INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES RENNES

Academic year 2020/2021

Courses offered by the programme

Electronique et Informatique Industrielle (EII)
Electronics and Computer Engineering

Semester(s) : 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
EII07-INVR-EB	Research and Innovation bibliography
EII08-INVR-CR	Research & Innovation : Design & Development
EII08-PROJ	Multidisciplinary project A
EII09-AHD	Advanced Hardware Design
EII09-PROJ	Project "Innovative Technologies"
EII09-VIS	Computer Vision
M&N09-PROJ	Technical project
SRC09-NETLAB	Network lab training
SRC09-PRCNUM	Digital Communications prerequisites
SRC09-REALTIME	Real Time Processing
SRC09-SOPC	System on Programmable Chips
SRC09-SYSLAB	Digital Systems Lab

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

Computer Architectures 2	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 of hardware methods that impact the performance of modern computers and have a feedback into the C/assembler code

Targeted main competences are:
-To design hierarchically a digital system with interconnected units/functions
-To program in C code and take into account hardware mechanisms of a modern computer
-To use efficiently available resources to solve digital system design problems (documentation, internet, supervisors)

Content :
- Pipelined design and dynamic execution: principles, case study of a basic pipelined design, branch prediction techniques
- Memory hierarchy and cache memory: structures and main characteristics
- Introduction on parallel computing: superscalar and VLIW architectures, data packing, from SIMD to MIMD architecture

Bibliography :
- TANENBAUM S., "Structured Computer Organization", Prentice Hall, 1999
- HENNESSY J. & PATTERSON D., "Computer Architecture: a Quantitativ Approach", McGraw-Hill, 1992
- STALLINGS W., "Computer Organization and Architecture", Prentice hall, 1999
- NOEERGAARD T., "Embedded Systems Architecture", Elsevier Newnes, 2005
- Websites

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

Organisation :
- Active pedagogy
- Revision of lecture notes
- Preparation for tutorials

Evaluation :
- Attendance
- Written examination

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 : 54.00 h	4.00 ECTS credit
CM : 26.00 h, TD : 6.00 h, TP : 12.00 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 them using the C++ language. Design patterns are addressed and the last hours are dedicated to graphical user interfaces where the OOP is widely used.

The targeted skills are :
-> To build a software solution to a simple problem by conceiving the relevant classes and by having a good command of the use of their instances;
-> To build a software solution to a more comple problem by using the inheritance mechanism and virtuals methods;
-> To choose and use a design pattern to solve a software issue;
-> To build a grazphical user interface using MFC, Windows Forms or Qt.

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)".

The two first parts are implemented during labs in C++ using a recent Visual Studio version, the fourth one is put into practice using the WPF and the multiplatform framework Qt. Design patterns labs are in Java.

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 :
Language C (ESM05-INFOC), Language C : Project (EII06-PJC) and Language C level 2 (EII05-LANG)

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

Evaluation :
Two final personnal 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

Research and Innovation bibliography	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	hand-out in English and course taught in English
Reference Teacher(s) : ZHANG LU	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

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 :

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 :

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 Architectures 2	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	O	Entrepreneurship and Innovation	3.00
	HUM07-EPS	O	Sport and physical education	1.00

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

Electronics III	EII07-ELE
Number of hours : 69.00 h	5.50 ECTS credit
CM : 23.00 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 Architectures 2	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 of hardware methods that impact the performance of modern computers and have a feedback into the C/assembler code

Targeted main competences are:
-To design hierarchically a digital system with interconnected units/functions
-To program in C code and take into account hardware mechanisms of a modern computer
-To use efficiently available resources to solve digital system design problems (documentation, internet, supervisors)

Content :
- Pipelined design and dynamic execution: principles, case study of a basic pipelined design, branch prediction techniques
- Memory hierarchy and cache memory: structures and main characteristics
- Introduction on parallel computing: superscalar and VLIW architectures, data packing, from SIMD to MIMD architecture

Bibliography :
- TANENBAUM S., "Structured Computer Organization", Prentice Hall, 1999
- HENNESSY J. & PATTERSON D., "Computer Architecture: a Quantitativ Approach", McGraw-Hill, 1992
- STALLINGS W., "Computer Organization and Architecture", Prentice hall, 1999
- NOEERGAARD T., "Embedded Systems Architecture", Elsevier Newnes, 2005
- Websites

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

Organisation :
- Active pedagogy
- Revision of lecture notes
- Preparation for tutorials

Evaluation :
- Attendance
- Written examination

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 : 54.00 h	4.00 ECTS credit
CM : 26.00 h, TD : 6.00 h, TP : 12.00 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 them using the C++ language. Design patterns are addressed and the last hours are dedicated to graphical user interfaces where the OOP is widely used.

The targeted skills are :
-> To build a software solution to a simple problem by conceiving the relevant classes and by having a good command of the use of their instances;
-> To build a software solution to a more comple problem by using the inheritance mechanism and virtuals methods;
-> To choose and use a design pattern to solve a software issue;
-> To build a grazphical user interface using MFC, Windows Forms or Qt.

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)".

The two first parts are implemented during labs in C++ using a recent Visual Studio version, the fourth one is put into practice using the WPF and the multiplatform framework Qt. Design patterns labs are in Java.

