INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES RENNES

Academic year 2023/2024

Courses offered by the programme

Electronique et Informatique Industrielle (EII)
Electronics and Computer Engineering

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
DET09-D-TASE-NUM	Processing and Architecture of Digital Electronic Systems
DET09-M-SNET	Smart Networks
DET09-M-SPES	Space Electronic Systems
DET09-M-SYNS	System and Network Security
EII06-PJM	Project and Methodology
EII08-LP	Programmable Logic Devices
EII08-PROJ	Multidisciplinary project A
EII09-AHD	Advanced Hardware Design
EII09-ANIM	Image Analysis II
EII09-COTR	Video Compression and Transcoding
EII09-DISPS	Digital Signal Processor
EII09-HWS	Hardware Security
EII09-PPEM	Parallel Programming for Embedded MPSoCs
EII09-PROJ	Project "Innovative Technologies"
EII09-SYSC	High-Level SystemC Language
EII09-VIS	Computer Vision

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

Semestre 5

Parcours Logique

1	**EII05-E**		**Electronics S5**	**6.00**
	EII05-ELE	O	Electronics 1	6.00
2	**EII05-II**		**INFORMATIQUE INDUSTRIELLE S5 - Parcours Logique**	**10.50**
	ESM05-LOG	O	Combinatory and Sequential Logic	2.00
	EII05-ARC	O	Computer Architecture	4.00
	EII05-LANGC	O	Langage C	4.50
3	**EII05-MSA**		**MATHS, SIGNAL, AUTOMATIQUE S5 - Parcours Logique**	**6.50**
	ESM05-SIG	O	Signals and Systems	2.00
	ESM05-ANAL	O	Mathematical Analysis for the Engineer	1.50
	EII05-PROBA	O	Probabilistic tools for engineers	1.50
	EII05-SIG2	O	Signals and Systems II	1.50
4	**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
5	**HUMF1-ELSA Mus**		**Music with studies**	**1.00**
	HUMF1-MUS	F	Music Studies	1.00
8	**HUMF1-ELSA Thea**		**Theatre with studies**	**1.00**
	HUMF1-THEA	F	Study & Theater	1.00
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

Electronics 1	EII05-ELE
Number of hours : 80.00 h	6.00 ECTS credit
CM : 23.00 h, PR : 15.00 h, PR : 1.00 h, TD : 20.00 h, TP : 21.00 h	
Reference Teacher(s) : HAESE Sylvain	

Objectives :
Familiarization with the methods required to analyse the behavior of basic electronic passive and active circuits. Use of these methods to comprehend operational amplifiers circuits. Understanding of analog and mixed circuitry such as those used in microcontroller development platform including sensors and power actuators.
Introduction to bipolar and field effect transistors circuits for amplification and commutation.
Practical application of the theory studied in the courses, manipulation and further study of the circuits using Spice simulation software. Measurement techniques using typical laboratory instrumentation setup.

Content :
1. Sources, passives networks, Ohm's law, Kirchhoff's law, Thévenin and Norton theorems. Sinusoidal and Cissoidal analysis, complex Ohm's law.
2. First order systems, Bode plots. Spice simulator introduction, quadripoles, dependent sources
3. Differential amplifiers. Operational amplifier (Opamp) and the ideal Opamp. Basic Opamp circuits. Real Opamps imperfections.
4. Commutation circuits, comparators, diodes, bipolar an MOSFETs used in commutation circuits.
5. Review of bipolar transistors amplifiers. DC biasing. Analysis of the Ebers-Moll model, harmonic distortion rate. Non-linear Spice analysis capability.
6. Practice with measurement instruments and electronics components.
7. Pspice simulation, linear and non-linear analysis.
8. Practical circuits simulation and cabling including passive and active circuits.
9. Design of an electronic project from the specification using data sheets and application notes.

Bibliography :
1. BLOT J., "Electronique linéaire - Cours avec exercices et travaux pratiques", Chapitres 1 et 3, Dunod, 1993.
2. BLOT J., "Electronique linéaire - exercices résolus", Dunod, 1994.
3. BLOT J., "Les transistors - éléments d'intégration des circuits analogiques", Chapitres 1 à 3, Dunod, 1995.
4. SEDRA ADEL S. et SMITH KENNETH C., "Microelectronic circuits", Holt, Rinehart, and Winston, 1998.
5. GREBENE A. B., "Bipolar and MOS analog integrated circuit design", n° ISBN 0471085294, 1984.
6. KRASNOPOL E , “Réseaux linéaires : méthodes et applications”, Editions Casteilla, n° ISBN 2-7135-2513-6

Requirements :

Organisation :
Revision of lecture notes.
Preparation of exercises.
Practical application of the notions seen during lectures.

Evaluation :
1h written examination (without documents).
2h written examination (with documents) at the end of the semester.
Oral presentation of the practical results.
Project and written report.
The project takes place during the five last sessions of this module.

Target :
3EII

Combinatory and Sequential Logic	ESM05-LOG
Number of hours : 26.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 12.00 h	
Reference Teacher(s) : DARDAILLON Mickael	

Objectives :
Introduction to digital circuits. Methods and tools for the design of digital circuit.

Content :
Combinatory Logic
Logic basics, logic gates and logic functions. Boole Algebra
Logic Simplification/minimisation using Karnaugh.
Design of complex logic systems : multiplexer, decoder, adder

Sequential Logic
Sequential logic basics : synchronous et asynchronous flip-flops
Complex systems : counter, register, shifting
Temporal analysis

Complex Systems, state machines (Moore and Mealy). Design process starting from the specifications

Bibliography :
TOCCI R. J., "Circuits numériques - Théorie et applications", Dunod, 1992.
NKETSA A., " Circuits logiques", Collection TechnoSup, 2000
BRIE C., "Logique combinatoire et séquentielle : Méthodes, outils et réalisations", Editions Ellipses, collection Technosup, 2002.
Strandh R., " Architecture de l'Ordinateur ", Dunod , 2005

Requirements :

Organisation :
lectures, preparing exercises during TD

Evaluation :
Written examination of 2 hours, with documents

Target :
3rd year

Computer Architecture	EII05-ARC
Number of hours : 52.00 h	4.00 ECTS credit
CM : 14.00 h, PR : 12.00 h, TD : 14.00 h, TP : 12.00 h	
Reference Teacher(s) : COUSIN Jean-Gabriel	

Objectives :
- Understanding the computer behavior at the microarchitectural level
- Linking fundamental concepts introduced by the hardware "Combinatorial and Sequential Logic" and software "C language" courses

Targeted main competences:
- To analyze or design hierarchically a digital system with interconnected functions
' To develop, compile, simulate, prototype, debug the system, using adapted industrial CAD tools
- To use efficiently available resources (documentation, internet, supervisors) to solve digital system design problems

Content :
- What is an architecture?
- How to adapt combinatorial and sequential logic functions to a logic synthesis environment
- Complements on fixed-point and floating-point representations
- Case study of a reduced instruction-set computer (RISC architecture): processing unit (ALU, register-file, status register...), Harvard memory architecture (address spaces, memories, program counter, address register...), Moore/Mealy finite state machine as control unit
- Case study of a complex instruction-set computer (CISC architecture): processing unit, von Neumann memory architecture, hardwired/µProgrammed/mixed control unit versions
- Generalization of computer architecture

CAD tools used:
- Quartus-Prime of Intel Corporation
- Modelsim-Intel of Mentor-Graphics Corporation

Bibliography :
- Websites
- TANENBAUM S., "Structured Computer Organization", Prentice Hall
- HENNESSY J. & PATTERSON D., "Computer Architecture: a Quantitativ Approach", McGraw-Hill
- FLOYD T.L., "Systèmes numériques", Editions Goulet
- BRIE C., "Logique combinatoire et séquentielle : méthodes, outils et réalisations", Editions Ellipses, collection Technosup

Requirements :
- Notions of combinatorial and sequential logic (ESM05_LOG)
- Notions of C language (ESM05-INFOC)

Organisation :
- Active pedagogy
- Revision of course notes
- Preparation of tutorials and lab works

Evaluation :
- Attendance
- Written examination
- Project

Target :
3EII

Langage C	EII05-LANGC
Number of hours : 57.00 h	4.50 ECTS credit
CM : 19.00 h, TD : 4.00 h, TP : 34.00 h	
Reference Teacher(s) : PRESSIGOUT Muriel	

Objectives :
The course will be articulated in two parts. The first part, shared with the STIC pole, aims at acquiring the basic notions in C language. The pedagogical objectives of this first part are :
-> To discover and appropriate the syntax of the C language
-> Translate simple function specifications into C language
-> Write code using variables, arrays, structures, pointers and functions
-> Manipulate text files with a program written in C language
-> Handling IDE (Integrated Development Environment) and identify the tools and phases of building an executable within this IDE.
-> Use of the debugger for self-correction of code
To do this, there will be 6 practical sessions dedicated to these notions.

The second part will deepen the mastery of the C language and software developement. It will be about using the previous notions in more complex frameworks and to approach new ones in order to allow the student to translate a more complex problem in C language. The pedagogical objectives of this second part are :
-> Discovery, use and implementation of data structures (arrays, lists, trees, graphs) in C
-> Discover and use generic code mechanisms in C: function pointers
-> Write and read data on a binary stream while mastering low-level input-output operations
-> Be aware of the memory mechanisms involved in the execution of a program
-> Test and document a program
-> Write a Makefile
To do this, the student will have to analyze during 11 practical sessions the data structures proposed in different problems to understand their choice and their good use which he/she will apply. Good coding skills will be reinforced.

Content :
For the first part, where the documents and courses will be in French, please see the ECTS sheet of the module ESM05-INFOC

For the second part where the documents will be in English and the courses in French, the following courses will be presented:

1. Understanding the environment of an executable and writing a Makefile
2. Reminders on pointers to variables, pointers to functions and presentation of the ellipse
3. Reading and writing in a text or binary file and directory manipulation
4. Presentation of different data structures

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 :
Notion of algorithm

Organisation :
Lecture revision, preparing exercises and validating the results in labs

Evaluation :
The final grade for this module is a weighting of the results of two exams. The first one is a 2-hour written exam

with documents at the half of the semester, validating the first part of the module.
The second exam is a 2-hour graded DS on PC with documents at the end of the semester.

Target :
3EII

Signals and Systems	ESM05-SIG
Number of hours : 28.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : KPALMA Kidiyo	

Objectives :
Introduction and application of all the necessary mathematical tools to better understand electronics, control and signal processing. The applications are illustrated with simple examples taken from those disciplines.

Targeted competences are:
-> Understand the concept of a signal and know how to modelize it,
-> Understand what is a system and predict its behaviour face to an input signal,
-> Understand mathematical tools needed to electronics, control and signal processing

Content :
1. Overview of signals: signals described by functions and signals described by distributions. Deterministic and random signals. Classification of deterministic signals depending on their time variation (discrete or continuous), test signals (pulse, step, sinusoid, etc.)

2. Overview of systems: definition, system response and convolution. Linear system response to a sinusoidal input or to a non-sinusoidal periodic input (Fourier series).

3. Fourier series, Fourier and Laplace transforms - Definitions, spectral representation of a signal, properties of transformations, transforms of some usual signals. Notions of power spectral density (psd) and energy spectral density (esd). Wiener–Khinchin theorem.

4. Response of a linear system to any input. Application of the Laplace transform to the study of the response of a linear system subject to any input. Isomorph transfert function and spectral representation. Study of the stability (definition, the stability and poles location, stability of looped systems)

Bibliography :
1. BLOT J., "Electronique linéaire - cours", Chapitre 2, Dunod Université, 1993.
2. BOITE R., NEIRYNCK J., "Traité d'électricité, Théorie des réseaux de Kirchhoff", Georgi.
3. BORNE P., DAUPHIN-TANGUY G., RICHARD J. P., ROTELLA F., ZAMBETTAKIS I., "Automatique, Analyse et régulation des processus industriels", Tome 1, Tecnip.
4. COULON F., "Traité d'électricité, Théorie et traitement des signaux", Georgi.

Requirements :
None

Organisation :
Revision of lecture notes. Review of basic mathematics. Preparation of exercises. Active learning: participation in problem solving on the board.

Evaluation :
One-hour quizz (Moodle) in the middle of the semester (without documents) and a two-hour written examination (with documents) at the end of the semester.

Target :
3EII, 3GPM, 3GMA.

Mathematical Analysis for the Engineer	ESM05-ANAL
Number of hours : 20.00 h	1.50 ECTS credit
CM : 10.00 h, TD : 10.00 h	
Reference Teacher(s) : LEY Olivier	

Objectives :
Integration, Fourier transform, complex analysis

Content :
1. Integration
- Introduction to Lebesgue integral, integrable functions
- Convergence theorems
- Integrals with a parameter
- Fubini's Theorem
- Convolution
2. Fourier transform
- Fourier transform of an integrable function
- Properties and Inversion Theorem
- Fourier transform of a square-integrable function
- Plancherel theorem
3. Introduction to complex analysis
- Holomorphic functions
- Power series
- Exponential and logarithmic functions
- Complex line integral
- Cauchy's formula
- Residue Theorem
- Methods of contour integration

Bibliography :
1. M. Bergounioux, Mathématiques pour le traitement du signal, Mathématiques appliquées pour le Master, 2ème édition, Dunod, 2014.
2. W. Rudin, Real and complex analysis. Third edition. McGraw-Hill Book Co., New York, 1987.

Requirements :
Mathematical analysis of first and second year

Organisation :
30h

Evaluation :
1 written examination

Target :
3rd year students

Probabilistic tools for engineers	EII05-PROBA
Number of hours : 20.00 h	1.50 ECTS credit
CM : 9.00 h, TD : 8.00 h, TP : 3.00 h	
Reference Teacher(s) : PROVOST Jean-Noel	

Objectives :
To make students acquainted with two probabilistic tools, the characteristic function and the Gaussian vectors, together with their statistical applications for large samples.

Content :
Reminders on real random variables and vectors, moments and independence.
Characteristic function of real random vectors.
Link between probabilities and statistics.
Central limit theorem and its applications to the large samples. (confidence interval, statistical hypothesis testing).
Gaussian random vectors.
Chi-squared tests.

Bibliography :
F. Bertrand et M. Maumy-Bertrand. Mathématiques pour les sciences de l'ingénieur. Dunod, 2013.
B. Garel. Modélisation probabiliste et statistique. Cépaduès-Editions, 2002.

Requirements :
Basics of analysis and linear algebra.
Course "Introduction to probability" (STPI-2nd year).

Organisation :
Lecture revision, preparing exercises.

Evaluation :
One written examination (2h).

Target :
All students enrolled in the 1st semester 3EII.

Signals and Systems II	EII05-SIG2
Number of hours : 20.00 h	1.50 ECTS credit
CM : 5.00 h, TD : 6.00 h, TP : 9.00 h	
Reference Teacher(s) : KPALMA Kidiyo	

Objectives :
Provide theoretical notions and the practice linked to the response of a linear system to a signal.
Raise issues inherents to signal procesing and the stability of linear systems and propose some solutions. Provide methods for choosing an appropiate solution.

Targeted competences are:
-> Consolidation and application of the concepts learned in ESM05-SIG.
-> Understanding signal theory and its mathematical modeling
-> Assimilation of various techniques to manipulate feedback systems

Content :
1. Study of spectral analysis of signals,
2. Representation of linear systems and study of their stability,
3. Study of feedback systems and analysis of their stability.

Bibliography :
1. DE COULON F., "Théorie et traitement des signaux", Traité d'électricité, Volume VI, Presses Polytechniques Romandes, Lausanne, 1980.
2. FONTOLLIET P. G., "Systèmes de télécommunications, bases de transmission", Dunod, 1983.
3. CHARBIT M., "Eléments de théorie du signal : les signaux aléatoires", Ellipses, Collection Pédagogique des Télécommunications, 1990.

Requirements :
Signals et Systems (ESM05-SIG).

Organisation :
Revision of lecture notes. Preparation of exercises. Active learning: participation in problem solving on the board and work in sub-groups.

Evaluation :
One-hour written examination, with documents, at the end of the semester.

Target :
3EII

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 :

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

Study & Theater	HUMF1-THEA
Number of hours : 27.00 h	1.00 ECTS credit
TD : 27.00 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 and Theater", builds a theatrical artistic journey, grom writing to the stage along four successive semesters with four different artists.

The recruitment of "Study & Theater" section is carroed 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 commited to following the training provided over the term of two years. An evaluation at the end of each semester of the course is completed by the head of the section.

Since September 2017, a professional theater company, with a creation and training link with ADEC, has offered an artistic universe to promote the current year. The work is done either around a theatrical work or around an original work from materials (writing work, text editing work). In general, during this first semester, the set work takes up the basics of acting for addressing the artistic propositions. In addition to this course, the ADEC offers two interventions around the discovery of theatrical literature at the ADEC library and some slight initiations to the light operations.

