security protocols in various domains.

After a successful completion of this course, the students should be able to:
- Specify a protocol in a suitable formal framework;
- Formally define the security property against which the protocol should be checked;
- Select an appropriate verification tool to analyze the protocol;
- Detect logical flaws in improperly designed or implemented protocols.

Content :
The following topics will be covered in this course:
* Formal ways of specifying a protocol: Alice & Bob notation, message sequence charts, process algebra, Horn clauses, constraint systems, applied pi calculus;
* Attacker models: passive and active attackers, Dolev-Yao adversary, knowledge inference;
* Formal specification of security properties: trace properties, indistinguishability properties, equivalence properties, weak and strong secrecy, authentication (aliveness, agreement, synchronization), anonymity;
* Man-in-the-middle attacks;
* Protocol verification with a bounded number of sessions: constraint systems;
* Protocol verification with an unbounded number of sessions: Horn Clauses;
* Tools for automatic verification of security protocols: get started with Scyther, go deeper with ProVerif.

Bibliography :
- Cas Cremers and Sjouke Mauw. Operational Semantics and Verification of Security Protocols, Springer 2012, ISBN: 978-3-540-78635-1 (Print) 978-3-540-78636-8 (Online).
- Véronique Cortier, Steve Kremer. Formal Models and Techniques for Analyzing Security Protocols: A Tutorial. Foundations and Trends in Programming Languages 1(3): 151-267 (2014).

Requirements :
Introduction to security course 3INFO

Organisation :
Studying course work; personal work on the project.
This course will partially be taught in English.

Evaluation :
- Two-hour written examination (2/3 of teh final grade)
- Project (1/3 of teh final grade)

Target :
5info - Security track

Big Data Algorithms	INF09-ALGODATA
Number of hours : 26.00 h	2.00 ECTS credit
CM : 14.00 h, TP : 12.00 h	
Reference Teacher(s) : COSTAN Alexandru	

Objectives :
The goal of this course is to study the specific challenges of algorithms processing Big Data: how to reduce the data complexity, process the data deluge in real-time, propose new paradigms to allow the extraction of relevant knowledge. The course focuses on the main design principles of the fundamental algorithms for Big Data processing. In particular, we will study algorithms for stream processing, social networks, recommendation systems, classification, trend detection and sentiment analysis. We will implement and evaluate these algorithms using the Apache Flink Big Data processing framework.

Content :
- Graph theory and social networks
- Sentiment analysis and trend detection
- Stream processing
- Classification algorithms
- Recommandation algorithms
- Fake news detection
- Clustering algorithms

Bibliography :
B. Howe, Introduction to Data Science
R. Swan, J. Allan, Automatic Generation of Overview Timelines
H.R. Varian, H. Choi, Predic;ng the Present with Google Trends, Google Research Blog
J. Allan, R. Papka, V. Lavrenko, On-line New Event Detection and Tracking
R. Bandari, S. Asur, B. Huberman, The Pulse of News in Social Media: Forecasting Popularity

Requirements :
Database and systems (cloud, parallelism) concepts, Java programming skills.

Organisation :
7 Lectures (1,5h each)
6 Practical Labs (1,5h each)
4 Support Sessions – online (2 Lectures + 2 Practical Labs - 1,5h each)

Evaluation :
The grade of the course will be the grade of the practical sessions.

Target :
Students interested in becoming data scientists, big data analysts, social networks experts.

Big Data Storage and Processing	INF09-DATA
Number of hours : 26.00 h	2.00 ECTS credit
CM : 14.00 h, TP : 12.00 h	hand-out in English and course taught in English
Reference Teacher(s) : COSTAN Alexandru	

Objectives :
This course aims to provide the theoretical and practical bases for storing and effectively processing large volumes of data. It essentially aims to familiarize students with data storage and sharing at large scale (collecting, retrieving, accessing Big Data) and to introduce the concepts associated with these types of data (metadata, NoSQL, cloud storage).

We will first study how to analyze, organize and present Big Data in order to address their specific challenges: reduce the complexity, process the data deluge in real time, propose new paradigms to allow the extraction of relevant knowledge.

The course will then introduce the state-of-art Big Data computing platforms with the focus on how to utilize them in processing (managing and analyzing) massive datasets. Specifically, we will discuss the Apache Hadoop MapReduce and Apache Spark frameworks, which provide the most accessible and practical means of computing with large datasets in the Cloud.

We will also introduce the emerging distributed database and services, such as HBase/Cassandra etc.

Finally, we will utilize several key data processing tasks, including simple statistics, data aggregation, frequent pattern mining, data clustering, information retrieval, PageRank, and massive graph analytics as the real-life case study for large scale data processing in the fields of science and business.

Content :
- Unstructured and structured Big Data
- Consistency models
- Special contextual and ubiquitous data (sensors and mobile sensors, RFID readers, wireless sensor networks, etc.)
- Storage models for Cloud (Binary Large Objects: Amazon S3, Azure Blobs), NoSQL(Google BigTable, Cassandra), disk storage (GoogleFS, HDFS, PVFS, Lustre), in-memory storage (key-value stores, hybrid systems: memecached, mongoDB)
- Big Data processing platforms: Apache Hadoop, Apache Spark

Bibliography :
- Tom White, Hadoop: The Definitive Guide, 3rd Edition Storage and Analysis at Internet Scale, O'Reilly
- The Fourth Paradigm: Data-Intensive Scientific Discovery, Microsoft Research
- Jeffrey Dean, Sanjay Ghemawat, MapReduce: Simplified Data Processing on Large Clusters, Google Research
- Big Data Now, O'Reilly Media
- Q. Ethan McCallum, Bad Data Handbook: Cleaning Up The Data So You Can Get Back To Work, O'Reilly
- Pramod J. Sadalage, Martin Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley

Requirements :
Database and systems (cloud, parallelism) concepts, Java programming skills.

Organisation :
7 Lectures (1,5h each)
6 Practical Labs (1,5h each)
4 Support Sessions – online (2 Lectures + 2 Practical Labs - 1,5h each)

Evaluation :
The grade of the course will be the grade of the practical sessions.