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 :
Language C (ESM05-INFOC), Language C : Project (EII06-PJC) and Language C level 2 (EII05-LANG)

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

Evaluation :
Two final personnal 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 :

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 :

Semestre 7

Parcours Mixte INNOV-R et interne

1	**EII07-II**		**Computer Engineering S7**	**10.00**
	EII07-ARC	O	Computer Architectures 2	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	Research and Innovation bibliography	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	O	Entrepreneurship and Innovation	3.00
	HUM07-EPS	O	Sport and physical education	1.00

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

Computer Architectures 2	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 of hardware methods that impact the performance of modern computers and have a feedback into the C/assembler code

Targeted main competences are:
-To design hierarchically a digital system with interconnected units/functions
-To program in C code and take into account hardware mechanisms of a modern computer
-To use efficiently available resources to solve digital system design problems (documentation, internet, supervisors)

Content :
- Pipelined design and dynamic execution: principles, case study of a basic pipelined design, branch prediction techniques
- Memory hierarchy and cache memory: structures and main characteristics
- Introduction on parallel computing: superscalar and VLIW architectures, data packing, from SIMD to MIMD architecture

Bibliography :
- TANENBAUM S., "Structured Computer Organization", Prentice Hall, 1999
- HENNESSY J. & PATTERSON D., "Computer Architecture: a Quantitativ Approach", McGraw-Hill, 1992
- STALLINGS W., "Computer Organization and Architecture", Prentice hall, 1999
- NOEERGAARD T., "Embedded Systems Architecture", Elsevier Newnes, 2005
- Websites

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

Organisation :
- Active pedagogy
- Revision of lecture notes
- Preparation for tutorials

Evaluation :
- Attendance
- Written examination

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 : 54.00 h	4.00 ECTS credit
CM : 26.00 h, TD : 6.00 h, TP : 12.00 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 them using the C++ language. Design patterns are addressed and the last hours are dedicated to graphical user interfaces where the OOP is widely used.

The targeted skills are :
-> To build a software solution to a simple problem by conceiving the relevant classes and by having a good command of the use of their instances;
-> To build a software solution to a more comple problem by using the inheritance mechanism and virtuals methods;
-> To choose and use a design pattern to solve a software issue;
-> To build a grazphical user interface using MFC, Windows Forms or Qt.

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)".

The two first parts are implemented during labs in C++ using a recent Visual Studio version, the fourth one is put into practice using the WPF and the multiplatform framework Qt. Design patterns labs are in Java.

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 :
Language C (ESM05-INFOC), Language C : Project (EII06-PJC) and Language C level 2 (EII05-LANG)

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

Evaluation :
Two final personnal 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

Research and Innovation bibliography	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	hand-out in English and course taught in English
Reference Teacher(s) : ZHANG LU	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

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 :

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 :

Semestre 8

Innovation par la Recherche

1	**EII08-PJ-R**		**Project S8**	**6.00**
	EII08-INVR-CR	O	Research & Innovation : Design & Development	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 Analysis 1	2.00
	EII08-IAE	O	Intelligence Artificelle Embarquée	2.00
4	**HUM08**		**Non-scientific syllabus S8**	**6.00**
	HUM08-ANGL	O	English	2.00
	HUM08-ECO	O	Economy and Management	1.00
	HUM08-SHES1	O	Engineer & Society - M1	1.00
	HUM08-SHES2	O	Engineer & Society - M2	1.00
	HUM08-EPS	O	Sport and Physical Education	1.00
5	**EII-STAGE08**		**Industrial Placement**	**8.00**
	EII08-STAGE	O	4 EII Work Placement	8.00

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

Research & Innovation : Design & Development	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	hand-out in English and course taught in English
Reference Teacher(s) : ZHANG LU	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Embedded Operating Systems	EII08-SEE
Number of hours : 38.00 h	2.00 ECTS credit
CM : 16.00 h, TP : 22.00 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) :	

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	
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 Analysis 1	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.xtraction 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), Digital signal processing and automation (EII07-TSAN).

Organisation :
Revision of lecture notes. Personal'imput work.

Evaluation :
Evaluation of labs.
Two-hour written examination (with documents).

Target :
4EII

Intelligence Artificelle Embarquée	EII08-IAE
Number of hours : 40.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 14.00 h, TP : 14.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

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

Economy and Management	HUM08-ECO
Number of hours : 10.00 h	1.00 ECTS credit
TD : 10.00 h, TD : 10.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Engineer & Society - M1	HUM08-SHES1
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h, 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, 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 :

4 EII Work Placement	EII08-STAGE
Number of hours : 240.00 h	8.00 ECTS credit
ST : 240.00 h	
Reference Teacher(s) : PRESSIGOUT MURIEL	

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

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

Bibliography :
Industrial placements in 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 :

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 Analysis 1	2.00
	EII08-IAE	O	Intelligence Artificelle Embarquée	2.00
4	**HUM08**		**Non-scientific syllabus S8**	**6.00**
	HUM08-ANGL	O	English	2.00
	HUM08-ECO	O	Economy and Management	1.00
	HUM08-SHES1	O	Engineer & Society - M1	1.00
	HUM08-SHES2	O	Engineer & Society - M2	1.00
	HUM08-EPS	O	Sport and Physical Education	1.00
5	**EII-STAGE08**		**Industrial Placement**	**8.00**
	EII08-STAGE	O	4 EII Work Placement	8.00

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 : 38.00 h	2.00 ECTS credit
CM : 16.00 h, TP : 22.00 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) :	

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	
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 Analysis 1	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.xtraction 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), Digital signal processing and automation (EII07-TSAN).