Bibliography :

Requirements :
no specific acting requirement

Organisation :
On Thursday afternoon at the ADEC theater place

Evaluation :
Validation based on the student's involvement

Target :
Registered student between the first and third year

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 5

Parcours Mathématiques

1	**EII05-E**		**Electronics S5**	**6.00**
	EII05-ELE	O	Electronics 1	6.00
2	**EII05-II-PM**		**Computer Engineering S5**	**8.50**
	EII05-ARC	O	Computer Architecture	4.00
	EII05-LANGC	O	Langage C	4.50
3	**EII05-MSA-PM**		**Signal, Automatic, Mathematics S5**	**8.50**
	ESM05-SIG	O	Signals and Systems	2.00
	ESM05-ANAL	O	Mathematical Analysis for the Engineer	1.50
	EII05-PROBA	O	Probabilistic tools for engineers	1.50
	EII05-SIG2	O	Signals and Systems II	1.50
	EII05-MATH	O	Mathematics for EII engineers	2.00
4	**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
5	**HUMF1-ELSA Mus**		**Music with studies**	**1.00**
	HUMF1-MUS	F	Music Studies	1.00
6	**HUMF1-ELSA Thea**		**Theatre with studies**	**1.00**
	HUMF1-THEA	F	Study & Theater	1.00
9	**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

Electronics 1	EII05-ELE
Number of hours : 80.00 h	6.00 ECTS credit
CM : 23.00 h, PR : 15.00 h, PR : 1.00 h, TD : 20.00 h, TP : 21.00 h	
Reference Teacher(s) : HAESE Sylvain	

Objectives :
Familiarization with the methods required to analyse the behavior of basic electronic passive and active circuits. Use of these methods to comprehend operational amplifiers circuits. Understanding of analog and mixed circuitry such as those used in microcontroller development platform including sensors and power actuators.
Introduction to bipolar and field effect transistors circuits for amplification and commutation.
Practical application of the theory studied in the courses, manipulation and further study of the circuits using Spice simulation software. Measurement techniques using typical laboratory instrumentation setup.

Content :
1. Sources, passives networks, Ohm's law, Kirchhoff's law, Thévenin and Norton theorems. Sinusoidal and Cissoidal analysis, complex Ohm's law.
2. First order systems, Bode plots. Spice simulator introduction, quadripoles, dependent sources
3. Differential amplifiers. Operational amplifier (Opamp) and the ideal Opamp. Basic Opamp circuits. Real Opamps imperfections.
4. Commutation circuits, comparators, diodes, bipolar an MOSFETs used in commutation circuits.
5. Review of bipolar transistors amplifiers. DC biasing. Analysis of the Ebers-Moll model, harmonic distortion rate. Non-linear Spice analysis capability.
6. Practice with measurement instruments and electronics components.
7. Pspice simulation, linear and non-linear analysis.
8. Practical circuits simulation and cabling including passive and active circuits.
9. Design of an electronic project from the specification using data sheets and application notes.

Bibliography :
1. BLOT J., "Electronique linéaire - Cours avec exercices et travaux pratiques", Chapitres 1 et 3, Dunod, 1993.
2. BLOT J., "Electronique linéaire - exercices résolus", Dunod, 1994.
3. BLOT J., "Les transistors - éléments d'intégration des circuits analogiques", Chapitres 1 à 3, Dunod, 1995.
4. SEDRA ADEL S. et SMITH KENNETH C., "Microelectronic circuits", Holt, Rinehart, and Winston, 1998.
5. GREBENE A. B., "Bipolar and MOS analog integrated circuit design", n° ISBN 0471085294, 1984.
6. KRASNOPOL E , “Réseaux linéaires : méthodes et applications”, Editions Casteilla, n° ISBN 2-7135-2513-6

Requirements :

Organisation :
Revision of lecture notes.
Preparation of exercises.
Practical application of the notions seen during lectures.

Evaluation :
1h written examination (without documents).
2h written examination (with documents) at the end of the semester.
Oral presentation of the practical results.
Project and written report.
The project takes place during the five last sessions of this module.

Target :
3EII

Computer Architecture	EII05-ARC
Number of hours : 52.00 h	4.00 ECTS credit
CM : 14.00 h, PR : 12.00 h, TD : 14.00 h, TP : 12.00 h	
Reference Teacher(s) : COUSIN Jean-Gabriel	

Objectives :
- Understanding the computer behavior at the microarchitectural level
- Linking fundamental concepts introduced by the hardware "Combinatorial and Sequential Logic" and software "C language" courses

Targeted main competences:
- To analyze or design hierarchically a digital system with interconnected functions
' To develop, compile, simulate, prototype, debug the system, using adapted industrial CAD tools
- To use efficiently available resources (documentation, internet, supervisors) to solve digital system design problems

Content :
- What is an architecture?
- How to adapt combinatorial and sequential logic functions to a logic synthesis environment
- Complements on fixed-point and floating-point representations
- Case study of a reduced instruction-set computer (RISC architecture): processing unit (ALU, register-file, status register...), Harvard memory architecture (address spaces, memories, program counter, address register...), Moore/Mealy finite state machine as control unit
- Case study of a complex instruction-set computer (CISC architecture): processing unit, von Neumann memory architecture, hardwired/µProgrammed/mixed control unit versions
- Generalization of computer architecture

CAD tools used:
- Quartus-Prime of Intel Corporation
- Modelsim-Intel of Mentor-Graphics Corporation

Bibliography :
- Websites
- TANENBAUM S., "Structured Computer Organization", Prentice Hall
- HENNESSY J. & PATTERSON D., "Computer Architecture: a Quantitativ Approach", McGraw-Hill
- FLOYD T.L., "Systèmes numériques", Editions Goulet
- BRIE C., "Logique combinatoire et séquentielle : méthodes, outils et réalisations", Editions Ellipses, collection Technosup

Requirements :
- Notions of combinatorial and sequential logic (ESM05_LOG)
- Notions of C language (ESM05-INFOC)

Organisation :
- Active pedagogy
- Revision of course notes
- Preparation of tutorials and lab works

Evaluation :
- Attendance
- Written examination
- Project

Target :
3EII

Langage C	EII05-LANGC
Number of hours : 57.00 h	4.50 ECTS credit
CM : 19.00 h, TD : 4.00 h, TP : 34.00 h	
Reference Teacher(s) : PRESSIGOUT Muriel	

Objectives :
The course will be articulated in two parts. The first part, shared with the STIC pole, aims at acquiring the basic notions in C language. The pedagogical objectives of this first part are :
-> To discover and appropriate the syntax of the C language
-> Translate simple function specifications into C language
-> Write code using variables, arrays, structures, pointers and functions
-> Manipulate text files with a program written in C language
-> Handling IDE (Integrated Development Environment) and identify the tools and phases of building an executable within this IDE.
-> Use of the debugger for self-correction of code
To do this, there will be 6 practical sessions dedicated to these notions.

The second part will deepen the mastery of the C language and software developement. It will be about using the previous notions in more complex frameworks and to approach new ones in order to allow the student to translate a more complex problem in C language. The pedagogical objectives of this second part are :
-> Discovery, use and implementation of data structures (arrays, lists, trees, graphs) in C
-> Discover and use generic code mechanisms in C: function pointers
-> Write and read data on a binary stream while mastering low-level input-output operations
-> Be aware of the memory mechanisms involved in the execution of a program
-> Test and document a program
-> Write a Makefile
To do this, the student will have to analyze during 11 practical sessions the data structures proposed in different problems to understand their choice and their good use which he/she will apply. Good coding skills will be reinforced.

Content :
For the first part, where the documents and courses will be in French, please see the ECTS sheet of the module ESM05-INFOC

For the second part where the documents will be in English and the courses in French, the following courses will be presented:

1. Understanding the environment of an executable and writing a Makefile
2. Reminders on pointers to variables, pointers to functions and presentation of the ellipse
3. Reading and writing in a text or binary file and directory manipulation
4. Presentation of different data structures

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 :
Notion of algorithm

Organisation :
Lecture revision, preparing exercises and validating the results in labs

Evaluation :
The final grade for this module is a weighting of the results of two exams. The first one is a 2-hour written exam

with documents at the half of the semester, validating the first part of the module.
The second exam is a 2-hour graded DS on PC with documents at the end of the semester.

Target :
3EII

Signals and Systems	ESM05-SIG
Number of hours : 28.00 h	2.00 ECTS credit
CM : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : KPALMA Kidiyo	

Objectives :
Introduction and application of all the necessary mathematical tools to better understand electronics, control and signal processing. The applications are illustrated with simple examples taken from those disciplines.

Targeted competences are:
-> Understand the concept of a signal and know how to modelize it,
-> Understand what is a system and predict its behaviour face to an input signal,
-> Understand mathematical tools needed to electronics, control and signal processing

Content :
1. Overview of signals: signals described by functions and signals described by distributions. Deterministic and random signals. Classification of deterministic signals depending on their time variation (discrete or continuous), test signals (pulse, step, sinusoid, etc.)

2. Overview of systems: definition, system response and convolution. Linear system response to a sinusoidal input or to a non-sinusoidal periodic input (Fourier series).

3. Fourier series, Fourier and Laplace transforms - Definitions, spectral representation of a signal, properties of transformations, transforms of some usual signals. Notions of power spectral density (psd) and energy spectral density (esd). Wiener–Khinchin theorem.

4. Response of a linear system to any input. Application of the Laplace transform to the study of the response of a linear system subject to any input. Isomorph transfert function and spectral representation. Study of the stability (definition, the stability and poles location, stability of looped systems)

Bibliography :
1. BLOT J., "Electronique linéaire - cours", Chapitre 2, Dunod Université, 1993.
2. BOITE R., NEIRYNCK J., "Traité d'électricité, Théorie des réseaux de Kirchhoff", Georgi.
3. BORNE P., DAUPHIN-TANGUY G., RICHARD J. P., ROTELLA F., ZAMBETTAKIS I., "Automatique, Analyse et régulation des processus industriels", Tome 1, Tecnip.
4. COULON F., "Traité d'électricité, Théorie et traitement des signaux", Georgi.

Requirements :
None

Organisation :
Revision of lecture notes. Review of basic mathematics. Preparation of exercises. Active learning: participation in problem solving on the board.

Evaluation :
One-hour quizz (Moodle) in the middle of the semester (without documents) and a two-hour written examination (with documents) at the end of the semester.

Target :
3EII, 3GPM, 3GMA.

Mathematical Analysis for the Engineer	ESM05-ANAL
Number of hours : 20.00 h	1.50 ECTS credit
CM : 10.00 h, TD : 10.00 h	
Reference Teacher(s) : LEY Olivier	

Objectives :
Integration, Fourier transform, complex analysis

Content :
1. Integration
- Introduction to Lebesgue integral, integrable functions
- Convergence theorems
- Integrals with a parameter
- Fubini's Theorem
- Convolution
2. Fourier transform
- Fourier transform of an integrable function
- Properties and Inversion Theorem
- Fourier transform of a square-integrable function
- Plancherel theorem
3. Introduction to complex analysis
- Holomorphic functions
- Power series
- Exponential and logarithmic functions
- Complex line integral
- Cauchy's formula
- Residue Theorem
- Methods of contour integration

Bibliography :
1. M. Bergounioux, Mathématiques pour le traitement du signal, Mathématiques appliquées pour le Master, 2ème édition, Dunod, 2014.
2. W. Rudin, Real and complex analysis. Third edition. McGraw-Hill Book Co., New York, 1987.

Requirements :
Mathematical analysis of first and second year

Organisation :
30h

Evaluation :
1 written examination

Target :
3rd year students

Probabilistic tools for engineers	EII05-PROBA
Number of hours : 20.00 h	1.50 ECTS credit
CM : 9.00 h, TD : 8.00 h, TP : 3.00 h	
Reference Teacher(s) : PROVOST Jean-Noel	

Objectives :
To make students acquainted with two probabilistic tools, the characteristic function and the Gaussian vectors, together with their statistical applications for large samples.

Content :
Reminders on real random variables and vectors, moments and independence.
Characteristic function of real random vectors.
Link between probabilities and statistics.
Central limit theorem and its applications to the large samples. (confidence interval, statistical hypothesis testing).
Gaussian random vectors.
Chi-squared tests.

Bibliography :
F. Bertrand et M. Maumy-Bertrand. Mathématiques pour les sciences de l'ingénieur. Dunod, 2013.
B. Garel. Modélisation probabiliste et statistique. Cépaduès-Editions, 2002.

Requirements :
Basics of analysis and linear algebra.
Course "Introduction to probability" (STPI-2nd year).

Organisation :
Lecture revision, preparing exercises.

Evaluation :
One written examination (2h).

Target :
All students enrolled in the 1st semester 3EII.

Signals and Systems II	EII05-SIG2
Number of hours : 20.00 h	1.50 ECTS credit
CM : 5.00 h, TD : 6.00 h, TP : 9.00 h	
Reference Teacher(s) : KPALMA Kidiyo	

Objectives :
Provide theoretical notions and the practice linked to the response of a linear system to a signal.
Raise issues inherents to signal procesing and the stability of linear systems and propose some solutions. Provide methods for choosing an appropiate solution.

Targeted competences are:
-> Consolidation and application of the concepts learned in ESM05-SIG.
-> Understanding signal theory and its mathematical modeling
-> Assimilation of various techniques to manipulate feedback systems

Content :
1. Study of spectral analysis of signals,
2. Representation of linear systems and study of their stability,
3. Study of feedback systems and analysis of their stability.

Bibliography :
1. DE COULON F., "Théorie et traitement des signaux", Traité d'électricité, Volume VI, Presses Polytechniques Romandes, Lausanne, 1980.
2. FONTOLLIET P. G., "Systèmes de télécommunications, bases de transmission", Dunod, 1983.
3. CHARBIT M., "Eléments de théorie du signal : les signaux aléatoires", Ellipses, Collection Pédagogique des Télécommunications, 1990.

Requirements :
Signals et Systems (ESM05-SIG).

Organisation :
Revision of lecture notes. Preparation of exercises. Active learning: participation in problem solving on the board and work in sub-groups.

Evaluation :
One-hour written examination, with documents, at the end of the semester.

Target :
3EII

Mathematics for EII engineers	EII05-MATH
Number of hours : 26.00 h	2.00 ECTS credit
TD : 26.00 h	
Reference Teacher(s) : BABEL Marie	

Objectives :
The objective of this module is to provide mathematical bases that are required for any Electronics and Computer Engineering 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.
2. Probabilities: definition, random variables
3. Algebra: matrices, determinants, eigenvalues, eigenvectors, inversion, scalar and vector product, diagonalization, resolution of linear systems

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 :

Target :
3EII

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 :

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

Study & Theater	HUMF1-THEA
Number of hours : 27.00 h	1.00 ECTS credit
TD : 27.00 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 and Theater", builds a theatrical artistic journey, grom writing to the stage along four successive semesters with four different artists.

The recruitment of "Study & Theater" section is carroed 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 commited to following the training provided over the term of two years. An evaluation at the end of each semester of the course is completed by the head of the section.

Since September 2017, a professional theater company, with a creation and training link with ADEC, has offered an artistic universe to promote the current year. The work is done either around a theatrical work or around an original work from materials (writing work, text editing work). In general, during this first semester, the set work takes up the basics of acting for addressing the artistic propositions. In addition to this course, the ADEC offers two interventions around the discovery of theatrical literature at the ADEC library and some slight initiations to the light operations.

Bibliography :

Requirements :
no specific acting requirement

Organisation :
On Thursday afternoon at the ADEC theater place

Evaluation :
Validation based on the student's involvement

Target :
Registered student between the first and third year

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 Logique

1	**EII06-E**		**Electronics S6**	**6.00**
	EII06-ELE	O	Electronics 2	6.00
2	**EII06-II**		**Computer Engineering S6**	**10.00**
	EII06-PS	O	System programming	2.50
	EII06-SMC	O	Microprocessor-Based Systems	5.00
	EII06-PJM	O	Project and Methodology	2.50
3	**EII06-MSA**		**Signal, Automatic, Mathematics S6**	**7.00**
	EII06-TS	O	Signal processing	4.00
	ESM06-AUTO	O	Control Systems Engineering	3.00
5	**HUM06**		**Non-scientific syllabus S6**	**7.00**
	HUM06-IMO	C	Introduction to Operational Management	1.50
	HUM06-IND	C	Introduction au Numérique Durable	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
8	**HUMF2-ELSA Mus**		**Music with Studies**	**1.00**
	HUMF2-MUS	C	Music Studies	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

Electronics 2	EII06-ELE
Number of hours : 81.00 h	6.00 ECTS credit
CM : 24.00 h, PR : 15.00 h, PR : 1.00 h, TD : 20.00 h, TP : 21.00 h	
Reference Teacher(s) : HAESE Sylvain	

Objectives :
Understanding of integrated circuits structures.
Introduction to closed-loop electronic systems and study of the feedback theory. Application to stability problems and frequency compensation. Study of the behavior of specific operational amplifiers.
Practical use of the theoretical concepts. Spice simulation of the structures and components studied.

Content :
1. Field effect transistors, MOSFET fir amplification and commutation.
2. Basis of integrated circuit specific structures : current mirrors, differential stages, output stages.
3. Study of the principles of feedback theory for the study of closed-loop systems.
4. Calculation methods and criteria for the study of stability. Amplifier compensation, with the study of the influence of poles on the closed-loop transfer function.
5. Analysis of limitations of operational amplifiers in dynamic use (frequency response, slew-rate).
6. Study of modern operational amplifiers: current feedback amplifiers.