Target :
Students pursuing a Big Data expert career, data analyst in science or industry, social networks expert etc.
5info - Option Data Science & Clouds

Distributed Algorithms	INF09-AD
Number of hours : 26.00 h	2.00 ECTS credit
CM : 14.00 h, TP : 12.00 h	
Reference Teacher(s) : BERTIER Marin	

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 :

English S9 Conversation	HUM09-ANGL-CONV
Number of hours : 10.00 h	1.50 ECTS credit
TD : 10.00 h	
Reference Teacher(s) : LE VOT Philippe	

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	HUM09-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 - LEAN MANAGEMENT	HUM09-PM-A
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, TD : 4.00 h	
Reference Teacher(s) :	

Objectives :
The Management Course shoudl enable students:
to engage with «management-oriented» themes d'aborder des thèmes « orientés métiers » relative to management,
to personnalise their programme by choosing modules «à la carte», in accordance with their interests and professional projects.

Each student chooses one course from the list of suggested courses.

Beyond the specific skills that are the focus of each course, the learning outcomes can be identifed as follows:

to understand and know how to use the specialised vocabulary of management
to recognise the main issues in a chosen management theme
to practise teamwork: taking decisions collectively and be able to deliver within set deadlines

Lean Management (28h)
To master the theoretical concepts and practices of Lean and Six Sigma
To develop your capacity to manage and lead value-creating projects
To understand the issues of associated with a culture of continuous progress and, by extension, its implementation within an organisation

Legal Knowledge (6h)
Objectives
To acquire a general knowledge of the law
To understand the organisation and main principles of the legal environment

Content :
«Lean Management» Course Programme
Lean Management (28h)

Lean Management is a structured management method. It is increasingly becoming an approach to improve the performance of companies through improved process efficiency.

Applied to company managament, « Lean Management » offers a range of methods to work towards operational excellence.
Associated with the «Six Sigma» methodology which is designed to improve quality, Lean offers an approach that ensures that all customer expectations in terms of quality, deadlines and costs are taken into account.
Programme
The content of this course develops and deepens understanding of certain notions seen in the core curriculum for 3rd Year (IMO).

Introduction to improvement
DMAIC Project
Organising and Leading a team
specific Lean tools
specific Six Sigma tools
field-oriented Lean and Six Sigma tools
feedback from industry and industrial applications

Students registered in this module will be able to participate in the Hackathon of quality and operational excellence organized in December in Nantes. This event will bring together for a whole day teams made up of 4 to 6 students from several educational institutions from Bac + 2 to Master 2 level, supervised by professionals in operational excellence, QHSE management, continuous improvement ...
Together, the students will have to take up the challenge of responding to a real business problem and proposing a relevant action plan. At the end of the day, each team will pitch their final work. The best presentation will be rewarded with a vote from the public and the jury of experts.
Legal Knowledge (6h)

sources of law, the hierarchy of rules, notion of jurisprudence;
jurisdictions;
types of law practioners;
the contract;
civil and criminal liability in a company

Bibliography :
A specific bibliography on the themes developed is suggested to students in class

Requirements :
Eco-Management Modules in S7 and S8

Organisation :
The different Management courses bring together students from the various speciality Departments. Eacg course includes the participation of external speakers (industry professionals, lawyers or consultants). Interactive pedagogy and project work are favoured, with students working in teams on projects that are defined in collaboration with the speakers.

Evaluation :
Continuous Assessment: teamwork with oral and/or written assignment

Target :

Economics, Law and Business Studies B (Human Resources Management)	HUM09-PM-B
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, TD : 4.00 h	
Reference Teacher(s) : BOUGUENNEC Christelle	

Objectives :
Objectives of Management Courses
The Management Course shoudl enable students:
to engage with «management-oriented» themes relative to management,
to personnalise their programme by choosing modules «à la carte», in accordance with their interests and professional projects.

Each student chooses a course from a list of suggested options:

Beyond the specific skills that are the focus of each course, the learning outcomes can be identifed as follows:

1. to understand and know how to use the specialised vocabulary of management
2. to recognise the main issues in a chosen management theme
3. to practise teamwork: taking decisions collectively and be able to deliver within set deadlines
Human Resources Management (20h)
This module therefore specifically aims to:

make future engineers aware of individual and collective management
identify the expectations associated with the manager's mission
equip students with the tools and techniques suited to the manager's mission

Labour Law (8h)
To make future engineers aware of the right to work by giving them key aspects of comprehension in this area which has been rendered more complex due to the diversity of its origins, the multiplication of reforms and frequent changes in jursiprudence.

To enable future engineers therefore to access the labour market with a concise overview of their rights and obligations within a company
Legal Knowledge (6h)
• To acquire a general knowledge of the law
• To understand the organisation and main principles of the legal environment

Content :
«Human Resources Management» Course Programme
Human Resources Management (20h)

Confronted with numerous and ever rapid changes, it is imperative for companies to adapt in order to ensure their sustainability band development. In this context, man management is capital. Leaders must know how to lead,develop and organise the skills of their teams that are necessary to meet objectives and at the same time create commitment in ways that nurture energies sustainably
Programme
the essentials of management
communication and motivatioon
knowing how to set objectives
leadership and team leadership
developing teamwork skills
managing complexity
supporting change

Labour Law (8h)
background to Labour law
the work contract : study of some essential clauses (workplace, salaries, work hours, non-competitive clause
some elements on the different types of work contract termination

Legal Knowledge (6h)
• sources of law, the hierarchy of rules, notion of jurisprudence;

• jurisdictions;
• types of law practioners;
• the contract;
• civil and criminal liability in a company

Bibliography :
A specific bibliography on the themes developed is suggested to students in class.