Organisation :
Revision of lecture notes. Personal'imput work.

Evaluation :
Evaluation of labs.
Two-hour written examination (with documents).

Target :
4EII

Intelligence Artificelle Embarquée	EII08-IAE
Number of hours : 40.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 14.00 h, TP : 14.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

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

Economy and Management	HUM08-ECO
Number of hours : 10.00 h	1.00 ECTS credit
TD : 10.00 h, TD : 10.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Engineer & Society - M1	HUM08-SHES1
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h, 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, 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 :

4 EII Work Placement	EII08-STAGE
Number of hours : 240.00 h	8.00 ECTS credit
ST : 240.00 h	
Reference Teacher(s) : PRESSIGOUT MURIEL	

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

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

Bibliography :
Industrial placements in 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 :

Semestre 8

Parcours Mixte INNOV-R et interne

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 Analysis 1	2.00
	EII08-IAE	O	Intelligence Artificelle Embarquée	2.00
4	**EII-STAGE08**		**Industrial Placement**	**8.00**
	EII08-STAGE	O	4 EII Work Placement	8.00

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 : 38.00 h	2.00 ECTS credit
CM : 16.00 h, TP : 22.00 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) :	

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	
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 Analysis 1	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.xtraction 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), Digital signal processing and automation (EII07-TSAN).

Organisation :
Revision of lecture notes. Personal'imput work.

Evaluation :
Evaluation of labs.
Two-hour written examination (with documents).

Target :
4EII

Intelligence Artificelle Embarquée	EII08-IAE
Number of hours : 40.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 14.00 h, TP : 14.00 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
ST : 240.00 h	
Reference Teacher(s) : PRESSIGOUT MURIEL	

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

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

Bibliography :
Industrial placements in 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 :

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-DATA	O	Data Transmission	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	SystemC	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 six sigma)	2.00
	HUM09-PM-B	C	Economics, Law and Business Studies B (Human Resource 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 - ETHICS - RESPONSIBILITY)	2.00
	HUM09-PM-E	C	Economics, Law and Business Studies E (International Strategy and Development)	2.00
	HUM09-PM-F	C	Economics, Law and Business Studies F (sustainable development)	2.00
	EII09-EVST	C	Evaluation stage	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	Evaluation stage	1.00
	INF09-DROIT	C	Legal Training for Engineers	2.00
	SRC09-SPEC	C	Conferences	1.00
	SRC09-CONF	C	SRC09-CONFERENCES	1.00

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	
Reference Teacher(s) : 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
classcal 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, Pierrick Philippe, 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 :
Digital signal processing and automation (EII07-TSAN).
Image processing (EII08-AI)
Mathematical programming (EII08-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 and 5M&N students

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	hand-out in English and course taught in English
Reference Teacher(s) : PRESSIGOUT MURIEL	

Objectives :
This course is an introduction to computer vision techniques with a single camera or with several ones. Estimation processes used in computer vision are also studied.

The targeted skills are :
-> Solve a pose computation problem by using a Gauss-Newton minimization
-> Compute a depth map from stereoscopic images using the epipolar geometry properties
-> Estimate a 2D tranformation using a RANSAC algorithm

Content :
1. Monocular vision geometry (perspective projection, calibration and pose estimation)
2. Sterevision : 3D reconstruction, epipolar geometry, 2D homography, autocalibration

Pratical exercises are in C++ language.

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

Requirements :
Optimization (EII08-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, Media and Networks semester

Image Analysis II	EII09-ANIM
Number of hours : 20.00 h	2.00 ECTS credit
CM : 8.00 h, TP : 12.00 h	
Reference Teacher(s) : ZHANG LU	

Objectives :
Given the measurement signals from the real world, how can the needed information be inferred? In other words, how should the measurements from a sensory system be processed in order to bring maximum information in an explicit and usable form ? This is the main topic of this course - the same problem dealed with by the classification and the estimation. The state estimation (such as the Markov model) is out of the scope of the course.

Content :
1. Detection and classification
2. Parameter Estimation
3. Supervised Learning
4. Non-supervised Learning

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, ESM05-PROBA), Signal processing and Digital automatic(EII07-TSAN), Numérical methods (EII07-MN)

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

Evaluation :
Course attendance and Project

Target :
5EII ad 5M&N

Data Transmission	EII09-DATA
Number of hours : 18.00 h	1.00 ECTS credit
CM : 14.00 h, TP : 4.00 h	
Reference Teacher(s) : KPALMA KIDIYO	

Objectives :
Give students the general concepts of digital communication. Provide them with all the digital modulation techniques to complete and expand the knowledge acquired in the 3rd and 4th years in signal processing.

Les compétences visées sont:
-> Acquire digital communication techniques
-> Understand digital modulations
-> Understand the limits of these processings

Content :
1. Introduction to digital communication: description of a digital transmission chain, classification of modulations, structure of transmitters / receivers, description of digital signals, baseband modeling and complex envelope; digital modulations in baseband (MIC, MICD, MIC delta) and on carrier frequency (MDA, MDF, MDP, MAQ); performance of modulations; transmission on real channel.
2. Introduction to Data Transmission Concepts
3. Data Transmission Design Goals
4. Baseband Transmission and ISI
5. Inter-Symbol Interference (ISI)
6. Techniques for Controlling ISI:Partial Response Signalling

Bibliography :
1. KUNT M., "Traitement numérique des signaux", Traité d'électricité, Volume XX, Presses Polytechniques Romandes, Lausanne, 1980.
2. FONTOLLIET P. G., "Systèmes de télécommunications, bases de transmission", Dunod, 1983.
3. MARVEN C., EWERS G., "A simple approach to digital signal processing", Texas Instruments, 1993.
4. OPPENHEIM A. V., SHAFER R. W., "Digital Signal Processing", Printice Hall, Englewood Cliffs, 1975.