Bibliography :
1. BLOT J., ""Electronique linéaire -Cours avec exercices et travaux pratiques"", Chapitres 1 et 3, Dunod, 1993.
2. BLOT J., ""Electronique linéaire -exercices résolus"", Dunod, 1994.
3. BLOT J., ""Les transistors -éléments d'intégration des circuits analogiques"", Chapitres 1 à 3, Dunod, 1995.
4. SEDRA ADEL S. et SMITH KENNETH C.,"Microelectronic circuits", Holt, Rinehart, and Winston, 1998.
5. GREBENE A. B., ""Bipolar and MOS analog integrated circuit design"", n° ISBN 0471085294, 1984.

Requirements :
Electronics 1 (EII05-ELE)

Organisation :
Revision of lecture notes.
Preparation of exercises.
Practical application of the notions seen during lectures.

Evaluation :
1h written examination (without documents).
2h written examination (with documents) at the end of the semester.
Oral presentation of the practical results.
Project and written report.
The project takes place during the five last sessions of this module.

Target :
3EII

System programming	EII06-PS
Number of hours : 27.00 h	2.50 ECTS credit
CM : 6.00 h, TD : 6.00 h, TP : 15.00 h	
Reference Teacher(s) : PRESSIGOUT Muriel	

Objectives :
1.Introduction to the functions, principles and structure of computer operating systems by defining basic concepts and theirevolution.
2.The main mechanisms of Windows, Unix and Linux systems.

The targeted skills are :
-> Control a hardware architecture with a operating system by exploiting its elements, especially using shell scripts with regular expressions.
-> Handle a filesystem managing its configuration, the travelling methods and the pseudo-file concept.
-> Write and use a Makefile to handle a programming project by dealing with the linking process, either statically or dynamically.

Content :
1. Use of a Linux system
2. Filesystems
3. Binaries building
4. Presentation of the elements of a operating system

Bibliography :
1. SILBERSCHATZ A., GALVIN P. and GAGNE G., Operating Systems Concepts (6th Ed), John Wiley et Sons,).
2. MIDDOT, TANENBAUM A., Modern Operating Systems (2nd Ed), Prentice-Hal

Requirements :
Langage C (EII05-LANGC)

Organisation :
Lecture revision, preparing exercises and validating the results in practicals

Evaluation :
A final personnal test on computer with documents at the end of the semester lasting 3 hours.

Target :
3EII

Microprocessor-Based Systems	EII06-SMC
Number of hours : 58.50 h	5.00 ECTS credit
CM : 10.50 h, TD : 18.00 h, TP : 30.00 h	
Reference Teacher(s) : MENARD Daniel	

Objectives :
Apply the varied fundamental concepts introduced by the course: "Architecture des calculateurs I" (EII05-ARC). The studied microprocessor-based system is a board with a TI MSP430 microcontroller and several peripherals. The 16-bit MSP430 microcontroller and its different versions are studied thoroughly, including its internal architecture and instruction set. The students discover the low-level (assembly) and high-level (C code) programming of the microcontroller.

Targeted competences are:
- To program microcontroller-based systems while understanding their internal mechanisms
- To program in assembly language if necessary and to program efficiently in C code, using assembly code understanding
- To use efficiently available resources to solve digital system design problems (documentation, internet and supervisors)

Content :
1. General presentation of microcontrollers, internal MSP430 architecture
3. Assembly code and memory adressing
2. Programmation and introduction to compilation

Bibliography :
MSP430x2xx Family User¿s Guide (SLAU144E), Texas Instruments Manual, 2008

Requirements :
Computer Architecture I (EII05-ARC), C Language (ESM05-INFOC)

Organisation :
Active pedagogy, preparing exercises during TD and validating the results in practicals

Evaluation :
Written examination of 2 hours, with documents.

Target :
3EII

Project and Methodology	EII06-PJM
Number of hours : 23.00 h	2.50 ECTS credit
CM : 7.00 h, DIV : 4.00 h, EP : 8.00 h, TP : 4.00 h	handout in English
Reference Teacher(s) :	

Objectives :
The objective of this module is twofold:
* To present the methodologies and tools for managing programming project.
* To put into practice these methods for the realization of a C language project.

Objectives of the Methodology Part
To describe the general environment of a software development: fonctional analysis, tests, Présenter l'environnement général d'un développement logiciel: analyse fonctionnelle, tests, continuous integration continue, code versionning, project configuration.

The targeted skills are:
-> Handle the build of a program from C code by means of CMake
-> Manage a software development versionned by Git
-> Use test tools to check the code
-> Apply a methodology to break down a programming problem into smaller problems

Objectives of the Project Part
The objective of this project is to use the programming skills acquired during the previous semester. Objectives are classified along 3 axes:
1. Project Management
  * Develop a complete software including a graphical user interface application within a team.
  * Write precise specification and user requirements
  * Work with greater autonomy in a collaborative team
  * Experiment necessity of project management methodology
  * Develop skills for written and oral presentation of technical work
  * Establish a critical assessment of project results with respect to initial project goal
2. Software Architecture and Design
  * Conceive a software architecture according to functional specifications.
  * Implement the Model-View-Controller design pattern.
  * Select third-party library fitting the project objectives.
3. Technical skills
  * Document the code with Doxygen
  * Implement unitary tests.
  * Master professional tools for collaborative software development (Git, Gitlab, ...)
  * Self-training on some technical points in software development (graphic interfaces...)

Content :
Methodology
1. Build toolchain
2. Versionning tools
3. Tests and continuous integration
4. Functional analysis
5. Use a design pattern

Project
1. Produce written specifications
2. Task repartition
3. Regular meetings with supervising teacher
4. Project development
5. Report writing, oral presentation preparation
6. Oral defense of the project

4 hours of this course account for SHES.

Bibliography :

Requirements :
C Language (ESM05-INFOC), C Language Level 2 (EII05-LANG)

Organisation :
Methodology
Classical organization: Lecture and practical works.

Project
-Teams of 4 to 5 students, including a project leader
-Topics proposed by students and/or teachers
-Regular meetings between the students and the project supervisor (a professor) are planned in the timetable.
-Autonomous work over several months: no specific hours fixed in the time-table

Evaluation :
Skills and knowledge from the methodology part are evaluated through their use in the project.

Each group of student will submit a 5-page report and make an oral presentation in front of two teachers and interested students. The project source code will be hosted on a Git repository whose access will be granted to the project supervisor for evaluation.
The final mark, out of 20 points, will take into account:
- Work, out of 10 points (including 3 points for individual modulation)
  * Work achieved
  * Project management
  * MVC
  * Git
  * Doxygen
  * Unitary tests
- Report, out of 5,
- Oral presentation, out of 5.

Target :
3EII

Signal processing	EII06-TS
Number of hours : 44.00 h	4.00 ECTS credit
CM : 15.00 h, TD : 14.00 h, TP : 15.00 h	
Reference Teacher(s) : KPALMA Kidiyo	

Objectives :
The fundamental elements of signal theory and signal processing. Raise the problems inherent to signal processing and propose some solutions. Provide methods for choosing an appropiate solution.

Targeted competences are:
-> Consolidate and apply the concepts learned in ESM05-SIG.
-> Understanding signal theory and its mathematical modeling
-> Assimilate various signal processing techniques

Content :
1. Signals: definition, temporal, energy, morphological, etc. classifications, representation by Fourier series, Fourier transform, and Laplace transform.
2. Deterministic signals: definition, a reminder of the basic notions of the Fourier transform, analytic signals and Hilbert transform, convolution integrals, correlation, matched filters, deterministic signals of finite energy and finite mean power, periodic signals.
3. Random signals: definition, a reminder of the basic notions of probability theory, temporal moments, statistical moments, stationarity, ergodicity, noise.
4. Linear filtering: definition, filter impulse response, filter transfer function, construction of a linear filter, properties of linear filters, filtering of a random signal, the matched filter.
5. Modulation, demodulation: introduction, the different types of modulation, modulations of a sinusoidal carrier wave (linear modulations, angle modulations), pulse modulations.

Bibliography :
1. DE COULON F., "Théorie et traitement des signaux", Traité d'électricité, Volume VI, Presses Polytechniques Romandes, Lausanne, 1980.
2. FONTOLLIET P. G., "Systèmes de télécommunications, bases de transmission", Dunod, 1983.
3. CHARBIT M., "Eléments de théorie du signal : les signaux aléatoires", Ellipses, Collection Pédagogique des Télécommunications, 1990.

Requirements :

Organisation :
Revision of lecture notes. Preparation of exercises. Active learning: participation in problem solving on the board and work in sub-groups.

Evaluation :
Two-hour written examination (with documents), one-hour written examination on lab-works and evaluation of lab-work reports at the end of the semester.

Target :
3EII

Control Systems Engineering	ESM06-AUTO
Number of hours : 40.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 14.00 h, TP : 12.00 h	
Reference Teacher(s) : GUEGAN Sylvain	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

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 :

Introduction au Numérique Durable	HUM06-IND
Number of hours : 21.00 h	1.50 ECTS credit
CM : 10.00 h, TA : 5.00 h, TD : 6.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

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

Music Studies	HUMF2-MUS
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h, TD : 25.00 h	
Reference Teacher(s) :	

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

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 6

Parcours Mathématiques

1	**EII06-E**		**Electronics S6**	**6.00**
	EII06-ELE	O	Electronics 2	6.00
2	**EII06-II**		**Computer Engineering S6**	**10.00**
	EII06-PS	O	System programming	2.50
	EII06-SMC	O	Microprocessor-Based Systems	5.00
	EII06-PJM	O	Project and Methodology	2.50
3	**EII06-MSA**		**Signal, Automatic, Mathematics S6**	**7.00**
	EII06-TS	O	Signal processing	4.00
	ESM06-AUTO	O	Control Systems Engineering	3.00
5	**HUM06**		**Non-scientific syllabus S6**	**7.00**
	HUM06-IMO	C	Introduction to Operational Management	1.50
	HUM06-IND	C	Introduction au Numérique Durable	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
7	**HUMF2-ELSA Mus**		**Music with Studies**	**1.00**
	HUMF2-MUS	C	Music Studies	1.00
8	**HUMF2-ELSA Thea**		**Theatre with Studies**	**1.00**
	HUMF2-THEA	C	Study & Theater	1.00

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

Electronics 2	EII06-ELE
Number of hours : 81.00 h	6.00 ECTS credit
CM : 24.00 h, PR : 15.00 h, PR : 1.00 h, TD : 20.00 h, TP : 21.00 h	
Reference Teacher(s) : HAESE Sylvain	

Objectives :
Understanding of integrated circuits structures.
Introduction to closed-loop electronic systems and study of the feedback theory. Application to stability problems and frequency compensation. Study of the behavior of specific operational amplifiers.
Practical use of the theoretical concepts. Spice simulation of the structures and components studied.

Content :
1. Field effect transistors, MOSFET fir amplification and commutation.
2. Basis of integrated circuit specific structures : current mirrors, differential stages, output stages.
3. Study of the principles of feedback theory for the study of closed-loop systems.
4. Calculation methods and criteria for the study of stability. Amplifier compensation, with the study of the influence of poles on the closed-loop transfer function.
5. Analysis of limitations of operational amplifiers in dynamic use (frequency response, slew-rate).
6. Study of modern operational amplifiers: current feedback amplifiers.

Bibliography :
1. BLOT J., ""Electronique linéaire -Cours avec exercices et travaux pratiques"", Chapitres 1 et 3, Dunod, 1993.
2. BLOT J., ""Electronique linéaire -exercices résolus"", Dunod, 1994.
3. BLOT J., ""Les transistors -éléments d'intégration des circuits analogiques"", Chapitres 1 à 3, Dunod, 1995.
4. SEDRA ADEL S. et SMITH KENNETH C.,"Microelectronic circuits", Holt, Rinehart, and Winston, 1998.
5. GREBENE A. B., ""Bipolar and MOS analog integrated circuit design"", n° ISBN 0471085294, 1984.

Requirements :
Electronics 1 (EII05-ELE)

Organisation :
Revision of lecture notes.
Preparation of exercises.
Practical application of the notions seen during lectures.

Evaluation :
1h written examination (without documents).
2h written examination (with documents) at the end of the semester.
Oral presentation of the practical results.
Project and written report.
The project takes place during the five last sessions of this module.

Target :
3EII

System programming	EII06-PS
Number of hours : 27.00 h	2.50 ECTS credit
CM : 6.00 h, TD : 6.00 h, TP : 15.00 h	
Reference Teacher(s) : PRESSIGOUT Muriel	

Objectives :
1.Introduction to the functions, principles and structure of computer operating systems by defining basic concepts and theirevolution.
2.The main mechanisms of Windows, Unix and Linux systems.

The targeted skills are :
-> Control a hardware architecture with a operating system by exploiting its elements, especially using shell scripts with regular expressions.
-> Handle a filesystem managing its configuration, the travelling methods and the pseudo-file concept.
-> Write and use a Makefile to handle a programming project by dealing with the linking process, either statically or dynamically.

Content :
1. Use of a Linux system
2. Filesystems
3. Binaries building
4. Presentation of the elements of a operating system

Bibliography :
1. SILBERSCHATZ A., GALVIN P. and GAGNE G., Operating Systems Concepts (6th Ed), John Wiley et Sons,).
2. MIDDOT, TANENBAUM A., Modern Operating Systems (2nd Ed), Prentice-Hal

Requirements :
Langage C (EII05-LANGC)

Organisation :
Lecture revision, preparing exercises and validating the results in practicals

Evaluation :
A final personnal test on computer with documents at the end of the semester lasting 3 hours.

Target :
3EII

Microprocessor-Based Systems	EII06-SMC
Number of hours : 58.50 h	5.00 ECTS credit
CM : 10.50 h, TD : 18.00 h, TP : 30.00 h	
Reference Teacher(s) : MENARD Daniel	

Objectives :
Apply the varied fundamental concepts introduced by the course: "Architecture des calculateurs I" (EII05-ARC). The studied microprocessor-based system is a board with a TI MSP430 microcontroller and several peripherals. The 16-bit MSP430 microcontroller and its different versions are studied thoroughly, including its internal architecture and instruction set. The students discover the low-level (assembly) and high-level (C code) programming of the microcontroller.

Targeted competences are:
- To program microcontroller-based systems while understanding their internal mechanisms
- To program in assembly language if necessary and to program efficiently in C code, using assembly code understanding
- To use efficiently available resources to solve digital system design problems (documentation, internet and supervisors)

Content :
1. General presentation of microcontrollers, internal MSP430 architecture
3. Assembly code and memory adressing
2. Programmation and introduction to compilation

Bibliography :
MSP430x2xx Family User¿s Guide (SLAU144E), Texas Instruments Manual, 2008

Requirements :
Computer Architecture I (EII05-ARC), C Language (ESM05-INFOC)

Organisation :
Active pedagogy, preparing exercises during TD and validating the results in practicals

Evaluation :
Written examination of 2 hours, with documents.

Target :
3EII

Project and Methodology	EII06-PJM
Number of hours : 23.00 h	2.50 ECTS credit
CM : 7.00 h, DIV : 4.00 h, EP : 8.00 h, TP : 4.00 h	handout in English
Reference Teacher(s) :	

Objectives :
The objective of this module is twofold:
* To present the methodologies and tools for managing programming project.
* To put into practice these methods for the realization of a C language project.

Objectives of the Methodology Part
To describe the general environment of a software development: fonctional analysis, tests, Présenter l'environnement général d'un développement logiciel: analyse fonctionnelle, tests, continuous integration continue, code versionning, project configuration.

The targeted skills are:
-> Handle the build of a program from C code by means of CMake
-> Manage a software development versionned by Git
-> Use test tools to check the code
-> Apply a methodology to break down a programming problem into smaller problems

Objectives of the Project Part
The objective of this project is to use the programming skills acquired during the previous semester. Objectives are classified along 3 axes:
1. Project Management
  * Develop a complete software including a graphical user interface application within a team.
  * Write precise specification and user requirements
  * Work with greater autonomy in a collaborative team
  * Experiment necessity of project management methodology
  * Develop skills for written and oral presentation of technical work
  * Establish a critical assessment of project results with respect to initial project goal
2. Software Architecture and Design
  * Conceive a software architecture according to functional specifications.
  * Implement the Model-View-Controller design pattern.
  * Select third-party library fitting the project objectives.
3. Technical skills
  * Document the code with Doxygen
  * Implement unitary tests.
  * Master professional tools for collaborative software development (Git, Gitlab, ...)
  * Self-training on some technical points in software development (graphic interfaces...)

Content :
Methodology
1. Build toolchain
2. Versionning tools
3. Tests and continuous integration
4. Functional analysis
5. Use a design pattern

Project
1. Produce written specifications
2. Task repartition
3. Regular meetings with supervising teacher
4. Project development
5. Report writing, oral presentation preparation
6. Oral defense of the project

4 hours of this course account for SHES.