Requirements :
Eco-Management Modules in S7 and S8

Organisation :
The different Management courses bring together students from the various speciality Departments. Eacg course includes the participation of external speakers (industry professionals, lawyers or consultants). Interactive pedagogy and project work are favoured, with students working in teams on projects that are defined in collaboration with the speakers

Evaluation :
Continuous Assessment: teamwork with oral and/or written assignment

Target :

Economics, Law and Business Studies C (Human Resources Management)	HUM09-PM-C
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, TD : 4.00 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 MANAGEMENT AND ETHICS FOR ENGINEERS	HUM09-PM-D
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, TD : 4.00 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 fundamentals of management
- Ethics and business practices (international and corporate frameworks and regulations, impact on project management and decision processes)
- Reflexion on personal motivations related to social and environmental impact of innovation and business, personal values vs professional goals)
Transversal approach by industry sector case studies

Bibliography :
Given during the course

Requirements :
NONE

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 (INTERNATIONAL DEVELOPPEMENT & STRATEGIES)	HUM09-PM-E
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, TD : 4.00 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 provides students with the tools necessary to understand and work effectively in today's international economic environment. It explores how innovative firms address new markets and compete outside their national frontiers. The course

Bibliography :
Given during the course

Requirements :
None

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 F (sustainable development)	HUM09-PM-F
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, TD : 4.00 h	
Reference Teacher(s) : BOUGUENNEC Christelle	

Objectives :
Sustainable Development (28h)
Sustainable development is a major societal issue that challenges all stakeholders, including training and research institutions. The INSA group has taken up this theme and actively engages with the ways and means of “training engineers to a very high technical level… |but who are also] aware of today's global challenges & capable of helping their companies to make their own energy and ecological transition ”(Inter-INSA Energy-Climate Challenges Working Group in engineer training).

INSA Rennes has committed to the SDSR (Sustainable Developmet and Social Responsibility) accreditation process. The Engineering students enrolled in Course F will be able to contribute concretely to this process by presenting projects that meet the requirements of this standard, in collaboration with the COPIL-DD (Sustainable Development Piloting Committee) and the CRIC-DD (Rennes Inter-Campus Collective for Sustainable Development).

Objectives
To deepen your knowledge of SDS issues and be able to raise awareness of them;
To understand the SD standards and the stages of the accreditation process;
To build a team project that serves the accreditation of INSA Rennes ;
To know how to convince others of your project's relevance and to assess its feasibility (technical and economic)

Legal Knowledge (6h)
Objectives
To acquire a general knowledge of the law
To understand the organisation and main principles of the legal environment

Content :
Programme
Presentation of COPIL-DD (Sustainable Development Piloting Committee), CRIC-DD (Rennes Inter-Campus Collective for Sustainable Development) and SD-SR accreditation
Conferences on SD: environmental impacts of digital technology , biodiversity and gardens, SSS (Social et Solidarity Space), etc.
Training on the «Fresco for the Climate» tool

Legal Knowledge (6h)
Programme
sources of law, the hierarchy of rules, notion of jurisprudence;
jurisdictions;
types of law practioners;
the contract;
civil and criminal liability in a company

Bibliography :
A specific bibliography on the themes developed is suggested to students in class

Requirements :
Eco-Management Modules in S7 and S8

Organisation :
The different Management courses bring together students from the various speciality Departments. Eacg course includes the participation of external speakers (industry professionals, lawyers or consultants). Interactive pedagogy and project work are favoured, with students working in teams on projects that are defined in collaboration with the speakers

As part of this module, the student engineers:
- will attend conferences on SD themes
- will be trained on how to use the «Fresco for the Climate» tool

- will work in pluridisciplinary teams to develop a project that is eligible for SD-SR accreditation and can be implemented on campus.

Personal study time will be provided for within the schedule in order to allow students to advance with the team projects

Evaluation :
Continuous assessment (collective work)

Target :

Internship evaluation	EII09-EVST
Number of hours : 5.00 h	1.00 ECTS credit
EP : 1.00 h, EP : 1.00 h, TA : 4.00 h, TA : 4.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Economics, Law and Business Studies G (serious game)	HUM09-PM-G
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, TD : 4.00 h	course taught in English
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) (28h / 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 as its technology and markets evolve. 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

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 :

Societal responsibility of business	EII09-HUMT
Number of hours : 20.00 h	1.00 ECTS credit
CM : 20.00 h	
Reference Teacher(s) : BOUGUENNEC Christelle	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Internship evaluation	EII09-EVST
Number of hours : 5.00 h	1.00 ECTS credit
EP : 1.00 h, EP : 1.00 h, TA : 4.00 h, TA : 4.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Internship Dating	INF09-STGDATING
Number of hours : 15.00 h	1.00 ECTS credit
CONF : 15.00 h	
Reference Teacher(s) : BLOUIN Arnaud	

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:
- data management, data science, big data
- introduction to the profession of IT architect

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 :

Management of construction project	GCU09-SPEC-GPC
Number of hours : 18.00 h	1.00 ECTS credit
CM : 18.00 h	
Reference Teacher(s) : KAMALI BERNARD Siham	

Objectives :
Presenting the different actors involved in project of construction, the operational organisation of the project, the different requirements to be fulfilled, the different phases to be achieved in a project, and the management techniques and tools to be used for this purpose.

Content :
Part 1
The industrial process and fulfillment of missions
Project actors (Project Owner, Project manager, Execution Company, Controller…): Structures, Responsibilities, Expertise, Means.
The project: Structure, organization, and evolution.
Strategies of project management: organization, supervision, modifications, coordination, subcontracting, delivery
Quality assurance and audits
Management of crises and conflicts

Part 2
Actors of technical management of a project: Project Director, Project Supervisor, Programming Engineer, Project Engineer, Specialty Leader…)
Management of technical documents
Management of works
Management of modifications
Management de delays (study, logistics, execution, delivery…
Operational techniques for cost control
Multi-component programming of projects (time, human resources, logistics, cost, risk…).

Online organization of projects and co-contracting

Bibliography :

Requirements :

Organisation :
Plenary lectures supplemented by case studies to illustrate the presented concept of project management. A challenge is organised for applying skills in real-like situations.

Evaluation :
The evaluation concerns the presented project during the challenge.