Requirements :
Signal processing (EII06-SIG et EII07-TRAN).

Organisation :
Lectures, preparing practical work

Evaluation :
Final mark : class attending ratio and report on practical work.

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	hand-out in English and course taught 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, M&N students

Digital Signal Processor	EII09-DISPS
Number of hours : 24.00 h	2.00 ECTS credit
CM : 10.00 h, TP : 14.00 h	
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 and 5M&N

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, M&N

SystemC	EII09-SYSC
Number of hours : 14.00 h	1.00 ECTS credit
CM : 8.00 h, TP : 6.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

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

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

Bibliography :

Requirements :

Organisation :

Evaluation :
1 hour exam

Target :
5EII, M&N

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	
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 and 5 M&N

English S9 Conversation	HUM09-ANGL-CONV
Number of hours : 10.00 h	1.50 ECTS credit
TD : 10.00 h, 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, 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 six sigma)	HUM09-PM-A
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 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 :
* Lean Six Sigma (28h / in French)
Lean Six Sigma is a methodology that enables firms to make their processes more effective and efficient. It¿s the current industry standard for process improvement designed to reduce waste and enhance output quality.

* Law (8h / in French)
Main principles of the French legal system

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies B (Human Resource Management)	HUM09-PM-B
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 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 C (Human Resources Management)	HUM09-PM-C
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 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 - ETHICS - RESPONSIBILITY)	HUM09-PM-D
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 h, TD : 4.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims at enabling students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
The program's main objective is to provide a multidisciplinary approach to the field of innovation, strategy and industrial design. This course will give an overview of the innovative process.
During this program, participants will have the opportunity to explore a business case covering the first stage of a product development project.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - S7 and S8

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 Strategy and Development)	HUM09-PM-E
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 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 focuses on strategic choices regarding effective actions in international business.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advice to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies F (sustainable development)	HUM09-PM-F
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 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 :
- Project Management (28 h / in French)
    - Efficient Project Management tools and organization according to PMI (Project Management Institute)
    - Agility
    - SCRUM

- Law (8 h / 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 advice to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Evaluation stage	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, CM : 30.00 h, TD : 4.00 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, CM : 20.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Evaluation stage	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 :

Legal Training for Engineers	INF09-DROIT
Number of hours : 20.00 h	2.00 ECTS credit
CM : 20.00 h, CM : 20.00 h	
Reference Teacher(s) :	

Objectives :
To give to final-year engineers, whether or not in project manager positions, the key legal concepts for understanding the protection of intellectual creations and software, the contractual mechanisms for producing software content, and the terms of software licenses.

Content :
5 independent modules CM1 to CM5

CM1: COMPUTER CREATIONS AND ACTORS

CM 2: GENERIC CONTRACTUAL STRUCTURES AND RESPONSIBILITIES

CM 3: SPECIFIC CONTRACTUAL STRUCTURES

CM 4: SOFTWARE LICENSES (INCLUDING GPL)

CM 5: CREATION AND ADMINISTRATION OF WEB SITES

Bibliography :
On the internet : http://www.legalis.net/

Books : Informatique, T_l_coms, Internet - Ed Francis Lefebvre 2012

Requirements :
passing the introductory module to general law (8H Lectures)

Organisation :
Lectures (7 x 2H)

Evaluation :
final exam

Target :

Conferences	SRC09-SPEC
Number of hours : 16.00 h	1.00 ECTS credit
CM : 16.00 h, CM : 16.00 h	
Reference Teacher(s) :	

Objectives :
Teaching students the fundamentals of Project Management and practice within specific projects.

Content :
Project's Organization
Planning, analysis and formalization of individual and team goals.
Methodological tools for project management
Analysis of deviations from the specifications
Risk Management
All the concepts covered in this course will be applied to a specific case study within dedicated projects (SRC09 TCBE
module).

Bibliography :

Requirements :

Organisation :

Evaluation :
Oral defense of the project (Implementation of the lecture's concepts)

Target :

SRC09-CONFERENCES	SRC09-CONF
Number of hours : 16.00 h	1.00 ECTS credit
CM : 16.00 h, CM : 16.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
Industrial or academic experts in various domains present small talks (typically 2h) about technical and scientific issues in their domain. The main idea is to open students to the world of industry and research and make them sensitive to state of the art issues.