Bibliography :

Requirements :
C Language (ESM05-INFOC), C Language Level 2 (EII05-LANG)

Organisation :
Methodology
Classical organization: Lecture and practical works.

Project
-Teams of 4 to 5 students, including a project leader
-Topics proposed by students and/or teachers
-Regular meetings between the students and the project supervisor (a professor) are planned in the timetable.
-Autonomous work over several months: no specific hours fixed in the time-table

Evaluation :
Skills and knowledge from the methodology part are evaluated through their use in the project.

Each group of student will submit a 5-page report and make an oral presentation in front of two teachers and interested students. The project source code will be hosted on a Git repository whose access will be granted to the project supervisor for evaluation.
The final mark, out of 20 points, will take into account:
- Work, out of 10 points (including 3 points for individual modulation)
  * Work achieved
  * Project management
  * MVC
  * Git
  * Doxygen
  * Unitary tests
- Report, out of 5,
- Oral presentation, out of 5.

Target :
3EII

Signal processing	EII06-TS
Number of hours : 44.00 h	4.00 ECTS credit
CM : 15.00 h, TD : 14.00 h, TP : 15.00 h	
Reference Teacher(s) : KPALMA Kidiyo	

Objectives :
The fundamental elements of signal theory and signal processing. Raise the problems inherent to signal processing and propose some solutions. Provide methods for choosing an appropiate solution.

Targeted competences are:
-> Consolidate and apply the concepts learned in ESM05-SIG.
-> Understanding signal theory and its mathematical modeling
-> Assimilate various signal processing techniques

Content :
1. Signals: definition, temporal, energy, morphological, etc. classifications, representation by Fourier series, Fourier transform, and Laplace transform.
2. Deterministic signals: definition, a reminder of the basic notions of the Fourier transform, analytic signals and Hilbert transform, convolution integrals, correlation, matched filters, deterministic signals of finite energy and finite mean power, periodic signals.
3. Random signals: definition, a reminder of the basic notions of probability theory, temporal moments, statistical moments, stationarity, ergodicity, noise.
4. Linear filtering: definition, filter impulse response, filter transfer function, construction of a linear filter, properties of linear filters, filtering of a random signal, the matched filter.
5. Modulation, demodulation: introduction, the different types of modulation, modulations of a sinusoidal carrier wave (linear modulations, angle modulations), pulse modulations.

Bibliography :
1. DE COULON F., "Théorie et traitement des signaux", Traité d'électricité, Volume VI, Presses Polytechniques Romandes, Lausanne, 1980.
2. FONTOLLIET P. G., "Systèmes de télécommunications, bases de transmission", Dunod, 1983.
3. CHARBIT M., "Eléments de théorie du signal : les signaux aléatoires", Ellipses, Collection Pédagogique des Télécommunications, 1990.

Requirements :

Organisation :
Revision of lecture notes. Preparation of exercises. Active learning: participation in problem solving on the board and work in sub-groups.

Evaluation :
Two-hour written examination (with documents), one-hour written examination on lab-works and evaluation of lab-work reports at the end of the semester.

Target :
3EII

Control Systems Engineering	ESM06-AUTO
Number of hours : 40.00 h	3.00 ECTS credit
CM : 14.00 h, TD : 14.00 h, TP : 12.00 h	
Reference Teacher(s) : GUEGAN Sylvain	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

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 :

Introduction au Numérique Durable	HUM06-IND
Number of hours : 21.00 h	1.50 ECTS credit
CM : 10.00 h, TA : 5.00 h, TD : 6.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

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

Music Studies	HUMF2-MUS
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h, TD : 25.00 h	
Reference Teacher(s) :	

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

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

Innovation par la Recherche

1	**EII07-II**		**Computer Engineering S7**	**10.00**
	EII07-ARC	O	Computer architecture II	2.00
	EII07-BdC	O	Data transmission systems	2.00
	EII07-POO	O	Object-Oriented Programming	4.00
	EII07-VHDL	O	VHDL Programming	2.00
2	**EII07-MSA**		**Signal, Automation, Mathematics S7**	**6.00**
	EII07-OM	O	Mathematical Programming	3.00
	EII07-TSAN	O	Digital signal processing and automation	3.00
3	**EII07-PJ**		**Project S7**	**8.00**
	EII07-INVR-EB	O	INNOV-R-Bibliographic studies	5.50
	EII07-MCPJ	O	Methodology and Project Management	2.50
4	**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
5	**HUMF1-ELSA Mus**		**Music with studies**	**1.00**
	HUMF1-MUS	F	Music Studies	1.00
8	**HUMF1-ELSA Thea**		**Theatre with studies**	**1.00**
	HUMF1-THEA	F	Study & Theater	1.00

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

Computer architecture II	EII07-ARC
Number of hours : 21.00 h	2.00 ECTS credit
CM : 10.50 h, PR : 2.00 h, PR : 0.50 h, TD : 8.00 h	
Reference Teacher(s) : COUSIN Jean-Gabriel	

Objectives :
- Study hardware methods that impact modern computer performance and have a feedback into their C/assembler code

Targeted main competences:
- To analyze or design hierarchically a digital system with interconnected functions
' To develop, compile, simulate, debug the system, using adapted industrial CAD tools
- To take into account the modern computer behavior to program in C code
- To use efficiently available resources (documentation, internet, supervisor) to solve digital system design problems

Content :
- Evolution of modern computer architecture
- Pipelined design: principles, impacts on computer performance, branch prediction techniques, case study of a pipelined RISC core
- Cache memories: structures and main characteristics
- Introduction on parallel computing: mono-core architecture (restricted dataflow, superscalar, VLIW), multi-core architecture (SIMD to MIMD)

CAD tools used:
- Quartus-Prime of Intel Corporation
- Modelsim-Intel of Mentor-Graphics Corporation

Bibliography :
- Websites
- TANENBAUM S., "Structured Computer Organization", Prentice Hall
- HENNESSY J., PATTERSON D., "Architecture des ordinateurs : une approche quantitative", McGraw-Hill
- STALLINGS W., "Computer Organization and Architecture", Prentice hall
- NOEERGAARD T., "Embedded Systems Architecture", Elsevier Newnes

Requirements :
- Microprocessor Systems (EII06-SMP)
- C Language (EII05-LANG)

Organisation :
- Active pedagogy
- Revision of course notes
- Preparation of tutorials
- Project-based learning in near-autonomy

Evaluation :
- Attendance
- Written examination
- Project

Target :
4EII

Data transmission systems	EII07-BdC
Number of hours : 20.00 h	2.00 ECTS credit
CM : 10.00 h, TP : 10.00 h	
Reference Teacher(s) : NEZAN Jean-Francois	

Objectives :
The goal is to learn about the main data transmission systems for real-time and/or embedded systems. The first part of the lecture is about the main contraints and requirements of data transmissions (security, error detection and correction). Point-to-point connections and network protocols are illustrated on existing use cases (SPI, SCI, CAN)

Targeted competences are:
-> To know the main classes of data communication systems
-> To program microcontrollers using data transmission capabilities

Content :
1. Overview of communication systems : introduction, main problems
2. Point to point communications : parallel / serial links, synchronous / asynchronous links, SPI et SCI busses
3. networks and multipoint communications : network topology, OSI model, CAN protocol

Bibliography :
1. MSP430x2xx Family User¿s Guide (SLAU144E), Texas Instruments Manual, 2008
2. CAN Specification 2.0. BOSCH, 1997 (http://esd.cs.ucr.edu/webres/can20.pdf)

Requirements :
Microprocessor -Based Systems (EII06-SMP).

Organisation :
Lectures, use of SPI and CAN communications protocols in practicals

Evaluation :
written examination of 2 hours, with documents.

Target :
4EII

Object-Oriented Programming	EII07-POO
Number of hours : 52.00 h	4.00 ECTS credit
CM : 24.00 h, TD : 8.00 h, TP : 10.00 h, TP : 10.00 h	
Reference Teacher(s) : ANQUETIL Eric	

Objectives :
Object Oriented programmation (OOP) is needed to build many software applications.
This course aims to familiarize the student with the object oriented programmation paradigm and to apply themus ing the C++ language. Design patterns are addressed and the last hours are dedicated to graphical user interfaces where the OOP is widely used. Python is finally studied as it is widely used in data processing.

Content :
1. Basic concepts in OOP : objects, classes, instances, encapsulation, methods, inheritance, constructors and destructors.
2. Advanced concepts in OOP : polymorphic objects, polymorphism, virtual methods and dynamic linking, genericity
3. Design patterns.
4. Concepts required to developp two types of application : "Simple Document Interface (SDI) or "Multiple Document Interface (MDI)".
5. Introduction to Python

Bibliography :
1. MEYER B., "Conception et programmation par objets", Interéditions.
2. BOOCH G., "Conception orientée objets et applications", Addison-Wesley.
3. DEWHURT S. C., STARK K. T., "Programmer en C++", Masson.
4. STROUSTRUP, "Le Langage C++", Addison-Wesley.
5. HILL, "Analyse orientée objet", Addison-Wesley.
6. RUMBAUGH et Al., "OMT - Modélisation et conception orientées objets", Masson.

Requirements :
Langage C (EII05-LANGC) and Language C : Project (EII06-PJC)

Organisation :
Lecture revision, preparing exercises and validating the results in practicals

Evaluation :
Two final personal tests with documents at the end of the semester: the first one is a written test of 2 hours and the last one is a test on computer lasting 2 hours.

Target :
4EII

VHDL Programming	EII07-VHDL
Number of hours : 26.00 h	2.00 ECTS credit
CM : 8.00 h, PR : 4.00 h, TP : 14.00 h	
Reference Teacher(s) : DEFORGES Olivier	

Objectives :
Familiarisation with VHDL, a standard high level Hardware Description Language (HDL). VHDL is widely used to model complex digital systems and to synthesise them on ASICs or programmable devices.
This first part of the course mainly focuses on the system behavior description.

Content :
1. Description: behaviour, data flow, structure.
2. Temporal modelling.
3. Lexical and syntactic basics of the language.
4. Structural description.
5. High level behavioural description.
6. Synchronous/asynchronous logic description.
7. General planning of a design.

The first 6 hours of practical work are dedicated to the modelling and simulation of digital systems composed of simple components (multiplexers, comparators, sequencers, pipeline registers, etc.).
The following 8 hours are dedicated to more complex specification and description : a 8085 based processor. The last 4 hours are dedicated to a project.

Bibliography :
1. AUMIAUX M., "Initiation au langage VHDL", Masson.
2. DUTRIEUX L., DEMIGNY D., "Logique programmable", Eyrolles.
3. PERRY D. L., "VHDL", McGraw-Hill Series on Computer Engineering.
4. Principal site web : http://www.vhdl.org/

Requirements :
Logic (ESM05-LOG), Architecture of Calculators (EII05-ARC).

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

Evaluation :
Project evaluation

Target :
4EII

Mathematical Programming	EII07-OM
Number of hours : 40.00 h	3.00 ECTS credit
CM : 12.00 h, TD : 12.00 h, TP : 16.00 h	
Reference Teacher(s) : HADDOU Mounir	

Objectives :
Linear programming and nonlinear optimisation with or without constraints; Finding an optimum through algorithmic
methods.

Content :
1. Linear programming: Definition, standard form, simplex algorithm, duality, geometrical interpretation.
2. Optimisation without constraints: Global/local minimums and maximums, and convex functions. Digital methods: Newton
method, gradient descent methods, conjugate gradient algorithm - Quasi-Newton methods.
3. Optimisation with constraints: Necessary conditions of optimality: Lagrange or Kuhn-Tucker conditions. Case of convex
programs. Presentation of some selected algorithms. Penalty methods.

Bibliography :
1. SAKAROVITCH M., "Optimisation combinatoire", Volume 1.
2. MINOUX M., "Programmation mathématique", tome 1, Dunod.
3. LUENBERGER D.G., "Introduction to linear and non linear programming", Addison-Wesley.

Requirements :
Mathematics INSA 1st cycle or Science DEUG level.

Organisation :
Revision of lecture notes. Preparation of exercises (2 hours per week). Programming. Writing of a project.

Evaluation :
Three-hour written examination (with documents).
Presentation of project at the end of the semester.

Target :

Digital signal processing and automation	EII07-TSAN
Number of hours : 36.50 h	3.00 ECTS credit
CM : 10.50 h, TD : 16.00 h, TP : 10.00 h	
Reference Teacher(s) : KPALMA Kidiyo	

Objectives :
Basics of digital signal processing. Provide students with digital processing methods in order to complete and extend their knowledge of signal theory and (analog) signal processing and control of analog dynamic systems.

Targeted competences are:
-> Acquire the techniques of signal discretization
-> Understand digital signal processing,
-> Apprehend the limits of those processings

Content :
1. Sampling and quantisation: discrete signals, different samplings, sampling theorem, signal reconstruction; quantisation: definition and principle, quantisation noise, quantisation efficiency, uniform quantisation, quantised signal encoding.
2. Discrete Fourier Transform (DFT): direct and inverse Fourier transform of a digital signal, digital signal frequency spectrums, digital signal Fourier transform properties, convolution, digital signal correlation: frequency sampling, sampling quality, periodic signal DFT, DFT properties, practical DFT for time-limited signals (windowing); Z-transform: direct and inverse transform, properties.
3. Digital filtering: representation methods, IIR/FIR classification, realisation structures, digital filters stability, IIR and FIR synthesis methods.
4. Unitary transforms: review of signals and vector spaces, signal transforms, transformation matrices generation by Kronecker product; Karhunen-Loève Transform (KLT), Hadamard transform (Walsh), Fast Fourier Transform (FFT), Discrete Cosine Transform (DCT); unitary transforms applications.
5. Digital system control using Z transform: first and second order models - stability - temporal and frequency specifications - study of dominant poles effects - proportional, integral and derivative action
synthesis of digital regulators - space state representation.

Bibliography :
1. KUNT M., "Traitement numérique des signaux", Traité d'électricité, Volume XX, Presses Polytechniques Romandes, Lausanne, 1980.
2. FONTOLLIET P. G., "Systèmes de télécommunications, bases de transmission", Dunod, 1983.
3. KPALMA K., COAT V., "Traitement numérique du signal : Théorie et applications", collection Technosup, éditions Ellipses, 2003.
4. OPPENHEIM A.V., SHAFER R. W., "Digital Signal Processing", Prentice Hall, Englewood Cliffs, 1975.
5. RIVOIRE M., FERRIER J.-L., 1993, " Cours d'automatique -tome 3 : commande par calculateur, identification", Eyrolles.
6. KUO Benjamin C., 1995, "Automatic control systems ", Prentice Hall International Editions.
7. DE LARMINAT Ph., 1993, "Automatique, commande des systèmes linéaires", Hermès.

Requirements :
Signals and Systems (ESM05-SIG)
Signal processing (EII06-TS).
Automation (ESM06-AUTO)

Organisation :
Lesson review. Preparation of exercises and practical work. Active learning: participation in problem solving on the board or work in sub-groups.

Evaluation :
Three-hours written examination in two tests.

Target :
4EII

INNOV-R-Bibliographic studies	EII07-INVR-EB
Number of hours : 74.00 h	5.50 ECTS credit
DIV : 3.00 h, PR : 6.00 h, TA : 65.00 h	
Reference Teacher(s) : ZHANG Lu	

Objectives :
Discovery of the research world and initiation to technology transfers and research valorisation.

Content :
The topics varying every year will be given by a teacher-reseracher or a PhD student (supervisor). Every proposed topic needs a reflection, a bibliographical study and a theoretical study of a complex problem.

Bibliography :

Requirements :

Organisation :
Students work within specified time slots and have free access to facilities of the laboratory proposing the topics. Students need to have regular meetings with their supervisors to be followed up.

Evaluation :
a written report (6/20), an oral presentation (6/20) and evaluation on the conducted work and the attitude (8/20).

Target :

Methodology and Project Management	EII07-MCPJ
Number of hours : 32.00 h	2.50 ECTS credit
CM : 6.00 h, CONF : 6.00 h, TD : 20.00 h	
Reference Teacher(s) : DEFORGES Olivier	

Objectives :
Presentation and learning of a design methodology for electronic systems: MCSE. Design approach consists of five essential stages (specification, functional design, definition, realisation and test). Each stage uses a specific description model for both structural (present entities, functions of the system, type of relation,etc.) and behavioural aspects. Otherwise, the module emphasises the necessity for a perfectly structured approach for the development of every digital system. Methodology used later for lectures on real-time systems, programmable logic and VHDL. Introduction to project management through lectures and conferences (given by representatives of various firms).

Content :
MCSE lectures:
1. Purpose of a methodology and general presentation of MCSE.
2. Specification: definition of the environment, descriptions of the entities, inputs/outputs bounding, functional specifications, operating and technological specifications.
3. Functional design: functional analysis, behaviour (description).
4. Realisation: layout constraints, hardware/software implementation.
5. Examples studied -control-command systems or digital circuits. Project management lectures:

1. Project life cycle.
2. The contract.
3. Cost Estimations.
4. Project design stages.
5. Scheduling.
6. Oral communication. The meeting.