Target :
5GCU

BIM Project Management	GCU09-SPEC-GPD
Number of hours : 18.00 h	1.00 ECTS credit
CM : 18.00 h	
Reference Teacher(s) : NGUYEN Quang Huy	

Objectives :
BIM technology is a process that involves the creation and use of an intelligent and configurable 3D model to make better decisions about a project and communicate them. This will involve designing, visualizing, simulating, collaborating and managing more easily throughout the project lifecycle. This course aims to introduce you to BIM technology in building project management.

Content :
Introduction to BIM

The digital technology in the construction industry
The main national and international users
Technical terms of the BIM
The digitization of trades
Technological watch
The implementation of a BIM approach

Interoperability

The challenges of openBIM
The IFC
The BCF
The Facility management

Modeling by BIM approach

Modeling a project by tender mission
Structural modeling
The point clouds
Introduction to Dynamo
Content creation
Architectural modeling

Network modeling

Communicating in a BIM approach
PC and digital DOE
Collaborative platforms
Digital communication tools
Virtual reality and augmented reality
4D simulation

Quality control in BIM approach

Automated and iterative control
Steering and refereeing a synthesis
The point clouds
The digital synthesis model

BIM approach methods

The site installation plan
3D phasing
The layout of facades
The banches cycle
The establishment of security element
The operating mode
BCF in different applications
Interference detection in Revit

Interference detection in Solibri Model Checker
Taking into account the specificities of the trades
Consideration of transitional phases of construction site or maintenance phases

Bibliography :
• De la maquette numérique au BIM, Eyrolles
BIM et architecture, DUNOD
Le BIM appliqué à la gestion du projet de construction: Outils, méthodes et flux de travaux, David McCool et Brad Hardin

Requirements :
Revit

Organisation :
8 hours of lectures and 8 hours of tutorials
Copies of handouts

Evaluation :
Mini-Project

Target :
5GCU

SRC09-CONFERENCES	DET09-CONF
Number of hours : 16.00 h	1.00 ECTS credit
CM : 16.00 h	
Reference Teacher(s) : LOISON Renaud	

Objectives :
"Industrial or academic experts in various domains present small talks (typically 2h) about technical and scientific issues in their domain. The main idea is to open students to the world of industry and research and make them sensitive to state of the art issues."

.

Content :
The talks may vary depending on the availability of experts

Bibliography :

Requirements :

Organisation :

Evaluation :
PASS if every session is attended, FAIL otherwise.

Target :
5SRC and 5M&N

Formation éthique de l'ingénieur	INF09-ETHIQUE
Number of hours : 16.00 h	1.00 ECTS credit
CM : 12.00 h, TD : 4.00 h	
Reference Teacher(s) : CELLIER-BELLINA Peggy	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Economics, Law and Business Studies (Professional management)	HUM09-PM-PRO
Number of hours : 70.00 h	2.00 ECTS credit
TA : 70.00 h, TA : 70.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Music Studies	HUMF1-MUS
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h	
Reference Teacher(s) : HOLZNER-JACQUES Cecile	

Objectives :
Targeted skills :
- working and communicating in a team
- cultural openness
- listening to others
- managing stress

Students have the opportunity to combine their studies with their passion for music. By joining two Jazz and Classical orchestras, they can continue their instrumental practice and also participate in a quality musical training course supervised by teachers from the Rennes Regional Conservatory. Through group practice, they will be able to develop their skills in listening, collaboration and their ability to adapt, all of which are essential to every kind of teamwork. They will participate actively in the cultural life of the school and frequently perform in public. Collective artistic practice within the institution will promote the personal development of the student.

Content :
2h collective lessons per week in the JAZZ et classical music ensembles with instrumental practice
training in chamber music. Participation in festivals and organisation of cultural events at INSA. Several concerts and recitals over the year at INA and externally.

Bibliography :
Musical scores are distributed at the beginning of the year

Requirements :
Good instrumental ability, music studies in conservatory or school of music; ability to read music.
Admission to the programme is based on dossier and an audition organised at the beginning of the year.

Organisation :
2 hours group practice per week

Evaluation :
validation without grade

Target :
INSA students, INP, Centrale/Supélec and external students

Semestre 9

Parcours Master Science Informatique

1	**INF09-SIF**		**Research in Computer Science**	**24.50**
	INF09-SIF	O	Average's Research master in Computer Science	23.00
	INF09-BIBL	O	Bibliography	1.50
2	**HUM09**		**Non-scientific syllabus S9**	**5.50**
	HUM09-ANGL-CONV	C	English S9 Conversation	1.50
	HUM09-ANGL-TOEIC	C	TOEIC 5th year	1.50
	HUM09-PM-A	C	Economics, Law and Business Studies A - LEAN MANAGEMENT	2.00
	HUM09-PM-B	C	Economics, Law and Business Studies B (Human Resources Management)	2.00
	HUM09-PM-C	C	Economics, Law and Business Studies C (Human Resources Management)	2.00
	HUM09-PM-D	C	Economics, Law and Business Studies D MANAGEMENT AND ETHICS FOR ENGINEERS	2.00
	HUM09-PM-E	C	Economics, Law and Business Studies E (INTERNATIONAL DEVELOPPEMENT & STRATEGIES)	2.00
	HUM09-PM-F	C	Economics, Law and Business Studies F (sustainable development)	2.00
	EII09-EVST	C	Internship evaluation	1.00
	HUM09-PM-G	C	Economics, Law and Business Studies G (serious game)	2.00
	EII09-HUMT	C	Societal responsibility of business	1.00
	EII09-EVST	C	Internship evaluation	1.00
	INF09-STGDATING	C	Internship Dating	1.00
	GCU09-SPEC-GPC	C	Management of construction project	1.00
	GCU09-SPEC-GPD	C	BIM Project Management	1.00
	DET09-CONF	C	SRC09-CONFERENCES	1.00
	INF09-ETHIQUE	C	Formation éthique de l'ingénieur	1.00
	HUM09-PM-PRO	C	Economics, Law and Business Studies (Professional management)	2.00
3	**HUMF1-ELSA Mus**		**Music with studies**	**1.00**
	HUMF1-MUS	F	Music Studies	1.00