Content :
The talks may vary depending on the availability of experts

Bibliography :

Requirements :

Organisation :

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

Target :
5SRC and 5M&N

Semestre 9

Parcours Media & Networks

1	**M&N09-SEIR**		**Embedded systems - Media - Networks**	**17.50**
	EII09-CONSO	C	Energy consumption in embedded systems	1.00
	EII09-DISPS	C	Digital Signal Processor	2.00
	EII09-PPEM	C	Parallel Programming for Embedded MPSoCs	2.50
	EII09-AHD	C	Advanced Hardware Design	1.00
	EII09-SYSC	C	SystemC	1.00
	SRC09-SOPC	C	System on Programmable Chips	1.00
	SRC09-REALTIME	C	Real Time Processing	1.50
	SRC09-SYSLAB	C	Digital Systems Lab	2.00
	EII09-COTR	C	Video Compression and Transcoding	3.00
	EII09-VIS	C	Computer Vision	2.00
	EII09-ANIM	C	Image Analysis II	2.00
	SRC09-PRCNUM	C	Digital Communications prerequisites	1.50
	SRC09-NETLAB	C	Network lab training	2.00
	SRC09-USECASE	C	Use Case in Network Security	1.50
	SRC09-LAN-DATA	C	Data Local Network	3.00
	SRC09-MOBILE	C	Mobile Networks	1.00
2	**M&N09-Projet**		**Technical Project**	**8.00**
	M&N09-PROJ	O	Technical project	8.00
3	**HUM09-M&N EII**		**Non-scientific syllabus**	**4.50**
	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 six sigma)	2.00
	HUM09-PM-B	C	Economics, Law and Business Studies B (Human Resource 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 - ETHICS - RESPONSIBILITY)	2.00
	HUM09-PM-E	C	Economics, Law and Business Studies E (International Strategy and Development)	2.00
	HUM09-PM-F	C	Economics, Law and Business Studies F (sustainable development)	2.00
	HUM09-PM-G	C	Economics, Law and Business Studies G (serious game)	2.00
	EII09-EVST	C	Evaluation stage	1.00

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

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, M&N students

Digital Signal Processor	EII09-DISPS
Number of hours : 24.00 h	2.00 ECTS credit
CM : 10.00 h, TP : 14.00 h	
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 and 5M&N

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	
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 and 5 M&N

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, M&N

SystemC	EII09-SYSC
Number of hours : 14.00 h	1.00 ECTS credit
CM : 8.00 h, TP : 6.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

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

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

Bibliography :

Requirements :

Organisation :

Evaluation :
1 hour exam

Target :
5EII, M&N

System on Programmable Chips	SRC09-SOPC
Number of hours : 10.00 h	1.00 ECTS credit
CM : 4.00 h, TP : 6.00 h	hand-out in English and course taught in English
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
Introduction to embedded systems (technology, management, hardware/software co-design). Case study on a SOPC platform (Altera FPGA).

Content :
Technology of embedded systems: ASIC, FPGA, Study of different reconfigurable circuits (Xilinx, Altera, ...). Introduction to rapid prototyping tools from system to physical level.

Bibliography :

Requirements :
SRC07-LPROG

Organisation :

Evaluation :
Practical training session

Target :

Real Time Processing	SRC09-REALTIME
Number of hours : 16.00 h	1.50 ECTS credit
CM : 10.00 h, TP : 6.00 h	hand-out in English and course taught in English
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
Study of real time operating systems and application examples.

Content :
Various fields of applications, embedded systems, kernel architecture, Kernel services (tasks, synchronizations, communications), multi-processes/multi-processors programming, scheduling policies, memory management.

Applications: embedded systems for signal processing (telecommunication, image / video) in automotive, avionics, etc. ....
Systems with strong real time constraints, system management / supervision.

Practical work on MicroC-OSII.

Bibliography :

Requirements :

Organisation :

Evaluation :
2 hours exam

Target :

Digital Systems Lab	SRC09-SYSLAB
Number of hours : 24.00 h	2.00 ECTS credit
TD : 24.00 h	hand-out in English and course taught in English
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
The role of this project is to apply all the concepts of Digital Design on a real application.

Content :
This 24 hours project aims to implement all the concepts learned in the SRC09-MOCNVHD and SRC09-SYSC module.
It starts with a SystemC modeling of a complex digital communication circuit (software and hardware blocks) for system simulation and platform sizing.
It ends up with the implementation of the circuit onto a real FPGA platform composed of software and hardware parts.

Bibliography :

Requirements :

Organisation :

Evaluation :
Project evaluation

Target :

Video Compression and Transcoding	EII09-COTR
Number of hours : 39.00 h	3.00 ECTS credit
CM : 15.00 h, TP : 24.00 h	
Reference Teacher(s) : MORIN LUCE, ZHANG LU	

Objectives :
This lecture aims at presenting fundamental and advanced methods dedicated
to image and video compression.
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
classcal 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, Pierrick Philippe, 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 :
Digital signal processing and automation (EII07-TSAN).
Image processing (EII08-AI)
Mathematical programming (EII08-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 and 5M&N students

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	hand-out in English and course taught in English
Reference Teacher(s) : PRESSIGOUT MURIEL	

Objectives :
This course is an introduction to computer vision techniques with a single camera or with several ones. Estimation processes used in computer vision are also studied.

The targeted skills are :
-> Solve a pose computation problem by using a Gauss-Newton minimization
-> Compute a depth map from stereoscopic images using the epipolar geometry properties
-> Estimate a 2D tranformation using a RANSAC algorithm

Content :
1. Monocular vision geometry (perspective projection, calibration and pose estimation)
2. Sterevision : 3D reconstruction, epipolar geometry, 2D homography, autocalibration

Pratical exercises are in C++ language.