Bibliography :
CALVEZ J. P., "Spécification et conception des systèmes : une méthodologie", Masson.

Requirements :
Logic (ESM05-LOG)

Organisation :
Active pedagogy, preparing exercises during TD and validating the results in practicals.

Evaluation :
Written examination 3 hours, with documents.

Target :
4EII

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 :

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

Study & Theater	HUMF1-THEA
Number of hours : 27.00 h	1.00 ECTS credit
TD : 27.00 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 and Theater", builds a theatrical artistic journey, grom writing to the stage along four successive semesters with four different artists.

The recruitment of "Study & Theater" section is carroed 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 commited to following the training provided over the term of two years. An evaluation at the end of each semester of the course is completed by the head of the section.

Since September 2017, a professional theater company, with a creation and training link with ADEC, has offered an artistic universe to promote the current year. The work is done either around a theatrical work or around an original work from materials (writing work, text editing work). In general, during this first semester, the set work takes up the basics of acting for addressing the artistic propositions. In addition to this course, the ADEC offers two interventions around the discovery of theatrical literature at the ADEC library and some slight initiations to the light operations.

Bibliography :

Requirements :
no specific acting requirement

Organisation :
On Thursday afternoon at the ADEC theater place

Evaluation :
Validation based on the student's involvement

Target :
Registered student between the first and third year

Semestre 7

Parcours Formation Initiale EII

1	**EII07-E**		**Electronics S7**	**8.00**
	EII07-ELE	O	Electronics III	5.50
	EII07-MCPJ	O	Methodology and Project Management	2.50
2	**EII07-II**		**Computer Engineering S7**	**10.00**
	EII07-ARC	O	Computer architecture II	2.00
	EII07-BdC	O	Data transmission systems	2.00
	EII07-POO	O	Object-Oriented Programming	4.00
	EII07-VHDL	O	VHDL Programming	2.00
3	**EII07-MSA**		**Signal, Automation, Mathematics S7**	**6.00**
	EII07-OM	O	Mathematical Programming	3.00
	EII07-TSAN	O	Digital signal processing and automation	3.00
4	**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
5	**HUMF1-ELSA Mus**		**Music with studies**	**1.00**
	HUMF1-MUS	F	Music Studies	1.00
7	**HUMF1-ELSA Thea**		**Theatre with studies**	**1.00**
	HUMF1-THEA	F	Study & Theater	1.00

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

Electronics III	EII07-ELE
Number of hours : 68.00 h	5.50 ECTS credit
CM : 22.00 h, TD : 22.00 h, TP : 24.00 h	
Reference Teacher(s) : HAESE Sylvain	

Objectives :
Identification of the various functions of a complex electronic system, defining specifications, suggesting satisfactory applications and distinguishing between theoretical design constraints and current technological limitations.

Content :
1. Filter design, passive and active implementation.
2. Harmonic oscillator (timebase clocks, local oscillators): Linear study of oscillation conditions; Nonlinear study of steady state; Frequency stability; Amplitude stability; Different kinds of harmonic oscillators: RC network oscillator, resonant LC and quartz oscillators.
3. Comparator, flip-flops: Ideal comparator, Real comparator circuits, Schmitt trigger, Monostable and astable flip-flops and relaxation oscillators, Voltage to frequency conversion, VCO.
4. Linear power supply. Voltage references with low temperature coefficient. Voltage regulation circuit schematics
5. Switched-mode power supply: Step-down, step-up and inverter circuits. Switched-mode regulators.
6. Non-linear circuits, amplitude modulation and demodulation circuits. Frequency transposition, heterodyne receiver.

Bibliography :
1. CHATELAIN J.D., DESSOULAVY R., ""Electronique"", Tome 2, Dunod.
2. GIRARD M., ""Alimentations à découpage"", Ediscience, 1993.

Requirements :
Analogue electronics 1 (EII05-ELE) and 2 (EII06-ELE), Signals and systems(ESM05-SIG).

Organisation :
Revision of lecture notes. Preparation of exercises.

Evaluation :
Two-hour written examination (with documents) at the end of the semester.
Practical work report.

Target :
4EII

Methodology and Project Management	EII07-MCPJ
Number of hours : 32.00 h	2.50 ECTS credit
CM : 6.00 h, CONF : 6.00 h, TD : 20.00 h	
Reference Teacher(s) : DEFORGES Olivier	

Objectives :
Presentation and learning of a design methodology for electronic systems: MCSE. Design approach consists of five essential stages (specification, functional design, definition, realisation and test). Each stage uses a specific description model for both structural (present entities, functions of the system, type of relation,etc.) and behavioural aspects. Otherwise, the module emphasises the necessity for a perfectly structured approach for the development of every digital system. Methodology used later for lectures on real-time systems, programmable logic and VHDL. Introduction to project management through lectures and conferences (given by representatives of various firms).

Content :
MCSE lectures:
1. Purpose of a methodology and general presentation of MCSE.
2. Specification: definition of the environment, descriptions of the entities, inputs/outputs bounding, functional specifications, operating and technological specifications.
3. Functional design: functional analysis, behaviour (description).
4. Realisation: layout constraints, hardware/software implementation.
5. Examples studied -control-command systems or digital circuits. Project management lectures:

1. Project life cycle.
2. The contract.
3. Cost Estimations.
4. Project design stages.
5. Scheduling.
6. Oral communication. The meeting.

Bibliography :
CALVEZ J. P., "Spécification et conception des systèmes : une méthodologie", Masson.

Requirements :
Logic (ESM05-LOG)

Organisation :
Active pedagogy, preparing exercises during TD and validating the results in practicals.

Evaluation :
Written examination 3 hours, with documents.

Target :
4EII

Computer architecture II	EII07-ARC
Number of hours : 21.00 h	2.00 ECTS credit
CM : 10.50 h, PR : 2.00 h, PR : 0.50 h, TD : 8.00 h	
Reference Teacher(s) : COUSIN Jean-Gabriel	

Objectives :
- Study hardware methods that impact modern computer performance and have a feedback into their C/assembler code

Targeted main competences:
- To analyze or design hierarchically a digital system with interconnected functions
' To develop, compile, simulate, debug the system, using adapted industrial CAD tools
- To take into account the modern computer behavior to program in C code
- To use efficiently available resources (documentation, internet, supervisor) to solve digital system design problems

Content :
- Evolution of modern computer architecture
- Pipelined design: principles, impacts on computer performance, branch prediction techniques, case study of a pipelined RISC core
- Cache memories: structures and main characteristics
- Introduction on parallel computing: mono-core architecture (restricted dataflow, superscalar, VLIW), multi-core architecture (SIMD to MIMD)

CAD tools used:
- Quartus-Prime of Intel Corporation
- Modelsim-Intel of Mentor-Graphics Corporation

Bibliography :
- Websites
- TANENBAUM S., "Structured Computer Organization", Prentice Hall
- HENNESSY J., PATTERSON D., "Architecture des ordinateurs : une approche quantitative", McGraw-Hill
- STALLINGS W., "Computer Organization and Architecture", Prentice hall
- NOEERGAARD T., "Embedded Systems Architecture", Elsevier Newnes

Requirements :
- Microprocessor Systems (EII06-SMP)
- C Language (EII05-LANG)

Organisation :
- Active pedagogy
- Revision of course notes
- Preparation of tutorials
- Project-based learning in near-autonomy

Evaluation :
- Attendance
- Written examination
- Project

Target :
4EII

Data transmission systems	EII07-BdC
Number of hours : 20.00 h	2.00 ECTS credit
CM : 10.00 h, TP : 10.00 h	
Reference Teacher(s) : NEZAN Jean-Francois	

Objectives :
The goal is to learn about the main data transmission systems for real-time and/or embedded systems. The first part of the lecture is about the main contraints and requirements of data transmissions (security, error detection and correction). Point-to-point connections and network protocols are illustrated on existing use cases (SPI, SCI, CAN)

Targeted competences are:
-> To know the main classes of data communication systems
-> To program microcontrollers using data transmission capabilities

Content :
1. Overview of communication systems : introduction, main problems
2. Point to point communications : parallel / serial links, synchronous / asynchronous links, SPI et SCI busses
3. networks and multipoint communications : network topology, OSI model, CAN protocol

Bibliography :
1. MSP430x2xx Family User¿s Guide (SLAU144E), Texas Instruments Manual, 2008
2. CAN Specification 2.0. BOSCH, 1997 (http://esd.cs.ucr.edu/webres/can20.pdf)

Requirements :
Microprocessor -Based Systems (EII06-SMP).

Organisation :
Lectures, use of SPI and CAN communications protocols in practicals

Evaluation :
written examination of 2 hours, with documents.

Target :
4EII

Object-Oriented Programming	EII07-POO
Number of hours : 52.00 h	4.00 ECTS credit
CM : 24.00 h, TD : 8.00 h, TP : 10.00 h, TP : 10.00 h	
Reference Teacher(s) : ANQUETIL Eric	

Objectives :
Object Oriented programmation (OOP) is needed to build many software applications.
This course aims to familiarize the student with the object oriented programmation paradigm and to apply themus ing the C++ language. Design patterns are addressed and the last hours are dedicated to graphical user interfaces where the OOP is widely used. Python is finally studied as it is widely used in data processing.

Content :
1. Basic concepts in OOP : objects, classes, instances, encapsulation, methods, inheritance, constructors and destructors.
2. Advanced concepts in OOP : polymorphic objects, polymorphism, virtual methods and dynamic linking, genericity
3. Design patterns.
4. Concepts required to developp two types of application : "Simple Document Interface (SDI) or "Multiple Document Interface (MDI)".
5. Introduction to Python

Bibliography :
1. MEYER B., "Conception et programmation par objets", Interéditions.
2. BOOCH G., "Conception orientée objets et applications", Addison-Wesley.
3. DEWHURT S. C., STARK K. T., "Programmer en C++", Masson.
4. STROUSTRUP, "Le Langage C++", Addison-Wesley.
5. HILL, "Analyse orientée objet", Addison-Wesley.
6. RUMBAUGH et Al., "OMT - Modélisation et conception orientées objets", Masson.

Requirements :
Langage C (EII05-LANGC) and Language C : Project (EII06-PJC)

Organisation :
Lecture revision, preparing exercises and validating the results in practicals

Evaluation :
Two final personal tests with documents at the end of the semester: the first one is a written test of 2 hours and the last one is a test on computer lasting 2 hours.

Target :
4EII

VHDL Programming	EII07-VHDL
Number of hours : 26.00 h	2.00 ECTS credit
CM : 8.00 h, PR : 4.00 h, TP : 14.00 h	
Reference Teacher(s) : DEFORGES Olivier	

Objectives :
Familiarisation with VHDL, a standard high level Hardware Description Language (HDL). VHDL is widely used to model complex digital systems and to synthesise them on ASICs or programmable devices.
This first part of the course mainly focuses on the system behavior description.

Content :
1. Description: behaviour, data flow, structure.
2. Temporal modelling.
3. Lexical and syntactic basics of the language.
4. Structural description.
5. High level behavioural description.
6. Synchronous/asynchronous logic description.
7. General planning of a design.

The first 6 hours of practical work are dedicated to the modelling and simulation of digital systems composed of simple components (multiplexers, comparators, sequencers, pipeline registers, etc.).
The following 8 hours are dedicated to more complex specification and description : a 8085 based processor. The last 4 hours are dedicated to a project.

Bibliography :
1. AUMIAUX M., "Initiation au langage VHDL", Masson.
2. DUTRIEUX L., DEMIGNY D., "Logique programmable", Eyrolles.
3. PERRY D. L., "VHDL", McGraw-Hill Series on Computer Engineering.
4. Principal site web : http://www.vhdl.org/

Requirements :
Logic (ESM05-LOG), Architecture of Calculators (EII05-ARC).

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

Evaluation :
Project evaluation

Target :
4EII

Mathematical Programming	EII07-OM
Number of hours : 40.00 h	3.00 ECTS credit
CM : 12.00 h, TD : 12.00 h, TP : 16.00 h	
Reference Teacher(s) : HADDOU Mounir	

Objectives :
Linear programming and nonlinear optimisation with or without constraints; Finding an optimum through algorithmic
methods.

Content :
1. Linear programming: Definition, standard form, simplex algorithm, duality, geometrical interpretation.
2. Optimisation without constraints: Global/local minimums and maximums, and convex functions. Digital methods: Newton
method, gradient descent methods, conjugate gradient algorithm - Quasi-Newton methods.
3. Optimisation with constraints: Necessary conditions of optimality: Lagrange or Kuhn-Tucker conditions. Case of convex
programs. Presentation of some selected algorithms. Penalty methods.

Bibliography :
1. SAKAROVITCH M., "Optimisation combinatoire", Volume 1.
2. MINOUX M., "Programmation mathématique", tome 1, Dunod.
3. LUENBERGER D.G., "Introduction to linear and non linear programming", Addison-Wesley.

Requirements :
Mathematics INSA 1st cycle or Science DEUG level.

Organisation :
Revision of lecture notes. Preparation of exercises (2 hours per week). Programming. Writing of a project.

Evaluation :
Three-hour written examination (with documents).
Presentation of project at the end of the semester.

Target :

Digital signal processing and automation	EII07-TSAN
Number of hours : 36.50 h	3.00 ECTS credit
CM : 10.50 h, TD : 16.00 h, TP : 10.00 h	
Reference Teacher(s) : KPALMA Kidiyo	

Objectives :
Basics of digital signal processing. Provide students with digital processing methods in order to complete and extend their knowledge of signal theory and (analog) signal processing and control of analog dynamic systems.

Targeted competences are:
-> Acquire the techniques of signal discretization
-> Understand digital signal processing,
-> Apprehend the limits of those processings

Content :
1. Sampling and quantisation: discrete signals, different samplings, sampling theorem, signal reconstruction; quantisation: definition and principle, quantisation noise, quantisation efficiency, uniform quantisation, quantised signal encoding.
2. Discrete Fourier Transform (DFT): direct and inverse Fourier transform of a digital signal, digital signal frequency spectrums, digital signal Fourier transform properties, convolution, digital signal correlation: frequency sampling, sampling quality, periodic signal DFT, DFT properties, practical DFT for time-limited signals (windowing); Z-transform: direct and inverse transform, properties.
3. Digital filtering: representation methods, IIR/FIR classification, realisation structures, digital filters stability, IIR and FIR synthesis methods.
4. Unitary transforms: review of signals and vector spaces, signal transforms, transformation matrices generation by Kronecker product; Karhunen-Loève Transform (KLT), Hadamard transform (Walsh), Fast Fourier Transform (FFT), Discrete Cosine Transform (DCT); unitary transforms applications.
5. Digital system control using Z transform: first and second order models - stability - temporal and frequency specifications - study of dominant poles effects - proportional, integral and derivative action
synthesis of digital regulators - space state representation.

Bibliography :
1. KUNT M., "Traitement numérique des signaux", Traité d'électricité, Volume XX, Presses Polytechniques Romandes, Lausanne, 1980.
2. FONTOLLIET P. G., "Systèmes de télécommunications, bases de transmission", Dunod, 1983.
3. KPALMA K., COAT V., "Traitement numérique du signal : Théorie et applications", collection Technosup, éditions Ellipses, 2003.
4. OPPENHEIM A.V., SHAFER R. W., "Digital Signal Processing", Prentice Hall, Englewood Cliffs, 1975.
5. RIVOIRE M., FERRIER J.-L., 1993, " Cours d'automatique -tome 3 : commande par calculateur, identification", Eyrolles.
6. KUO Benjamin C., 1995, "Automatic control systems ", Prentice Hall International Editions.
7. DE LARMINAT Ph., 1993, "Automatique, commande des systèmes linéaires", Hermès.

Requirements :
Signals and Systems (ESM05-SIG)
Signal processing (EII06-TS).
Automation (ESM06-AUTO)

Organisation :
Lesson review. Preparation of exercises and practical work. Active learning: participation in problem solving on the board or work in sub-groups.

Evaluation :
Three-hours written examination in two tests.

Target :
4EII

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 :

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

Study & Theater	HUMF1-THEA
Number of hours : 27.00 h	1.00 ECTS credit
TD : 27.00 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 and Theater", builds a theatrical artistic journey, grom writing to the stage along four successive semesters with four different artists.

The recruitment of "Study & Theater" section is carroed 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 commited to following the training provided over the term of two years. An evaluation at the end of each semester of the course is completed by the head of the section.

Since September 2017, a professional theater company, with a creation and training link with ADEC, has offered an artistic universe to promote the current year. The work is done either around a theatrical work or around an original work from materials (writing work, text editing work). In general, during this first semester, the set work takes up the basics of acting for addressing the artistic propositions. In addition to this course, the ADEC offers two interventions around the discovery of theatrical literature at the ADEC library and some slight initiations to the light operations.