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

Average's Research master in Computer Science	INF09-SIF
Number of hours : 360.00 h	23.00 ECTS credit
CM : 0.00 h	
Reference Teacher(s) : GOURANTON Valerie	

Objectives :
The aim of the 3rd semester of the MRI specialism is to provide each student with advanced knowledge in one research field, together with the broad bases applicable to all the various thematic tracks. It also gives students training in research methodology through the presentation of various aspects of this field, including oral and written scientific presentation techniques.
It is made up of a core syllabus and the 5 course units of the thematic track chosen by the student from the 9 tracks available at the consortium sites.

http://master.irisa.fr/index.php/en/

Content :
The core syllabus consists of:
* 2 course units (20 hours and 4 ECTS credits each) chosen by the student from the 3 available; students attend these courses either at the local site or remotely via video-conference. The aim of these core course units is to provide a broad background to the various research subjects;
* 1 course unit on a methodological approach to research (PROF - 0 ECTS credits): one course unit on the writing of scientific papers (RAS); a series of lectures (CONF) in which presentations are given about academic and industrial research professions, the organization of research, and various specific research fields;
* COLQ (2 ECTS credits), a course unit to prepare students for giving oral presentations, which includes the colloquium of the MRI specialism, giving all students the opportunity to present a scientific paper in a set amount of time, based on the internship carried out during semester 4.

Bibliography :

Requirements :

Organisation :
Each track is made up of 5 set course units of 20 hours each (4 ECTS credits) established by the teaching staff. Depending on the track, one of the 5 course units, as indicated by the track's teaching staff, may be chosen from a selection of course units offered in the other tracks.

Evaluation :
The core syllabus course units are assessed by a final written examination. They also require individual work (around the same volume of work as the course itself), based on the reading of papers suggested by the teaching staff. These course units may develop over the years. Each course unit from the thematic tracks is assessed by continuous assessment , based on summaries of research articles and homework-type tasks, etc. The individual work required for this type of course unit is around 150% of the volume of teaching for each unit.

Target :

Bibliography	INF09-BIBL
Number of hours : 40.00 h	1.50 ECTS credit
TD : 9.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

English S9 Conversation	HUM09-ANGL-CONV
Number of hours : 10.00 h	1.50 ECTS credit
TD : 10.00 h	
Reference Teacher(s) : LE VOT Philippe	

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	HUM09-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 - LEAN MANAGEMENT	HUM09-PM-A
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, TD : 4.00 h	
Reference Teacher(s) :	

Objectives :
The Management Course shoudl enable students:
to engage with «management-oriented» themes d'aborder des thèmes « orientés métiers » relative to management,
to personnalise their programme by choosing modules «à la carte», in accordance with their interests and professional projects.

Each student chooses one course from the list of suggested courses.

Beyond the specific skills that are the focus of each course, the learning outcomes can be identifed as follows:

to understand and know how to use the specialised vocabulary of management
to recognise the main issues in a chosen management theme
to practise teamwork: taking decisions collectively and be able to deliver within set deadlines

Lean Management (28h)
To master the theoretical concepts and practices of Lean and Six Sigma
To develop your capacity to manage and lead value-creating projects
To understand the issues of associated with a culture of continuous progress and, by extension, its implementation within an organisation

Legal Knowledge (6h)
Objectives
To acquire a general knowledge of the law
To understand the organisation and main principles of the legal environment

Content :
«Lean Management» Course Programme
Lean Management (28h)

Lean Management is a structured management method. It is increasingly becoming an approach to improve the performance of companies through improved process efficiency.

Applied to company managament, « Lean Management » offers a range of methods to work towards operational excellence.
Associated with the «Six Sigma» methodology which is designed to improve quality, Lean offers an approach that ensures that all customer expectations in terms of quality, deadlines and costs are taken into account.
Programme
The content of this course develops and deepens understanding of certain notions seen in the core curriculum for 3rd Year (IMO).

Introduction to improvement
DMAIC Project
Organising and Leading a team
specific Lean tools
specific Six Sigma tools
field-oriented Lean and Six Sigma tools
feedback from industry and industrial applications

Students registered in this module will be able to participate in the Hackathon of quality and operational excellence organized in December in Nantes. This event will bring together for a whole day teams made up of 4 to 6 students from several educational institutions from Bac + 2 to Master 2 level, supervised by professionals in operational excellence, QHSE management, continuous improvement ...
Together, the students will have to take up the challenge of responding to a real business problem and proposing a relevant action plan. At the end of the day, each team will pitch their final work. The best presentation will be rewarded with a vote from the public and the jury of experts.
Legal Knowledge (6h)

sources of law, the hierarchy of rules, notion of jurisprudence;
jurisdictions;
types of law practioners;
the contract;
civil and criminal liability in a company

Bibliography :
A specific bibliography on the themes developed is suggested to students in class

Requirements :
Eco-Management Modules in S7 and S8

Organisation :
The different Management courses bring together students from the various speciality Departments. Eacg course includes the participation of external speakers (industry professionals, lawyers or consultants). Interactive pedagogy and project work are favoured, with students working in teams on projects that are defined in collaboration with the speakers.

Evaluation :
Continuous Assessment: teamwork with oral and/or written assignment

Target :

Economics, Law and Business Studies B (Human Resources Management)	HUM09-PM-B
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, TD : 4.00 h	
Reference Teacher(s) : BOUGUENNEC Christelle	

Objectives :
Objectives of Management Courses
The Management Course shoudl enable students:
to engage with «management-oriented» themes relative to management,
to personnalise their programme by choosing modules «à la carte», in accordance with their interests and professional projects.