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

Requirements :
Optimization (EII08-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, Media and Networks semester

Image Analysis II	EII09-ANIM
Number of hours : 20.00 h	2.00 ECTS credit
CM : 8.00 h, TP : 12.00 h	
Reference Teacher(s) : ZHANG LU	

Objectives :
Given the measurement signals from the real world, how can the needed information be inferred? In other words, how should the measurements from a sensory system be processed in order to bring maximum information in an explicit and usable form ? This is the main topic of this course - the same problem dealed with by the classification and the estimation. The state estimation (such as the Markov model) is out of the scope of the course.

Content :
1. Detection and classification
2. Parameter Estimation
3. Supervised Learning
4. Non-supervised Learning

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, ESM05-PROBA), Signal processing and Digital automatic(EII07-TSAN), Numérical methods (EII07-MN)

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

Evaluation :
Course attendance and Project

Target :
5EII ad 5M&N

Digital Communications prerequisites	SRC09-PRCNUM
Number of hours : 16.00 h	1.50 ECTS credit
CM : 16.00 h	hand-out in English and course taught in English
Reference Teacher(s) : HELARD JEAN FRANCOIS	

Objectives :
To deal with the basis digital communication techniques as channel coding, multicarrier modulations and single carrier transmissions on limited bandwidth channel.

Content :
1. Model of a digital communication system
2. Basis channel coding techniques
Block codes and cyclic block codes. Codes construction. Decoding techniques. Performance and channel coding gain.
Convolutional codes. Representation and main principles. Decoding techniques. Performance and main applications.
3. Single carrier transmission over unlimited and limited bandwidth channels. Nyquist criterion. Equalization techniques.
4. Multicarrier modulations. Frequency and time selectivity of the radio-mobile channel. Multicarrier modulation principle (OFDM). Digital implementation of OFDM with Fast Fourier Transform Demodulation and performance. Applications to broadcast and telecommunication systems.

Bibliography :
M. Joindot, A. Glavieux, "Introductions aux communications numériques", Ed. Dunod,
S. Beneddeto, E. Biglieri, V. Castellani, "Digital transmission theory", Prentice Hall International Editions,
J. G. Proakis., "Digital communications", 6th Edition, Mc Graw-Hill Int. Editions, 2003,
C. Berrou, « Codes et turbocodes », collection IRIS, Springer,
K. Fazel, S. Kaiser, « Multi-Carrier and spread spectrum systems, Wiley.

Requirements :
Modules SRC05-PRER, SRC06-TSIA, SRC07-DESTI, SRC07-SINUM

Organisation :
Courses documents

Evaluation :
Un contrôle continu (Cours, Td, TP)
1 Devoir surveillé de 1 heure.

Target :

Network lab training	SRC09-NETLAB
Number of hours : 24.00 h	2.00 ECTS credit
PR : 24.00 h	hand-out in English and course taught in English
Reference Teacher(s) : UZEL FABIENNE	

Objectives :
Build a real network, including VLAN, VPN, routing protocols and Qos services. This project will illustrate layers 1 up to layers 4.

Content :
In the first step, students will simulate the network using Packet tracer software. In this architecture, they will observe the influences of VLAn VPN strategies.
In the 2nd step, they will use equipments in order to build their real network. Typical equipment¿s are : CISCO (wired and wireless), LINKSYS, DLINK, ¿They will anlayse the traffic, the data rate, filter the messages (thanks to wireshark for example).

Bibliography :

Requirements :
SRC09-TCRC and SRC09-WIRED

Organisation :
labs= 24 hours

Evaluation :
course mark

Target :

Use Case in Network Security	SRC09-USECASE
Number of hours : 16.00 h	1.50 ECTS credit
CM : 8.00 h, CM : 8.00 h	
Reference Teacher(s) : AVOINE GILDAS	

Objectives :
Study on additionnal mechanisms in IP network. Part 1 : Security in LAN - IPSEc, attacks, from layer 7 down to layer 2 . Part 2 : use case : which netwrok for which application. Two analyses, one based on IoT, one based on mobile communication 3G/4G

Content :
Part 1 - 8H, review of different security mechanisms and attacks. Part 2 : 2*4H : two scenarios using IoT and mobile network (lessons given by network companies)

Bibliography :

Requirements :
SRC06-RES, SRC08-RES, any network lessons (MAC, IP, TCP, wireless communication)

Organisation :

Evaluation :
2-hour written exam

Target :
5th year SRC - Major track,
Student of the M&N track MASTER I-MARS

Data Local Network	SRC09-LAN-DATA
Number of hours : 24.00 h	3.00 ECTS credit
CM : 10.00 h, CM : 10.00 h, TD : 2.00 h, TD : 2.00 h	
Reference Teacher(s) : UZEL FABIENNE	

Objectives :
2 parts : one on IPV6 and WLAN, one on WPAN based on IP

Content :
"Partie 1- 8H : Network administration, ipv6, inter-as routing . Partie 2- 8H- Introduction of some of wireless network using IP(bluetooth, wifi, wlan, wimax, ..)