Bibliography :

Requirements :
no specific acting requirement

Organisation :
On Thursday afternoon at the ADEC theater place

Evaluation :
Validation based on the student's involvement

Target :
Registered student between the first and third year

Semestre 8

Innovation par la Recherche

1	**EII08-PJ-R**		**Project S8**	**6.00**
	EII08-INVR-CR	O	Innov-R-Conception and implementation	6.00
2	**EII08-II-R**		**Computer Engineering S8**	**6.00**
	EII08-SEE	O	Embedded Operating Systems	2.00
	EII08-STR	O	Real -Time Systems	2.00
	EII08-LP	O	Programmable Logic Devices	2.00
3	**EII08-MSA**		**Signal, Automation, Mathematics S8**	**4.00**
	EII08-AI	O	Image Processing	2.00
	EII08-IAE	O	Articifial Intelligence	2.00
4	**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
5	**EII-STAGE08**		**Industrial Placement**	**8.00**
	EII08-STAGE	O	4 EII Work Placement	8.00
6	**HUMF2-ELSA Mus**		**Music with Studies**	**1.00**
	HUMF2-MUS	C	Music Studies	1.00
7	**HUMF2-ELSA Thea**		**Theatre with Studies**	**1.00**
	HUMF2-THEA	C	Study & Theater	1.00

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

Innov-R-Conception and implementation	EII08-INVR-CR
Number of hours : 80.00 h	6.00 ECTS credit
PR : 6.00 h, TA : 3.00 h, TA : 71.00 h	
Reference Teacher(s) : ZHANG Lu	

Objectives :
Discovery of the research world and initiation to technology transfers and research valorisation.

Content :
The topics varying every year will be given by a teacher-reseracher or a PhD student (supervisor). Every proposed topic needs a reflection, a bibliographical study and a theoretical study of a complex problem.

Bibliography :

Requirements :

Organisation :
Students work within specified time slots and have free access to facilities of the laboratory proposing the topics. Students need to have regular meetings with their supervisors to be followed up.

Evaluation :
a written report (6/20), an oral presentation (6/20) and evaluation on the conducted work and the attitude (8/20).

Target :

Embedded Operating Systems	EII08-SEE
Number of hours : 32.00 h	2.00 ECTS credit
CM : 8.00 h, PR : 14.00 h, TP : 10.00 h	
Reference Teacher(s) : HEULOT Julien	

Objectives :
This course mainly aims at making the students comfortable with compiling and porting Linux to an embedded platform. Student compiles and prepares a Linux distribution and runs it on an autonomous system based on a TI OMAP3530 containing an ARM Cortex A8 core.

Targeted competences are:
- To configure, cross-compile and load a Linux kernel on an embedded platform
- To create executables and device drivers for embedded platforms
- To adapt rapidly to a new Linux-based target

Content :
1. Cross-compilation
3. Bootloading and board support package
2. Modules and device drivers

Bibliography :
Building Embedded Linux Systems Second Edition, Karim Yaghmour, Jon Masters, Gilad Ben-Yossef, Philippe Gerum, O'Reilly Media, 2008
Linux Device Drivers, 3rd Edition, Corbet Jonathan, Rubini Alessandro, Kroah-Hartman Greg, O'Reilly Media, 2005

Requirements :
C Language (ESM05-INFOC), Microprocessor-Based Systems (EII06-SMP), C Language Level 2 (EII05-LANG), Programming Systems (EII06-PS).

Organisation :
Courses and practicals.

Evaluation :
Practical work.

Target :
4EII

Real -Time Systems	EII08-STR
Number of hours : 28.00 h	2.00 ECTS credit
CM : 10.00 h, TD : 6.00 h, TP : 12.00 h	
Reference Teacher(s) : NEZAN Jean-Francois	

Objectives :
Presentation of real-time systems specificities, main features of real-time operation systems, programmation of real-time systems, concept of Multi-Task on monocore and multicore processors.
Targeted competences are:
-> To know main features proposed by real-time operating systems
-> To program an application using a real-time operating system
-> To know the organisation of a real-time operating system

Content :
1. Introduction to real-time : reactive systems, time constraints, position in the design process, need for a real-time operating system
2. multi-task approach : notion of parallelism, task model, monoprocessor and multiprocessor multi-task execution
3. Real-time operating system : goals and features, programming model, task management, sheduling algorithms
4. Examples of application : deadlocks, message passing ...
5. Most popular real-time operating systems
6. Scheduling analysis

Bibliography :
DORSEUIL A., PILLOT P., "Temps réel en milieu industriel : Concepts, environnements, multitâches", Dunod, 1991.

Requirements :
C language and C language level 2 (ESM05-INFOC, EII05-LANG), Methodology and project management (EII07-MCPJ) .
.

Organisation :
lectures, preparing exercises during TD and validating the results in practicals

Evaluation :
Written examination of 3 hours, with documents.

Target :
4EII

Programmable Logic Devices	EII08-LP
Number of hours : 38.00 h	2.00 ECTS credit
CM : 10.00 h, PR : 10.00 h, TD : 8.00 h, TP : 10.00 h	handout in English
Reference Teacher(s) : DEFORGES Olivier	

Objectives :
The integration of systems in programmable logic devices. Presentation of the different existing component families and their respective capabilities. Illustrations of the embedding of digital functions and systems. Presentation of synthetisable VHDL and its main concept.

Targeted competences are:
-> To be able to choose an adapted componant family, and use the corresponding design frameworks,
-> To be able to design a dedicated architecture, and perform optimized implementations.
-> To be able to synthesize a system into a FPGA from a VHDL description.

Content :
1. Simple PLD and CPLD.
2. FPGA : main concepts architectures, technonogies, functionnalities, ...
3. Present FPGA : STRATIX and VIRTEX families.
4. Design techniques: current methods and advanced ones based on SOC and IP.
5. Exercises : implementation of basic functions (convolution, FIR, ..) into CPLD and FPGA.
6. VHDL synthesis.
7. Link VHDL to design methodology: MCSE.

Bibliography :
1. TAVERNIER, "Circuits logiques programmables", Dunod.
2. BROWN D., FRANCIS R. J., "Field-Programmable Gate-Arrays", Kluwer Academic Publishers.
3. Sites Web constructeurs.

Requirements :
Methodology for Project Design and Management (EII07-MCPJ).

Organisation :
Active pedagogy, preparing exercises during TD and validating the results in practicals

Evaluation :
Note based on the project performances

Target :
4EII

Image Processing	EII08-AI
Number of hours : 32.00 h	2.00 ECTS credit
CM : 16.00 h, TP : 16.00 h	
Reference Teacher(s) : MORIN Luce	

Objectives :
This lecture aims at presenting basic image processing principles and tools together with basic methods dedicated to image analysis and segmentation.

Targeted skills are:
-> To know image processing principles and methods
-> To translate state-of-the-art algorithms into C or Matlab code

Content :
1.
Human vision properties and modelling: perception of light, photometry and colorimetry, the visual system, visual phenomena, monochrome vision model, colour vision model.

2.
Introduction to information theory: source information, entropy.

3.
Sampling: Shannon theorem, error recovery, distortions caused by contour sampling

4.
Quantization: scalar quantization definition, optimal quantifier (definition and properties), non-linear quantifier, quantifier enhancement criteria, vector quantisation.

5.
Binary image processing: discrete topology elements, topological skeleton, mathematical morphology.

6.
Image quality enhancement: Enhancement (Contrast manipulation, histogram correction, false-color).

7.
Segmentation: basic primitive extraction (pixel, outline, line/shape), sequential segmentation, iterative segmentation.

8.
Extraction and tracking of image features, Kalman filter.

Bibliography :
1. KUNT M., GRANLUND R., KOCHER M., ""Traitement numérique des images, traitement de l'information"", Volume 2, Presses Polytechniques Romandes, 1993.
2. GONZALEZ R. C., WOODS R. E., ""Digital image processing"", Addison Wesley Publishing Company, 1992.
3. COSTER M., CHERMAN J. L., ""Précis d'analyse d'images"", Editions du CNRS, 1985.

Requirements :
Signal processing (EII06-TS, EII07-TSAN).

Organisation :
Revision of lecture notes. Personal input work.

Evaluation :
Evaluation of labs.
Two-hour written examination

Target :
4EII

Articifial Intelligence	EII08-IAE
Number of hours : 44.00 h	2.00 ECTS credit
CM : 20.00 h, TD : 2.00 h, TP : 22.00 h	
Reference Teacher(s) : HAMIDOUCHE Wassim	

Objectives :
The objective of this course is to acquire theoretical and practical skills on artificial intelligence algorithms as well as their implementation on different architectures.

Content :
The course is composed of a theoretical part which reviews the mathematical background used in artificial intelligence algorithms: linear algebra, resolution of linear systems, least squares problem, matrices decomposition into eigen and singular values, classification and regression with SVM and SVR algorithms. The second part of the course is devoted to the study of different machine learning algorithms: introduction to deep learning, convolutional neural networks, autoencoders, recurrent neural networks and generative adversary networks.

Bibliography :
MIT deep neural networks course

Requirements :
Python programming, probability, linear algebra.

Organisation :
The IAE courses are organized in lectures (50%) and practical works (50%); The practical work will allow the implementation of the various algorithms seen in lectures on CPU and GPU platforms.

Evaluation :
Three assessments are planned: two written exams on the two parts of the course with 2/5 of the final mark each, and an evaluation on the reports of the practical works which completes the final mark.

Target :
4-EII students

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 :

4 EII Work Placement	EII08-STAGE
Number of hours : 240.00 h	8.00 ECTS credit
ES : 1.00 h	
Reference Teacher(s) : MORIN Luce	

Objectives :
In the interim between the fourth and fifth year of studies, each student from the Electronics and Computer Engineering
speciality must do a compulsory two-month (min) work placement; subject to an agreement.
Their placement allows students to:
- Acquire practical experience in an industrial environment by developing his communication and teamwork skills.
-Increase their capacities of observation, adaptation and integration in a professional context.
-Acquire concrete knowledge of a professional field by discovering how it functions and its operating methods.
- Practice collecting, analysing and summarising information about a project.
- Plan, propose and perform the tasks required to carry out a project.
- Learn the methods needed to take stock of the company's activities.

Content :
- Duration: Two to four months (minimum of eight weeks).
- Period: Mid-May to mid-September (depending on university timetable).
- Level: End of fourth year speciality Electronics and Computer Engineering (Bac + 4).
- Location: Private or public firm, preferably in a professional field related to Electronics and Computer Engineering. (Finding
the company and making contact with it is the student's responsibility).
- Administrative formalities: The placement is subject to an agreement between INSA and the company.
- Placement report: A ten-to-fifteen-page placement report (written in French). One copy to be delivered to the department
registrar's office and one to be delivered to the student's supervising teacher.

Bibliography :
Industrial placements in 2013-2014
- Locations: West of France (63%), Paris area (8,5%), other areas in France (17%), abroad 11,5%)
- Types of companies: SMB-SME, Large companies, universities and Research laboratories.
- Fields of activity: Electronics, Telecommunications, Computer science, Automation, Signal and picture processing.

Requirements :

Organisation :

Evaluation :
Final mark (maximum of 20) is awarded for:
(1) trainee assessment reports (placement supervisor + EII supervisor).
(2) placement report.
(3) poster ST4EII.
ECTS credits: The placement gives four ECTS credits in fourth year. The six remaining credits are awarded after the
assessment at the beginning of fifth year.

Target :

Music Studies	HUMF2-MUS
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h, TD : 25.00 h	
Reference Teacher(s) :	

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

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 8

Parcours Formation Initiale EII

1	**EII08-PJ**		**Electronics S8**	**4.50**
	EII08-PROJ	O	Multidisciplinary project A	4.50
2	**EII08-II**		**Computer Engineering S8**	**7.50**
	EII08-RES	O	Computer networks	1.50
	EII08-SEE	O	Embedded Operating Systems	2.00
	EII08-STR	O	Real -Time Systems	2.00
	EII08-LP	O	Programmable Logic Devices	2.00
3	**EII08-MSA**		**Signal, Automation, Mathematics S8**	**4.00**
	EII08-AI	O	Image Processing	2.00
	EII08-IAE	O	Articifial Intelligence	2.00
4	**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
5	**EII-STAGE08**		**Industrial Placement**	**8.00**
	EII08-STAGE	O	4 EII Work Placement	8.00
6	**HUMF2-ELSA Mus**		**Music with Studies**	**1.00**
	HUMF2-MUS	C	Music Studies	1.00
7	**HUMF2-ELSA Thea**		**Theatre with Studies**	**1.00**
	HUMF2-THEA	C	Study & Theater	1.00

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

Multidisciplinary project A	EII08-PROJ
Number of hours : 38.00 h	4.50 ECTS credit
CM : 2.00 h, DIV : 14.00 h, PR : 18.00 h, PR : 4.00 h	hand-out in English and course taught in English
Reference Teacher(s) : BEDAT Laurent	

Objectives :
-Emphasis on design, problem solving, teamwork and practical experience through the design of a new multidisciplinary
application.
-Put into practice the skills previously acquired in other modules (methodology and project leading, electronic systems, microprocessor systems, programming languages).
-Design and produce a complex electronic application which includes an analog part, and a digital part that uses a microcontroller and logic components.
-Write a technical report on thisproject.

Content :
Based on the supplied specifications, each team (4 to 5 students) must solve problems similar to those they may encounter in
an industrial environment. The multidisciplinary project, for practical reasons, is divided into two modules. For further details
on stages 4 and 5, please refer to MULTIDISCIPLINARY PROJECT B (EII08-PROJB).
-Stage 1: Preliminary design (1h presentation; 3x3h of supervised project work): Analysis of the specifications detailing the
different operating modes. Study of the problem using the MCSE approach : Each team decides on a solution. Production of
"methodological specifications". Production of a "preliminary draft report" detailing the diagrams, solutions and justifying the
choice of the microcontroller.
-Stage 2: Presentation of the different solutions. Critical study and elaboration of a joint solution (2h30): Each team presents its
hardware solution to the whole graduation class using PowerPoint (5 minutes per group). The teacher leads a discussion on the
different solutions and the class reaches agreement on the best solution (45 minutes). The practical problems associated with
the embedding of components and the manufacturing of printed circuit boards are presented and various items are introduced
to facilitate the tuning of the system (decoupling capacitors, loop resistors, additional wiring zones for eventual corrections,
etc.) (45 minutes).
-Stage 3: Production of the printed circuit board (1h30): The teacher presents the tools, techniques and files associated with the
drawing and routing of the circuit, demonstrating how to place some components and then presents the final result (1h30).
The files are then transmitted to a service firm which produces identical boards for each team. The boards are then wired at the
INSA.
-Stage 4: Study and realisation of the analogical electronic part (6x3h of supervised project work).
-Stage 5: Programming and tuning (4x3h of supervised project work).

Bibliography :

Requirements :

Organisation :
Approximately 30h per team of 4/5 students.

Evaluation :
Evaluation is based on a marking grid that takes into account the following items: methodological specifications, preliminary draft report, and presentation of the hardware solution.

Target :

Computer networks	EII08-RES
Number of hours : 24.00 h	1.50 ECTS credit
CM : 14.00 h, TD : 6.00 h, TP : 4.00 h	
Reference Teacher(s) : BEDAT Laurent	

Objectives :
This module is aimed at students who have chosen not to specialise in networks. Explanation of the evolution of networks of all sizes (LAN/MAN/WAN and Telecom) and demonstration of how current and future infrastructures may be suitable for new applications. Focus on two main points: "quality of service" and "high-speed". Quality of service is defined by a set of parameters (data integrity, real-time, security, hierarchical organisation of data) that are exchanged between the software and the network. High-speed is analysed by making a comparison between classic protocols (Ethernet, Token Ring, RNIS, IP) and emerging protocols (ATM, IPv6). The spread of new network architectures and carefully-chosen applied-examples demonstrates suitability.

Content :
1. Evolution of networks: Taxonomy of existing networks; PDH, SDH and cell based physical layers; optical and satellite links; Concept of Quality of service.
2. Protocols: Local Area Networks (Ethernet), Mid and High-range networks (IP, ATM).
3. Quality of Service: Data integrity, Security, Real Time applications, Current and future applications, Multimedia applications (text, sound, image, vide, etc.); LAN infrastructures, MAN, high-speed WAN.
4. Internet architecture: IPv4, IPv6, UDP, TCP protocols, DNS servers, Web Servers, Proxy servers, Firewalls.

Bibliography :
1. TANENBAUM A., ""Réseaux"", Dunod 3ème édition, 1999.
2. ROLIN P., ""Réseaux haut débit"", Hermès, 1995.
3. PUJOLLE G., ""Les réseaux"", 1997.
4. STEVENS R., ""TCP/IP illustré"", volume 1, Thomson Publishing, 1996.

Requirements :
None

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

Evaluation :
Two-hour written examination (with documents) at the end of the semester. Remedial examination at the end of the year (if required).

Target :

Embedded Operating Systems	EII08-SEE
Number of hours : 32.00 h	2.00 ECTS credit
CM : 8.00 h, PR : 14.00 h, TP : 10.00 h	
Reference Teacher(s) : HEULOT Julien	

Objectives :
This course mainly aims at making the students comfortable with compiling and porting Linux to an embedded platform. Student compiles and prepares a Linux distribution and runs it on an autonomous system based on a TI OMAP3530 containing an ARM Cortex A8 core.