Each student chooses a course from a list of suggested options:

Beyond the specific skills that are the focus of each course, the learning outcomes can be identifed as follows:

1. to understand and know how to use the specialised vocabulary of management
2. to recognise the main issues in a chosen management theme
3. to practise teamwork: taking decisions collectively and be able to deliver within set deadlines
Human Resources Management (20h)
This module therefore specifically aims to:

make future engineers aware of individual and collective management
identify the expectations associated with the manager's mission
equip students with the tools and techniques suited to the manager's mission

Labour Law (8h)
To make future engineers aware of the right to work by giving them key aspects of comprehension in this area which has been rendered more complex due to the diversity of its origins, the multiplication of reforms and frequent changes in jursiprudence.

To enable future engineers therefore to access the labour market with a concise overview of their rights and obligations within a company
Legal Knowledge (6h)
• To acquire a general knowledge of the law
• To understand the organisation and main principles of the legal environment

Content :
«Human Resources Management» Course Programme
Human Resources Management (20h)

Confronted with numerous and ever rapid changes, it is imperative for companies to adapt in order to ensure their sustainability band development. In this context, man management is capital. Leaders must know how to lead,develop and organise the skills of their teams that are necessary to meet objectives and at the same time create commitment in ways that nurture energies sustainably
Programme
the essentials of management
communication and motivatioon
knowing how to set objectives
leadership and team leadership
developing teamwork skills
managing complexity
supporting change

Labour Law (8h)
background to Labour law
the work contract : study of some essential clauses (workplace, salaries, work hours, non-competitive clause
some elements on the different types of work contract termination

Legal Knowledge (6h)
• sources of law, the hierarchy of rules, notion of jurisprudence;

• jurisdictions;
• types of law practioners;
• the contract;
• civil and criminal liability in a company

Bibliography :
A specific bibliography on the themes developed is suggested to students in class.

Requirements :
Eco-Management Modules in S7 and S8

Organisation :
The different Management courses bring together students from the various speciality Departments. Eacg course includes the participation of external speakers (industry professionals, lawyers or consultants). Interactive pedagogy and project work are favoured, with students working in teams on projects that are defined in collaboration with the speakers

Evaluation :
Continuous Assessment: teamwork with oral and/or written assignment

Target :

Economics, Law and Business Studies C (Human Resources Management)	HUM09-PM-C
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, TD : 4.00 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 MANAGEMENT AND ETHICS FOR ENGINEERS	HUM09-PM-D
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, TD : 4.00 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 fundamentals of management
- Ethics and business practices (international and corporate frameworks and regulations, impact on project management and decision processes)
- Reflexion on personal motivations related to social and environmental impact of innovation and business, personal values vs professional goals)
Transversal approach by industry sector case studies

Bibliography :
Given during the course

Requirements :
NONE

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 (INTERNATIONAL DEVELOPPEMENT & STRATEGIES)	HUM09-PM-E
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, TD : 4.00 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 provides students with the tools necessary to understand and work effectively in today's international economic environment. It explores how innovative firms address new markets and compete outside their national frontiers. The course

Bibliography :
Given during the course

Requirements :
None

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 F (sustainable development)	HUM09-PM-F
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, TD : 4.00 h	
Reference Teacher(s) : BOUGUENNEC Christelle	

Objectives :
Sustainable Development (28h)
Sustainable development is a major societal issue that challenges all stakeholders, including training and research institutions. The INSA group has taken up this theme and actively engages with the ways and means of “training engineers to a very high technical level… |but who are also] aware of today's global challenges & capable of helping their companies to make their own energy and ecological transition ”(Inter-INSA Energy-Climate Challenges Working Group in engineer training).

INSA Rennes has committed to the SDSR (Sustainable Developmet and Social Responsibility) accreditation process. The Engineering students enrolled in Course F will be able to contribute concretely to this process by presenting projects that meet the requirements of this standard, in collaboration with the COPIL-DD (Sustainable Development Piloting Committee) and the CRIC-DD (Rennes Inter-Campus Collective for Sustainable Development).

Objectives
To deepen your knowledge of SDS issues and be able to raise awareness of them;
To understand the SD standards and the stages of the accreditation process;
To build a team project that serves the accreditation of INSA Rennes ;
To know how to convince others of your project's relevance and to assess its feasibility (technical and economic)

Legal Knowledge (6h)
Objectives
To acquire a general knowledge of the law
To understand the organisation and main principles of the legal environment

Content :
Programme
Presentation of COPIL-DD (Sustainable Development Piloting Committee), CRIC-DD (Rennes Inter-Campus Collective for Sustainable Development) and SD-SR accreditation
Conferences on SD: environmental impacts of digital technology , biodiversity and gardens, SSS (Social et Solidarity Space), etc.
Training on the «Fresco for the Climate» tool

Legal Knowledge (6h)
Programme
sources of law, the hierarchy of rules, notion of jurisprudence;
jurisdictions;
types of law practioners;
the contract;
civil and criminal liability in a company

Bibliography :
A specific bibliography on the themes developed is suggested to students in class

Requirements :
Eco-Management Modules in S7 and S8

Organisation :
The different Management courses bring together students from the various speciality Departments. Eacg course includes the participation of external speakers (industry professionals, lawyers or consultants). Interactive pedagogy and project work are favoured, with students working in teams on projects that are defined in collaboration with the speakers

As part of this module, the student engineers:
- will attend conferences on SD themes
- will be trained on how to use the «Fresco for the Climate» tool

- will work in pluridisciplinary teams to develop a project that is eligible for SD-SR accreditation and can be implemented on campus.

Personal study time will be provided for within the schedule in order to allow students to advance with the team projects

Evaluation :
Continuous assessment (collective work)

Target :

Internship evaluation	EII09-EVST
Number of hours : 5.00 h	1.00 ECTS credit
EP : 1.00 h, EP : 1.00 h, TA : 4.00 h, TA : 4.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Economics, Law and Business Studies G (serious game)	HUM09-PM-G
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, TD : 4.00 h	course taught in English
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) (28h / 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 as its technology and markets evolve. 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

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 :

Societal responsibility of business	EII09-HUMT
Number of hours : 20.00 h	1.00 ECTS credit
CM : 20.00 h	
Reference Teacher(s) : BOUGUENNEC Christelle	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Internship evaluation	EII09-EVST
Number of hours : 5.00 h	1.00 ECTS credit
EP : 1.00 h, EP : 1.00 h, TA : 4.00 h, TA : 4.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Internship Dating	INF09-STGDATING
Number of hours : 15.00 h	1.00 ECTS credit
CONF : 15.00 h	
Reference Teacher(s) : BLOUIN Arnaud	

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:
- data management, data science, big data
- introduction to the profession of IT architect

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 :

Management of construction project	GCU09-SPEC-GPC
Number of hours : 18.00 h	1.00 ECTS credit
CM : 18.00 h	
Reference Teacher(s) : KAMALI BERNARD Siham	

Objectives :
Presenting the different actors involved in project of construction, the operational organisation of the project, the different requirements to be fulfilled, the different phases to be achieved in a project, and the management techniques and tools to be used for this purpose.