"

Bibliography :

Requirements :
network, IP V4

Organisation :

Evaluation :
2-hour written exam

Target :
5th year SRC - Optional track "network design", Student of the M&N track MASTER I-MARS

Mobile Networks	SRC09-MOBILE
Number of hours : 12.00 h	1.00 ECTS credit
CM : 8.00 h, TD : 4.00 h	
Reference Teacher(s) : EL ZEIN GHAIS	

Objectives :
Acquisition of the fundamental foundations
of the field of cellular and mobile radio networks
through a description of the main techniques
used and their applications, focusing on the
physical layer of networks

Content :
1. Wireless Networks: history, market development, principle
2. Cellular Concept: frequency reuse, co-channel interference, traffic model, capacity, handover
3. Transmission Techniques (from 1G to 4G):
- 1G (RC2000, NMT, AMPS, TACS, ...)
- 2G (GSM/DCS, IS-95, PDC, D-AMPS, ...)
- 2.5G (GPRS, HSCSD, EDGE, ...)
- 3G (UMTS, cdma2000, IMT-2000, ...)
- 3.5G (HSDPA) - 3.75G (HSUPA)
- 3G++ (HSPA+)
- 3.9G (LTE) - 4G (LTE-Advanced, WiMax, ...)
4. Emerging Technologies: 5G
"

"1. Wireless Networks: history, market development, principle
2. Cellular Concept: frequency reuse, co-channel interference, traffic model, capacity, handover
3. Transmission Techniques (from 1G to 4G):
- 1G (RC2000, NMT, AMPS, TACS, ...)
- 2G (GSM/DCS, IS-95, PDC, D-AMPS, ...)
- 2.5G (GPRS, HSCSD, EDGE, ...)
- 3G (UMTS, cdma2000, IMT-2000, ...)
- 3.5G (HSDPA) - 3.75G (HSUPA)
- 3G++ (HSPA+)
- 3.9G (LTE) - 4G (LTE-Advanced, WiMax, ...)
4. Emerging Technologies: 5G
"

Bibliography :

Requirements :
Network architecture - Radiocommunications

Organisation :

Evaluation :
1-hour written exam

Target :
5th year SRC - Major track, MASTER I-MARS

Technical project	M&N09-PROJ
Number of hours : 360.00 h	8.00 ECTS credit
PR : 50.00 h	hand-out in English and course taught in English
Reference Teacher(s) : MORIN LUCE	

Objectives :
-Manage a project within a team, on a technical topic proposed by an industrial partner.
-Collaborate with an industrial partner and take into account industrial requirements and organization.
-Apply technical and management skills acquired during academic courses.
-Practice report writing and oral presentation on technical topics.

Content :
1. Meet industrial partner and write project functional specifications.
2. Task scheduling and task repartition.
3. State of the art and bibliographic research.
4. Experimental development and validation ; regular meetings with project advisor.
5. Report writing, preparation of presentation slides.
6. Oral defense of the project.

Examples of project topics:
-Visual closed-loop control of an AR-Drone
-Audio bench test for mobile phones
-Calibration of a network of heterogeneous cameras
-Direct WI-FI remote control
-CPL transmission of video stream on an ETTUS card
-Optimization of a conversion of audio sampling rate library on ARM architecture
-RFID for electronic passport reading in multi-platform Windows/Linux environment
-Activity and physiologic parameters measurement with a Kinect sensor

Bibliography :

Requirements :

Organisation :
-Teams of 4 to 6 students, including a project leader
-Topics proposed by industrial partners and work at Insa research/teaching labs.
-Regular meetings with the project advisor (a professor).
-Autonomous work over the whole semester, with dedicated time shifts (6 hour/week)
-Free access to software and hardware to teaching and research labs, industrial partner might provide software/hardware if necessary for the project.

Evaluation :
The work realized by each group is subject to a written report and an oral presentation before an audience comprised of fellow students. The jury is composed of professors and industrial partners.
A final mark awarded based on the quality of the work, written report and oral presentation.

Target :
M&N students from 5EII/5SRC/5INFO

English S9 Conversation	HUM09-ANGL-CONV
Number of hours : 10.00 h	1.50 ECTS credit
TD : 10.00 h, 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, 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 six sigma)	HUM09-PM-A
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 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 :
* Lean Six Sigma (28h / in French)
Lean Six Sigma is a methodology that enables firms to make their processes more effective and efficient. It¿s the current industry standard for process improvement designed to reduce waste and enhance output quality.

* Law (8h / in French)
Main principles of the French legal system

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies B (Human Resource Management)	HUM09-PM-B
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 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 C (Human Resources Management)	HUM09-PM-C
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 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 - ETHICS - RESPONSIBILITY)	HUM09-PM-D
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 h, TD : 4.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :
This course aims at enabling students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:
- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :
The program's main objective is to provide a multidisciplinary approach to the field of innovation, strategy and industrial design. This course will give an overview of the innovative process.
During this program, participants will have the opportunity to explore a business case covering the first stage of a product development project.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - S7 and S8

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 Strategy and Development)	HUM09-PM-E
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 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 focuses on strategic choices regarding effective actions in international business.

Bibliography :
Given during the course

Requirements :
ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :
This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advice to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies F (sustainable development)	HUM09-PM-F
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 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 :
- Project Management (28 h / in French)
    - Efficient Project Management tools and organization according to PMI (Project Management Institute)
    - Agility
    - SCRUM

- Law (8 h / 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 advice to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :
Continuous assessment (collective work)

Target :

Economics, Law and Business Studies G (serious game)	HUM09-PM-G
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 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 :

Evaluation stage	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 :