Targeted competences are:
- To configure, cross-compile and load a Linux kernel on an embedded platform
- To create executables and device drivers for embedded platforms
- To adapt rapidly to a new Linux-based target

Content :
1. Cross-compilation
3. Bootloading and board support package
2. Modules and device drivers

Bibliography :
Building Embedded Linux Systems Second Edition, Karim Yaghmour, Jon Masters, Gilad Ben-Yossef, Philippe Gerum, O'Reilly Media, 2008
Linux Device Drivers, 3rd Edition, Corbet Jonathan, Rubini Alessandro, Kroah-Hartman Greg, O'Reilly Media, 2005

Requirements :
C Language (ESM05-INFOC), Microprocessor-Based Systems (EII06-SMP), C Language Level 2 (EII05-LANG), Programming Systems (EII06-PS).

Organisation :
Courses and practicals.

Evaluation :
Practical work.

Target :
4EII

Real -Time Systems	EII08-STR
Number of hours : 28.00 h	2.00 ECTS credit
CM : 10.00 h, TD : 6.00 h, TP : 12.00 h	
Reference Teacher(s) : NEZAN Jean-Francois	

Objectives :
Presentation of real-time systems specificities, main features of real-time operation systems, programmation of real-time systems, concept of Multi-Task on monocore and multicore processors.
Targeted competences are:
-> To know main features proposed by real-time operating systems
-> To program an application using a real-time operating system
-> To know the organisation of a real-time operating system

Content :
1. Introduction to real-time : reactive systems, time constraints, position in the design process, need for a real-time operating system
2. multi-task approach : notion of parallelism, task model, monoprocessor and multiprocessor multi-task execution
3. Real-time operating system : goals and features, programming model, task management, sheduling algorithms
4. Examples of application : deadlocks, message passing ...
5. Most popular real-time operating systems
6. Scheduling analysis

Bibliography :
DORSEUIL A., PILLOT P., "Temps réel en milieu industriel : Concepts, environnements, multitâches", Dunod, 1991.

Requirements :
C language and C language level 2 (ESM05-INFOC, EII05-LANG), Methodology and project management (EII07-MCPJ) .
.

Organisation :
lectures, preparing exercises during TD and validating the results in practicals

Evaluation :
Written examination of 3 hours, with documents.

Target :
4EII

Programmable Logic Devices	EII08-LP
Number of hours : 38.00 h	2.00 ECTS credit
CM : 10.00 h, PR : 10.00 h, TD : 8.00 h, TP : 10.00 h	handout in English
Reference Teacher(s) : DEFORGES Olivier	

Objectives :
The integration of systems in programmable logic devices. Presentation of the different existing component families and their respective capabilities. Illustrations of the embedding of digital functions and systems. Presentation of synthetisable VHDL and its main concept.

Targeted competences are:
-> To be able to choose an adapted componant family, and use the corresponding design frameworks,
-> To be able to design a dedicated architecture, and perform optimized implementations.
-> To be able to synthesize a system into a FPGA from a VHDL description.

Content :
1. Simple PLD and CPLD.
2. FPGA : main concepts architectures, technonogies, functionnalities, ...
3. Present FPGA : STRATIX and VIRTEX families.
4. Design techniques: current methods and advanced ones based on SOC and IP.
5. Exercises : implementation of basic functions (convolution, FIR, ..) into CPLD and FPGA.
6. VHDL synthesis.
7. Link VHDL to design methodology: MCSE.

Bibliography :
1. TAVERNIER, "Circuits logiques programmables", Dunod.
2. BROWN D., FRANCIS R. J., "Field-Programmable Gate-Arrays", Kluwer Academic Publishers.
3. Sites Web constructeurs.

Requirements :
Methodology for Project Design and Management (EII07-MCPJ).

Organisation :
Active pedagogy, preparing exercises during TD and validating the results in practicals

Evaluation :
Note based on the project performances

Target :
4EII

Image Processing	EII08-AI
Number of hours : 32.00 h	2.00 ECTS credit
CM : 16.00 h, TP : 16.00 h	
Reference Teacher(s) : MORIN Luce	

Objectives :
This lecture aims at presenting basic image processing principles and tools together with basic methods dedicated to image analysis and segmentation.

Targeted skills are:
-> To know image processing principles and methods
-> To translate state-of-the-art algorithms into C or Matlab code

Content :
1.
Human vision properties and modelling: perception of light, photometry and colorimetry, the visual system, visual phenomena, monochrome vision model, colour vision model.

2.
Introduction to information theory: source information, entropy.

3.
Sampling: Shannon theorem, error recovery, distortions caused by contour sampling

4.
Quantization: scalar quantization definition, optimal quantifier (definition and properties), non-linear quantifier, quantifier enhancement criteria, vector quantisation.

5.
Binary image processing: discrete topology elements, topological skeleton, mathematical morphology.

6.
Image quality enhancement: Enhancement (Contrast manipulation, histogram correction, false-color).

7.
Segmentation: basic primitive extraction (pixel, outline, line/shape), sequential segmentation, iterative segmentation.

8.
Extraction and tracking of image features, Kalman filter.

Bibliography :
1. KUNT M., GRANLUND R., KOCHER M., ""Traitement numérique des images, traitement de l'information"", Volume 2, Presses Polytechniques Romandes, 1993.
2. GONZALEZ R. C., WOODS R. E., ""Digital image processing"", Addison Wesley Publishing Company, 1992.
3. COSTER M., CHERMAN J. L., ""Précis d'analyse d'images"", Editions du CNRS, 1985.

Requirements :
Signal processing (EII06-TS, EII07-TSAN).

Organisation :
Revision of lecture notes. Personal input work.

Evaluation :
Evaluation of labs.
Two-hour written examination

Target :
4EII

Articifial Intelligence	EII08-IAE
Number of hours : 44.00 h	2.00 ECTS credit
CM : 20.00 h, TD : 2.00 h, TP : 22.00 h	
Reference Teacher(s) : HAMIDOUCHE Wassim	

Objectives :
The objective of this course is to acquire theoretical and practical skills on artificial intelligence algorithms as well as their implementation on different architectures.

Content :
The course is composed of a theoretical part which reviews the mathematical background used in artificial intelligence algorithms: linear algebra, resolution of linear systems, least squares problem, matrices decomposition into eigen and singular values, classification and regression with SVM and SVR algorithms. The second part of the course is devoted to the study of different machine learning algorithms: introduction to deep learning, convolutional neural networks, autoencoders, recurrent neural networks and generative adversary networks.

Bibliography :
MIT deep neural networks course

Requirements :
Python programming, probability, linear algebra.

Organisation :
The IAE courses are organized in lectures (50%) and practical works (50%); The practical work will allow the implementation of the various algorithms seen in lectures on CPU and GPU platforms.

Evaluation :
Three assessments are planned: two written exams on the two parts of the course with 2/5 of the final mark each, and an evaluation on the reports of the practical works which completes the final mark.

Target :
4-EII students

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 :

4 EII Work Placement	EII08-STAGE
Number of hours : 240.00 h	8.00 ECTS credit
ES : 1.00 h	
Reference Teacher(s) : MORIN Luce	

Objectives :
In the interim between the fourth and fifth year of studies, each student from the Electronics and Computer Engineering
speciality must do a compulsory two-month (min) work placement; subject to an agreement.
Their placement allows students to:
- Acquire practical experience in an industrial environment by developing his communication and teamwork skills.
-Increase their capacities of observation, adaptation and integration in a professional context.
-Acquire concrete knowledge of a professional field by discovering how it functions and its operating methods.
- Practice collecting, analysing and summarising information about a project.
- Plan, propose and perform the tasks required to carry out a project.
- Learn the methods needed to take stock of the company's activities.

Content :
- Duration: Two to four months (minimum of eight weeks).
- Period: Mid-May to mid-September (depending on university timetable).
- Level: End of fourth year speciality Electronics and Computer Engineering (Bac + 4).
- Location: Private or public firm, preferably in a professional field related to Electronics and Computer Engineering. (Finding
the company and making contact with it is the student's responsibility).
- Administrative formalities: The placement is subject to an agreement between INSA and the company.
- Placement report: A ten-to-fifteen-page placement report (written in French). One copy to be delivered to the department
registrar's office and one to be delivered to the student's supervising teacher.

Bibliography :
Industrial placements in 2013-2014
- Locations: West of France (63%), Paris area (8,5%), other areas in France (17%), abroad 11,5%)
- Types of companies: SMB-SME, Large companies, universities and Research laboratories.
- Fields of activity: Electronics, Telecommunications, Computer science, Automation, Signal and picture processing.

Requirements :

Organisation :

Evaluation :
Final mark (maximum of 20) is awarded for:
(1) trainee assessment reports (placement supervisor + EII supervisor).
(2) placement report.
(3) poster ST4EII.
ECTS credits: The placement gives four ECTS credits in fourth year. The six remaining credits are awarded after the
assessment at the beginning of fifth year.

Target :

Music Studies	HUMF2-MUS
Number of hours : 25.00 h	1.00 ECTS credit
TD : 25.00 h, TD : 25.00 h	
Reference Teacher(s) :	

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

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 9

Parcours Formation Initiale EII

1	**EII09-TTI**		**T.C Data Processing and Transmission**	**9.00**
	EII09-COTR	O	Video Compression and Transcoding	3.00
	EII09-VIS	O	Computer Vision	2.00
	EII09-ANIM	O	Image Analysis II	2.00
	EII09-HWS	O	Hardware Security	1.00
	EII09-CONF	O	Conferences	1.00
2	**EII09-P&L**		**T.C Programming and Languages**	**8.00**
	EII09-QLOG	O	Software Quality	2.50
	EII09-PROJ	O	Project "Innovative Technologies"	5.50
3	**EII09-SE**		**Embedded systems**	**7.50**
	EII09-CONSO	O	Energy consumption in embedded systems	1.00
	EII09-DISPS	O	Digital Signal Processor	2.00
	EII09-AHD	O	Advanced Hardware Design	1.00
	EII09-SYSC	O	High-Level SystemC Language	1.00
	EII09-PPEM	O	Parallel Programming for Embedded MPSoCs	2.50
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
	INF09-ETHIQUE	C	Formation éthique de l'ingénieur	1.00
	HUM09-PM-PRO	C	Economics, Law and Business Studies (Professional management)	2.00
	DET10-SPEC PRO	C	Expérience en entreprise	2.00
7	**DEIF1-MOB24**		**PROJET RECHERCHE MOBILITE ENTRANTE 24 crédits**	**24.00**
	DEIF1-MOB24	C	Projet de recherche pour la mobilité entrante 24 crédits	24.00

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

Video Compression and Transcoding	EII09-COTR
Number of hours : 39.00 h	3.00 ECTS credit
CM : 15.00 h, TP : 24.00 h	handout in English
Reference Teacher(s) : HERROU Glenn, MORIN Luce, ZHANG Lu	

Objectives :
This lecture aims at presenting fundamental and advanced methods dedicated
to image and video compression.
An overview of Audio/Video Standards and Codecs most commonly used in industry is presented.
Practical work is done using didactic softwares (ImageINSA VCdemo), programming
classical algorithms (in C and Matlab) and running classical codecs through opensource APIs
allowing to analyse and transcode Audio/Video files (ffmpeg, directshow, mediaInfo).

Targeted skills are:
-> To know image and video coding principles and methods
-> To understand and build a coding scheme described as a block diagram
-> To translate state-of-the-art algorithms into C or Matlab code
-> To master parameter setting of encoders
-> To transcode a video

Content :
1. Transcoding of audio-visual contents : use-cases, codec, quality, containers
2. Introduction to image coding: entropy coding, PCM, DPCM, transform coding
3. Still image standards: JPEG, JPEG-LS, JPEG 2000
4. Video compression principles : motion estimation, motion compensation
5. Standard video codecs: MPEG-2, MPEG-4, AVC, SVC, HEVC
6. Conferences by industrial partners ; conferences may vary each year
examples :
- Standardization, Felix Henry, Orange Labs
- Quality asssment for video coding, Jérome Fournier, Orange Labs

Bibliography :
-http://www.fourcc.org
-http://support.microsoft.com/kb/294880
-http://mpeg.chiariglione.org/
-http://en.wikipedia.org/wiki/Comparison_of_container_formats
-T. Ebrahimi, C. Christopoulos, "JPEG 2000 The next generation still image coding system", EUSIPCO'00, 2000
-Gregory K. Wallace, "The JPEG Still Picture Compression Standard" , IEEE Transactions on Consumer Electronics, Vol.38, No. 1, Février 1992
-Bernd Girod, "Image and Video Compression", lecture notes, Standford University, 2005
-Ian E Richardson, "H.264 and MPEG-4 Video Compression", John Wiley ed., 2003
-Vector Quantization and Signal Compression, Allen Gersho, Robert M. Gray, Springer, 1992 - Computers

Requirements :
Signal Processing (EII06-TS)
Image Analysis (EII08-AI)
Mathematical optimization (EII07-OM)

Organisation :
- Revision of lecture notes. Preparation of practical works.
- Labs on transcoding with Visual Studio (C++, C#), ffmpeg, directshow, mediaInfo.
- Labs on compression with ImageINSA and VCDemo softwares, implementation of coding algorithms in C and Matlab.

Evaluation :
Attendence,
Lab evaluation,
Written examination.

Target :
5EII

Computer Vision	EII09-VIS
Number of hours : 26.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 2.00 h, TP : 12.00 h	handout in English
Reference Teacher(s) : MORIN Luce	

Objectives :
This course is an introduction to computer vision techniques with a single camera or with several ones. Estimation processes used in computer vision are also studied.
The targeted skills are :
-> Solve a pose computation problem by using a Gauss-Newton minimization,
-> Compute and display the epipolar geometry properties of a stereo pair of images,
-> Estimate a 2D tranformation using a RANSAC algorithm.

Content :
1. Monocular vision geometry (perspective projection, calibration and pose estimation)
2. Sterevision : 3D reconstruction, epipolar geometry, 2D homography, autocalibration
Pratical exercises are in C++ language.
Course written supports are in english.

Bibliography :
1. HORAUD R., MONGA O., ""Vision par ordinateur"", Hermès, 1993.
2. AYACHE N., ""Vision stéréoscopique et perception multi-sensorielle"", Inter-Ed. Science Info, 1988.
3. HARTLEY R., ZISSERMAN A., "Multiple View Geometry in Computer Vision", Second Edition, Cambridge University Press, March 2004.

Requirements :
Optimization (EII08-OM) and object oriented programming (EII07-POO)

Organisation :
Revision of lecture notes. Preparation of labs.

Evaluation :
Two-hour written examination (no documents) at the end of the semester.

Target :
5EII

Image Analysis II	EII09-ANIM
Number of hours : 20.00 h	2.00 ECTS credit
CM : 8.00 h, TP : 12.00 h	hand-out in English and course taught in English
Reference Teacher(s) : ZHANG Lu	

Objectives :
This lecture aims at presenting basic machine learning methods dedicated to the detection and classification problem in the image processing domain.
Targeted skills are:
-> To know the principles of the basic machine learning methods
-> Implement a project of detection or classification using one of the methods presented in the course

Content :
1 - Detection and classification
2 - Supervised Learning
3 - Non-supervised Learning
4 - Neural Networks

Bibliography :
[1] Bangjun Lei, Guangzhu Xu, Ming Feng, Yaobin Zou, Ferdinand Van Der Heijden, Dick De Ridder and David M.J.Tax, "Classification, parameter estimation and state estimation : an engineering approach using MatLab", Second Edition, Wiley, 2017.
[2] R.O. Duda, P.E. Hart and D.G. Stork, "Pattern Classification", John Wiley & Sons, Ltd, London, UK, 2001.
[3] S.M. Kay, "Fundamentals of Statistical Signal Processing - Estimation Theory", Prentice Hall, New Jersey, 1994.

Requirements :
Mathematics (ESM05-ANAL, EII05-PROBA), Signal processing and Digital automatic(EII07-TSAN)

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

Evaluation :
Course attendance and Project

Target :
5EII

Hardware Security	EII09-HWS
Number of hours : 18.00 h	1.00 ECTS credit
CM : 6.00 h, TP : 12.00 h	hand-out in English and course taught in English
Reference Teacher(s) : PELCAT Maxime	

Objectives :
This course aims at providing a broad view on the challenges of hardware security in digital systems, and to make students experiment on security breaches that are resistant to software-based solutions.

Content :
The course gives first an overview on the digital hardware security challenges in their three dimensions: confidentiality, integrity, and availability of system assets: code, data, cryptographic key, and peripherals. The main types of attacks are explained, as well as main countermeasures, based e.g. on cryptography and protocols for confidentiality and integrity threats. Network-based attacks, intrusions detection methods and countermeasures are introduced, as well as malwares.

A focus is then put on attacks that cannot be solved through pure software solutions: "hardware attacks". Three types of attacks are detailed: attacks on the software stack mitigated through architectural features, attacks on hardware architecture itself, and physical attacks on digital processing through covert and side channels.

The software stack, including advanced operating systems, containers and firmwares, has reached a high level of sophistication to offer strong, versatile and energy efficient processing in a large range of domains. This stack however offers a large attack surface, allowing attackers to exploit vunerabilities to exfiltrate data, or tamper with processing and data. The course details some currently known threats, as well as main architectural countermeasures in the form of Trusted Execution Environments (TEEs), secure boot systems and secure file systems.