Content :
Part 1
The industrial process and fulfillment of missions
Project actors (Project Owner, Project manager, Execution Company, Controller…): Structures, Responsibilities, Expertise, Means.
The project: Structure, organization, and evolution.
Strategies of project management: organization, supervision, modifications, coordination, subcontracting, delivery
Quality assurance and audits
Management of crises and conflicts

Part 2
Actors of technical management of a project: Project Director, Project Supervisor, Programming Engineer, Project Engineer, Specialty Leader…)
Management of technical documents
Management of works
Management of modifications
Management de delays (study, logistics, execution, delivery…
Operational techniques for cost control
Multi-component programming of projects (time, human resources, logistics, cost, risk…).

Online organization of projects and co-contracting

Bibliography :

Requirements :

Organisation :
Plenary lectures supplemented by case studies to illustrate the presented concept of project management. A challenge is organised for applying skills in real-like situations.

Evaluation :
The evaluation concerns the presented project during the challenge.

Target :
5GCU

BIM Project Management	GCU09-SPEC-GPD
Number of hours : 18.00 h	1.00 ECTS credit
CM : 18.00 h	
Reference Teacher(s) : NGUYEN Quang Huy	

Objectives :
BIM technology is a process that involves the creation and use of an intelligent and configurable 3D model to make better decisions about a project and communicate them. This will involve designing, visualizing, simulating, collaborating and managing more easily throughout the project lifecycle. This course aims to introduce you to BIM technology in building project management.

Content :
Introduction to BIM

The digital technology in the construction industry
The main national and international users
Technical terms of the BIM
The digitization of trades
Technological watch
The implementation of a BIM approach

Interoperability

The challenges of openBIM
The IFC
The BCF
The Facility management

Modeling by BIM approach

Modeling a project by tender mission
Structural modeling
The point clouds
Introduction to Dynamo
Content creation
Architectural modeling

Network modeling

Communicating in a BIM approach
PC and digital DOE
Collaborative platforms
Digital communication tools
Virtual reality and augmented reality
4D simulation

Quality control in BIM approach

Automated and iterative control
Steering and refereeing a synthesis
The point clouds
The digital synthesis model

BIM approach methods

The site installation plan
3D phasing
The layout of facades
The banches cycle
The establishment of security element
The operating mode
BCF in different applications
Interference detection in Revit

Interference detection in Solibri Model Checker
Taking into account the specificities of the trades
Consideration of transitional phases of construction site or maintenance phases

Bibliography :
• De la maquette numérique au BIM, Eyrolles
BIM et architecture, DUNOD
Le BIM appliqué à la gestion du projet de construction: Outils, méthodes et flux de travaux, David McCool et Brad Hardin

Requirements :
Revit

Organisation :
8 hours of lectures and 8 hours of tutorials
Copies of handouts

Evaluation :
Mini-Project

Target :
5GCU

SRC09-CONFERENCES	DET09-CONF
Number of hours : 16.00 h	1.00 ECTS credit
CM : 16.00 h	
Reference Teacher(s) : LOISON Renaud	

Objectives :
"Industrial or academic experts in various domains present small talks (typically 2h) about technical and scientific issues in their domain. The main idea is to open students to the world of industry and research and make them sensitive to state of the art issues."

.

Content :
The talks may vary depending on the availability of experts

Bibliography :

Requirements :

Organisation :

Evaluation :
PASS if every session is attended, FAIL otherwise.

Target :
5SRC and 5M&N

Formation éthique de l'ingénieur	INF09-ETHIQUE
Number of hours : 16.00 h	1.00 ECTS credit
CM : 12.00 h, TD : 4.00 h	
Reference Teacher(s) : CELLIER-BELLINA Peggy	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Economics, Law and Business Studies (Professional management)	HUM09-PM-PRO
Number of hours : 70.00 h	2.00 ECTS credit
TA : 70.00 h, TA : 70.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Music Studies	HUMF1-MUS
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h	
Reference Teacher(s) : HOLZNER-JACQUES Cecile	

Objectives :
Targeted skills :
- working and communicating in a team
- cultural openness
- listening to others
- managing stress

Students have the opportunity to combine their studies with their passion for music. By joining two Jazz and Classical orchestras, they can continue their instrumental practice and also participate in a quality musical training course supervised by teachers from the Rennes Regional Conservatory. Through group practice, they will be able to develop their skills in listening, collaboration and their ability to adapt, all of which are essential to every kind of teamwork. They will participate actively in the cultural life of the school and frequently perform in public. Collective artistic practice within the institution will promote the personal development of the student.

Content :
2h collective lessons per week in the JAZZ et classical music ensembles with instrumental practice
training in chamber music. Participation in festivals and organisation of cultural events at INSA. Several concerts and recitals over the year at INA and externally.

Bibliography :
Musical scores are distributed at the beginning of the year

Requirements :
Good instrumental ability, music studies in conservatory or school of music; ability to read music.
Admission to the programme is based on dossier and an audition organised at the beginning of the year.