Semestre 9

Parcours Spécifique Media & Networks - IGR 2

1	**M&N09-SEIR-IGR2**		**Systèmes embarqués - Images- Réseaux - IGR 2**	**10.50**
	EII09-PPEM	C	Parallel Programming for Embedded MPSoCs	2.50
	EII09-DISPS	C	Digital Signal Processor	2.00
	EII09-AHD	C	Advanced Hardware Design	1.00
	EII09-SYSC	C	SystemC	1.00
	SRC09-SOPC	C	System on Programmable Chips	1.00
	SRC09-REALTIME	C	Real Time Processing	1.50
	SRC09-USECASE	C	Use Case in Network Security	1.50
2	**M&N09-Projet**		**Technical Project**	**8.00**
	M&N09-PROJ	O	Technical project	8.00

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

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	
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 and 5 M&N

Digital Signal Processor	EII09-DISPS
Number of hours : 24.00 h	2.00 ECTS credit
CM : 10.00 h, TP : 14.00 h	
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 and 5M&N

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, M&N

SystemC	EII09-SYSC
Number of hours : 14.00 h	1.00 ECTS credit
CM : 8.00 h, TP : 6.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

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

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

Bibliography :

Requirements :

Organisation :

Evaluation :
1 hour exam

Target :
5EII, M&N

System on Programmable Chips	SRC09-SOPC
Number of hours : 10.00 h	1.00 ECTS credit
CM : 4.00 h, TP : 6.00 h	hand-out in English and course taught in English
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
Introduction to embedded systems (technology, management, hardware/software co-design). Case study on a SOPC platform (Altera FPGA).

Content :
Technology of embedded systems: ASIC, FPGA, Study of different reconfigurable circuits (Xilinx, Altera, ...). Introduction to rapid prototyping tools from system to physical level.

Bibliography :

Requirements :
SRC07-LPROG

Organisation :

Evaluation :
Practical training session

Target :

Real Time Processing	SRC09-REALTIME
Number of hours : 16.00 h	1.50 ECTS credit
CM : 10.00 h, TP : 6.00 h	hand-out in English and course taught in English
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :
Study of real time operating systems and application examples.

Content :
Various fields of applications, embedded systems, kernel architecture, Kernel services (tasks, synchronizations, communications), multi-processes/multi-processors programming, scheduling policies, memory management.

Applications: embedded systems for signal processing (telecommunication, image / video) in automotive, avionics, etc. ....
Systems with strong real time constraints, system management / supervision.

Practical work on MicroC-OSII.

Bibliography :

Requirements :

Organisation :

Evaluation :
2 hours exam

Target :

Use Case in Network Security	SRC09-USECASE
Number of hours : 16.00 h	1.50 ECTS credit
CM : 8.00 h, CM : 8.00 h	
Reference Teacher(s) : AVOINE GILDAS	

Objectives :
Study on additionnal mechanisms in IP network. Part 1 : Security in LAN - IPSEc, attacks, from layer 7 down to layer 2 . Part 2 : use case : which netwrok for which application. Two analyses, one based on IoT, one based on mobile communication 3G/4G

Content :
Part 1 - 8H, review of different security mechanisms and attacks. Part 2 : 2*4H : two scenarios using IoT and mobile network (lessons given by network companies)

Bibliography :

Requirements :
SRC06-RES, SRC08-RES, any network lessons (MAC, IP, TCP, wireless communication)

Organisation :

Evaluation :
2-hour written exam

Target :
5th year SRC - Major track,
Student of the M&N track MASTER I-MARS

Technical project	M&N09-PROJ
Number of hours : 360.00 h	8.00 ECTS credit
PR : 50.00 h	hand-out in English and course taught in English
Reference Teacher(s) : MORIN LUCE	

Objectives :
-Manage a project within a team, on a technical topic proposed by an industrial partner.
-Collaborate with an industrial partner and take into account industrial requirements and organization.
-Apply technical and management skills acquired during academic courses.
-Practice report writing and oral presentation on technical topics.

Content :
1. Meet industrial partner and write project functional specifications.
2. Task scheduling and task repartition.
3. State of the art and bibliographic research.
4. Experimental development and validation ; regular meetings with project advisor.
5. Report writing, preparation of presentation slides.
6. Oral defense of the project.

Examples of project topics:
-Visual closed-loop control of an AR-Drone
-Audio bench test for mobile phones
-Calibration of a network of heterogeneous cameras
-Direct WI-FI remote control
-CPL transmission of video stream on an ETTUS card
-Optimization of a conversion of audio sampling rate library on ARM architecture
-RFID for electronic passport reading in multi-platform Windows/Linux environment
-Activity and physiologic parameters measurement with a Kinect sensor

Bibliography :

Requirements :

Organisation :
-Teams of 4 to 6 students, including a project leader
-Topics proposed by industrial partners and work at Insa research/teaching labs.
-Regular meetings with the project advisor (a professor).
-Autonomous work over the whole semester, with dedicated time shifts (6 hour/week)
-Free access to software and hardware to teaching and research labs, industrial partner might provide software/hardware if necessary for the project.

Evaluation :
The work realized by each group is subject to a written report and an oral presentation before an audience comprised of fellow students. The jury is composed of professors and industrial partners.
A final mark awarded based on the quality of the work, written report and oral presentation.

Target :
M&N students from 5EII/5SRC/5INFO

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, 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 :

Semestre 10

Parcours Media & Networks

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
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- 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 :

Semestre 10

Parcours Spécifique Media & Networks - IGR 2

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, ST : 346.00 h	
Reference Teacher(s) : PRESSIGOUT MURIEL	

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Requirements :

Organisation :

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- Mark for report.
- Mark for oral presentation.
The overall mark will be taken into account by the 5th year jury.

Target :