Digital hardware and architectures themselves present vulnerabilities. Certainly the most studied hardware vulnerability is the one of instruction and data caches. Exploiting state information of caches shared between processes of different confidentiality levels, a process may access information from another process. In such a context, both countermeasures and intrusion detection methods are valuable assets. Other architectural features as well as data integrity can also been affected by active attacks such as Rowhammer.

As most systems are now distributed and connected, they are potentially accessible to attackers, either physically or from a limited distance. Moreover, malwares can be inserted in non-trusted applications, giving internal access to parts of a system. Any information system gives rise to the emission of compromising interference signals that can be intercepted by an attacker. These emissions can be of different nature (electromagnetic, electrical acoustic, etc.) and transmitted by radiation or by conduction. Although most of the results of the field are not made public, the presence of hidden and exploitable electromagnetic channels has e.g. been demonstrated in devices such as keyboards, tablets, LCD screens, and laptops.

The side channels created by compromising interference signals (often referred to by the code name TEMPEST) lead to the risk of leakage of sensitive and unencrypted data from an information system to a local or remote attacker. Moreover, active attacks can temper with systems, threatening also availability and integrity of systems. The course will explain these physical attacks as well as currently deployed countermeasures.

Practical work will experiment on getting the secrets of a microcontroller-based system.

Bibliography :
* Colin O'Flynn and Jasper van Woudenberg. Breaking Embedded Security with Hardware Attacks. No Starch Press, 2022
* Swarup Bhunia, and Mark Tehranipoor. Hardware security: a hands-on learning approach. Morgan Kaufmann, 2018.

Requirements :
* EII05-SIG2 - Signaux et systèmes II
* EII06-TS - Traitement du signal
* EII05-ARC - Architecture des calculateurs
* EII06-SMC - Systèmes à microcontroleurs
* EII06-PS - Programmation Système

Organisation :
* Courses with internal and external teachers
* The objective of the labs is to demonstrate the exploitation of a security vulnerability and to implement the vulnerability analysis method

Evaluation :
* 1 grade on course understanding
* 1 grade on practical work results

Target :
5EII

Conferences	EII09-CONF
Number of hours : 16.00 h	1.00 ECTS credit
CONF : 16.00 h	
Reference Teacher(s) : PRESSIGOUT Muriel	

Objectives :
Experts in Compression, transcoding and computer vision will present state-of-the art technologies.

Content :

Bibliography :

Requirements :
Computer Vision (EII09-VIS), Compression and transcoding (EII09-COTR)

Organisation :
Revision of lecture notes. Preparation of labs.

Evaluation :
PASS if every session is attended, FAIL otherwise.

Target :
5EII

Software Quality	EII09-QLOG
Number of hours : 26.00 h	2.50 ECTS credit
CM : 10.00 h, TD : 4.00 h, TP : 12.00 h	
Reference Teacher(s) : BLOUIN Arnaud	

Objectives :
Management of quality, methodology and standard tools is now essential in the systems and software design. It has to be taken into account both in downstream and upstream tasks.

As far as the conception step is concerned, these lectures accompanied by practical work introduce the basic concepts of software quality approach and of the design and analysis with UML. OMT method principle is also introduced for modelling object-oriented systems. Design pattern are also presented as solutions for recurrent problems in software design.

Regarding the validation step, software testing aims at verifying that the product works as expected. The objective of these lectures is to understand the issues of software testing and how to apply the essential principles at work.

Content :
1. Software quality, Introduction to quality. Objectives and stakes within firms. Software life cycle, V-Model, Spiral Model.
Documents during the different phases. The basic elements of software quality measurement. Structural and temporal complexity, Call and control flow graphs. Static and dynamic software metrics for software quality.Hierarchical system of quality, Quality criteria and factors. Quality management in software lifecycle. Quality controlled development.
2. Object oriented modelling, The interest of modelling, Basic object oriented concepts. Static description of objects and relationships. Notion of object state, object behaviour. Introduction to UML language and OMT method. Modelling of actors, class and object diagrams. Dynamic models. Sequence, communication and class diagrams. Analysis and design related to the interaction between objects. State-transition description. Functional models. Overview of system functionality: Use Cases.
Activities and data flow diagrams. Diagrams illustrating the implementation. Packages. Deployment and component diagrams.
Tools and methods for the different phases of a development.
3. Design patterns
Unserstand the most used design patterns. To be able to identify which design pattern to use for a given case. To be able to code these design patterns.
4. Test
Unit and integration testing. To generate a test coverage to verify the software meets the conception requirements.

Bibliography :
1. F. PAROBRECK, G. BONNO, ""La qualité logicielle"", Dunod, 1991.
2. J.P. MARTIN, ""Qualité du logiciel et système qualité"", Masson, 1992.
3. J. RUMBAUGH, ""OMT, modélisation et conception orientées objet"", Masson, 1995.
4. N. LOPEZ et al., ""Intégrer UML dans vos projets"", Eyrolles, 1997.

Requirements :
Object Oriented Programming (EII07-POO).

Organisation :
Revision of lecture notes. Preparation of exercises.

Evaluation :
Two-hour written examination (with documents) at the end of the semester. Remedial examination at the end of the year (if required).

Target :
5EII

Project "Innovative Technologies"	EII09-PROJ
Number of hours : 60.00 h	5.50 ECTS credit
DIV : 6.00 h, EP : 9.00 h, TA : 45.00 h	handout in English
Reference Teacher(s) : HAMIDOUCHE Wassim	

Objectives :
Targeted main competences are:
- To manage a project within a team on a technical topic proposed by an industrial partner
- To collaborate with an industrial partner and take into account industrial requirements and organization
- To apply technical and management skills acquired during academic lectures
- To practice report writing and oral presentation on technical topics

Content :
- First meeting with industrial partner to write together project functional specifications
- Task scheduling and task repartition
- State of the art and bibliographic research (if necessary)
- Experimental development and validation
- Regular meetings with project advisors (academic/industrial)
- Report writing, presentation slides
- Oral defense of the project

Examples of project topics:
- Visual closed-loop control of a UAV (Unmanned Aerial Vehicle)
- Optimization of an audio resampling rate library
- Development of an oriented-object library for audio fixed-point processing
- Multi-energy heating management
- Physiologic parameters measurement from video sensor
- CPL transmission of video stream on a specific electronic card

Bibliography :

Requirements :

Organisation :
- Teams of 3 to 4 students, including a project leader
- Topics proposed by industrial partners and work at INSA research/teaching labs
- Regular meetings with the academic/industrial advisors
- Autonomous work over the whole semester, with dedicated time shifts (~ 4 hour/week)
- Free access to software and hardware to teaching and research labs, industrial partner might provide software/hardware if necessary for the project

Evaluation :
- Quality of work done
- Written report
- Oral presentation
N.B.: The jury is composed of professors and industrial partners.

Target :
5EII

Energy consumption in embedded systems	EII09-CONSO
Number of hours : 16.00 h	1.00 ECTS credit
CM : 8.00 h, TP : 8.00 h	
Reference Teacher(s) : MENARD Daniel	

Objectives :
Energy consumption is a major challenge for electronic systems. For autonomous systems, managing energy consumption is essential to extend the autonomy or the system lifetime. Moreover, the significant increase of embedded electronic systems implies to reduce the energy optimization in order to limit the overall electricity consumption. The goal of this course is to manage and to optimize the energy consumption of embedded digital systems.

Content :
1. Introduction

2. Energy Consumption Modeling
    2.1 Transistor models
    2.2 Dynamic energy
    2.3 Static energy

3. Energy consumption reduction
    3.1 Dynamic energy reduction
    3.2 Static energy reduction

4. Low power & energy System design
    4.1 Power & energy estimation
    4.2 Hardware design
    4.3 Software design

Bibliography :
Low-Power Electronics Design, C. Piguet, CRC Press, 2004

Requirements :
EII08-LP -Programmable Logic Devices
EII08-SEE -Embedded Operating Systems
EII07-ARC -Computer Architectures 2

Organisation :
- Courses given by internal and external professors
- Practical work are based on managing energy and power consumption on embedded multi-core platform with Linux OS. The targeted platform is a Heterogeneous Multi-Processing (HMP) Octa Core Linux Computer (Odroid Exynos XU3).

Evaluation :
Practical work and project grading.

Target :
5EII

Digital Signal Processor	EII09-DISPS
Number of hours : 24.00 h	2.00 ECTS credit
CM : 10.00 h, TP : 14.00 h	handout in English
Reference Teacher(s) : MENARD Daniel	

Objectives :
More and more embedded applications integrate Digital Signal Processing to deliver innovative features. The goal of this course is to master the implementation of digital signal processing applications on single-core fixed-point DSPs

Targeted main competences are:
- Develop C code for digital signal processing applications
- Optimize code for low power DSPs
- Optimize code for high performance DSPs
- Fixed-point conversion of digital signal processing systems

Content :
- Models for DSP applications
- Architecture of low power DSPs
- Architecture of high performance DSPs
- Fixed-point arithmetic
- Fixed-point conversion (dynamic range evaluation, fixed-point coding, numerical accuracy evaluation)

Bibliography :
[1] MADISETTI V., "VLSI Digital Signal Processors", IEEE Press, 1995;
[2] LAPSLEY P. & al., "DSP Processor Fundamentals", IEEE Press, 1995;
[3] BAUDOUIN G. & VIROLLEAU F., "DSP : les processeurs de traitement du signal", Dunod, 1996.

Requirements :
EII07-ARC : Computer Architecture 2;
EII07-TSAN : Signal processing and Digital automatic

Organisation :
Pedagogy based on project.

Evaluation :
Exam 2h

Target :
5EII

Advanced Hardware Design	EII09-AHD
Number of hours : 12.00 h	1.00 ECTS credit
CM : 4.00 h, PR : 8.00 h	hand-out in English and course taught in English
Reference Teacher(s) : DARDAILLON Mickael	

Objectives :
- Advanced hardware design method for complex digital systems
- Study and implementation of a complete design flow, from high-level description to hardware implementation

Targeted main competences are:
-Efficient use of available ressources pour design a numeric system
-Use of an high-level synthesis tool

Content :
-C language for high-level synthesis, design and optimisation
-Test and validation: verification methodology, automatic verification, testbed implementation
-Design, synthesis and verification of a system using Vivado HLS

Bibliography :
R. Kastner, J. Matai, and S. Neuendorffer, Parallel Programming for FPGAs. 2018.
http://kastner.ucsd.edu/hlsbook

Requirements :
- Programmable Logic
- C Language

Organisation :

Evaluation :
-Attendance at lectures and lab sessions
-Lab report

Target :
5EII

High-Level SystemC Language	EII09-SYSC
Number of hours : 14.00 h	1.00 ECTS credit
CM : 8.00 h, TP : 6.00 h	course taught in English
Reference Teacher(s) : PREVOTET Jean-Christophe	

Objectives :
This lecture aims at presenting the System Design languages (SystemC) for complex system designing. Special emphasis will be given on modelling across different levels of abstraction from untimed via timed transaction level models down to register transfer models including the needed refinement steps.

Content :
1. Requirements for a system methodology in order to design a system. Overview of existing methodologies
2. Presentation of the System C language syntax. :
-Programming environment.
-Concepts of module, port, channel, interface.
Channels, ports, interfaces, Module constructor
Events, Event queue
Thread processes, Method processes
Module instantiation (in modules)
3. Simulation of complex systems with System C.
4. Labs on a transmission system. Simulation of the system and implementation on an embedded SOC.

Bibliography :

Requirements :

Organisation :

Evaluation :
1 hour exam

Target :
5EII

Parallel Programming for Embedded MPSoCs	EII09-PPEM
Number of hours : 30.00 h	2.50 ECTS credit
CM : 8.00 h, PR : 10.00 h, TP : 12.00 h	hand-out in English and course taught in English
Reference Teacher(s) : DESNOS Karol	

Objectives :
For many years, following the ever-increasing number of transistors per chip, advances in computer architecture mostly consisted of adding complex mechanisms to mono-core processors to improve their computing performance. In the last decade, the continuous growth of computing performance was supported by the introduction of multi-core architectures, first for high-performance computing, then in mainstream desktop CPUs, and now in smartphones and embedded systems.

Embedded systems implementing modern applications such as telecommunication standard 3GPP Long Term Evolution (LTE) and video compression standard MPEG High Efficiency Video Coding (HEVC) require high execution speed, low power consumption and run-time adaptivity.

Adaptivity, memory limitation and load balancing between cores are hard to obtain. This course intends to give an overview of distributed high performance solutions and of the new challenges brought by latest applications and Multiprocessors Systems-on-Chips (MPSoCs) architectures such as the 8-core Texas Instruments TMS320C6678 or the 256-core Kalray MPPA. Solutions for programming such architectures will be discussed.

Targeted competences are:
- To understand internal mechanisms of multicore MPSoCs
- To program multi-core architectures using pthread, OpenMP, and Preesm
- To choose a multicore programming method while understanding its limitations
- To design a high performance embedded systems using available resources efficiently

Content :
Content:
- Models of Computation
- Multicore Architectures
- Architecture Models
- Assignment and Ordering Problem
- Multicore Programming Tools

Bibliography :
J Karam, I. AlKamal, A. Gatherer, G. A Frantz, D. V Anderson, and B. L Evans, "Trends in multicore DSP platforms, IEEE SPM, 2009
Hae-woo Park, Hyunok Oh, and Soonhoi Ha, "Multiprocessor SoC Design Methods and Tools", IEEE SPM, 2009
S. Sriram, S. S. Bhattacharyya, "Embedded Multiprocessors : Scheduling and Synchronization - Second Edition", CRC Press, 2009
M. Pelcat, S. Aridhi, J. Piat, J-F. Nezan, "Physical Layer Multicore Prototyping: A Dataflow-Based Approach for LTE eNodeB", Springer, 2012

Requirements :
Computer Architecture I & II (EII05-ARC, EII07-ARC), C Language (ESM05-INFOC).

Organisation :
- Courses given by internal and external professors
- Practical work and project are based on pthread, OpenMP, and the dataflow-based programming.
- Target architectures are multicore x86 processors and the TMS320C6678 multi-DSP evaluation board
- The goal of practical work is for students to acquire competences for programming the platform
- The project aims at giving students some programming habits

Evaluation :
Practical work and project grading.

Target :
5EII

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 : 24.00 h	1.00 ECTS credit
CONF : 24.00 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

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 :

Expérience en entreprise	DET10-SPEC PRO
Number of hours : 30.00 h	2.00 ECTS credit
PR : 0.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Projet de recherche pour la mobilité entrante 24 crédits	DEIF1-MOB24
Number of hours : 280.00 h	24.00 ECTS credit
PR : 24.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Semestre 10

Parcours Formation Initiale EII

1	EII-PFE10		Final Year Project	30.00
	EII10-PFE	O	End of Studies Project	30.00

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

End of Studies Project	EII10-PFE
Number of hours : 350.00 h	30.00 ECTS credit
ES : 4.00 h, ES : 4.00 h, ST : 346.00 h, ST : 346.00 h	
Reference Teacher(s) : PRESSIGOUT Muriel	

Objectives :
To complete the second semester of their studies, 5th year students must carry out a four-to-six month work-experience
placement, enabling them to form a link between their practical and theoretical studies and the professional world.

Content :
- Duration: Four to six months.
- Period: From the first week of February.
- Level: Electronics and Computer Science Engineer (A-level +5).
- Host Establishment: The placement may be carried out in a public or private organisation whose activities are closely linked
to the Electronics and Computer Engineering departments study programme.
- Administrative formalities: All placements are subject to an agreement between the INSA and the host organisation. For
further information, please contact Josiane VILLORY (Work Placement Office).
- Report: A written report must be handed in upon completion of the placement. The report must then be presented orally
before a jury and audience of fellow students.
- Location: West of France 39,5%. Rest of France 21%. Abroad 18,5 %. Paris 21 %.
- Type: Small-to-Medium sized businesses. Large Groups. Universities and Research laboratories.
- Category: Electronics. Telecommunications. Computer Science. Automation. Signal and Image Processing.

Bibliography :
Examples of end-of-studies projects:
- 3D tools in C++ for automatic guidance in Transcranial Magnetic Stimulation.
- Usefulness of Real-Time Java in avionics systems.
- Electronic Test-cards in programming MicroBlaze processors in VHDL;
- Adjusting the FPGA to compensate for the xxxxxxxxxx caused by the IP.
- Bit-rate adjustment for a scalable video coder MPG4 AUC/H 264.
- Digital TV. Development of a new LINUX on board home automation platform.
- Setting up of a protection system for Gaz de Frances methane terminal at Montoir de Bretagne.
- Detection and surveillance of persons in a busy urban environment.
- Performance evaluation techniques for GSM/GPRS terminals with M2M communication solutions.

Requirements :

Organisation :

Evaluation :
- Mark for quality of work achieved in the host organisation.
- Mark for report.
- Mark for oral presentation.
The overall mark will be taken into account by the 5th year jury.

Target :