Organisation :
2 hours group practice per week

Evaluation :
validation without grade

Target :
INSA students, INP, Centrale/Supélec and external students

Semestre 10

Parcours Contrat de professionalisation

1	INF-PFE10		End of studies Internship	30.00
	INF10-PFE	O	End of Studies Project	30.00

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

End of Studies Project	INF10-PFE
Number of hours : 350.00 h	30.00 ECTS credit
ES : 4.00 h, ST : 346.00 h	
Reference Teacher(s) : COSTAN Alexandru	

Objectives :
The final internship (PFE) takes place in companies or in research laboratories for a period of at least 16 weeks and at most 26 weeks (6 months).
The final internship is a good exercise for students in order to prepare them to the integration in the working world. They can go
further in the notion of management and software engineering already study during the project of the 4th year. The studant has to contact the companies and be interviewed. It is a good preparation for job search.
Students must write a report during their internship and prepare a presentation.

Content :
Examples of previous internship subjects:
* Development of an interactive map-based application for reporting and analysis of cellular network coverage on tablets.
* Workflow for managin dialogues with subscribers of e-mail marketing system
* Development of a raster library and rocessing tool/calculator for 3D rasters.
* Study of the security on internet, threats and solutions.
* Development af an Android game.
* Elaboration of models of natural language for handwritting recognition.
* Development of an administrative tool for the fraud department.

Bibliography :

Requirements :
Students must draw upon their experience of five semesters specialising in computer science.

Organisation :
The student integrates the company on a full-time basis.
While working at the company, the student has to write the report and prepare the presentation.

Evaluation :
Mark awarded by the internship supervisor for work accomplished.
Mark for the report.
Mark for the presentation.

Target :

Semestre 10

Parcours DD Mobilité

1	INF-PFE10		End of studies Internship	30.00
	INF10-PFE	O	End of Studies Project	30.00

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

End of Studies Project	INF10-PFE
Number of hours : 350.00 h	30.00 ECTS credit
ES : 4.00 h, ST : 346.00 h	
Reference Teacher(s) : COSTAN Alexandru	

Objectives :
The final internship (PFE) takes place in companies or in research laboratories for a period of at least 16 weeks and at most 26 weeks (6 months).
The final internship is a good exercise for students in order to prepare them to the integration in the working world. They can go
further in the notion of management and software engineering already study during the project of the 4th year. The studant has to contact the companies and be interviewed. It is a good preparation for job search.
Students must write a report during their internship and prepare a presentation.

Content :
Examples of previous internship subjects:
* Development of an interactive map-based application for reporting and analysis of cellular network coverage on tablets.
* Workflow for managin dialogues with subscribers of e-mail marketing system
* Development of a raster library and rocessing tool/calculator for 3D rasters.
* Study of the security on internet, threats and solutions.
* Development af an Android game.
* Elaboration of models of natural language for handwritting recognition.
* Development of an administrative tool for the fraud department.

Bibliography :

Requirements :
Students must draw upon their experience of five semesters specialising in computer science.

Organisation :
The student integrates the company on a full-time basis.
While working at the company, the student has to write the report and prepare the presentation.

Evaluation :
Mark awarded by the internship supervisor for work accomplished.
Mark for the report.
Mark for the presentation.

Target :

Semestre 10

Parcours Formation Initiale INFO

1	INF-PFE10		End of studies Internship	30.00
	INF10-PFE	O	End of Studies Project	30.00

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

End of Studies Project	INF10-PFE
Number of hours : 350.00 h	30.00 ECTS credit
ES : 4.00 h, ST : 346.00 h	
Reference Teacher(s) : COSTAN Alexandru	

Objectives :
The final internship (PFE) takes place in companies or in research laboratories for a period of at least 16 weeks and at most 26 weeks (6 months).
The final internship is a good exercise for students in order to prepare them to the integration in the working world. They can go
further in the notion of management and software engineering already study during the project of the 4th year. The studant has to contact the companies and be interviewed. It is a good preparation for job search.
Students must write a report during their internship and prepare a presentation.

Content :
Examples of previous internship subjects:
* Development of an interactive map-based application for reporting and analysis of cellular network coverage on tablets.
* Workflow for managin dialogues with subscribers of e-mail marketing system
* Development of a raster library and rocessing tool/calculator for 3D rasters.
* Study of the security on internet, threats and solutions.
* Development af an Android game.
* Elaboration of models of natural language for handwritting recognition.
* Development of an administrative tool for the fraud department.

Bibliography :

Requirements :
Students must draw upon their experience of five semesters specialising in computer science.

Organisation :
The student integrates the company on a full-time basis.
While working at the company, the student has to write the report and prepare the presentation.

Evaluation :
Mark awarded by the internship supervisor for work accomplished.
Mark for the report.
Mark for the presentation.

Target :

Semestre 10

Parcours Master Science Informatique

1	INF-PFE10		End of studies Internship	30.00
	INF10-PFE	O	End of Studies Project	30.00

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

End of Studies Project	INF10-PFE
Number of hours : 350.00 h	30.00 ECTS credit
ES : 4.00 h, ST : 346.00 h	
Reference Teacher(s) : COSTAN Alexandru	

Objectives :
The final internship (PFE) takes place in companies or in research laboratories for a period of at least 16 weeks and at most 26 weeks (6 months).
The final internship is a good exercise for students in order to prepare them to the integration in the working world. They can go
further in the notion of management and software engineering already study during the project of the 4th year. The studant has to contact the companies and be interviewed. It is a good preparation for job search.
Students must write a report during their internship and prepare a presentation.

Content :
Examples of previous internship subjects:
* Development of an interactive map-based application for reporting and analysis of cellular network coverage on tablets.
* Workflow for managin dialogues with subscribers of e-mail marketing system
* Development of a raster library and rocessing tool/calculator for 3D rasters.
* Study of the security on internet, threats and solutions.
* Development af an Android game.
* Elaboration of models of natural language for handwritting recognition.
* Development of an administrative tool for the fraud department.

Bibliography :

Requirements :
Students must draw upon their experience of five semesters specialising in computer science.

Organisation :
The student integrates the company on a full-time basis.
While working at the company, the student has to write the report and prepare the presentation.

Evaluation :
Mark awarded by the internship supervisor for work accomplished.
Mark for the report.
Mark for the presentation.

Target :