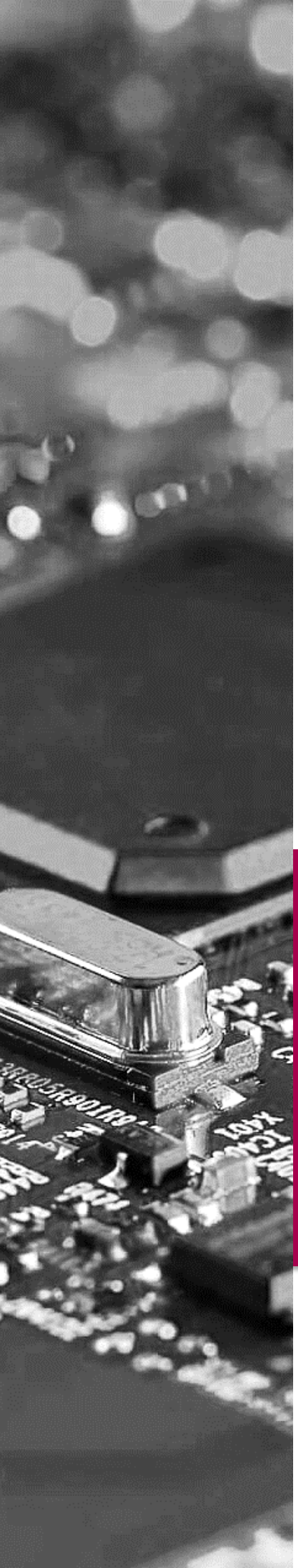

ENSEA

Beyond Engineering

Electrical & Computer Engineering

Computer Science & Signal Processing majors

Graduate/Master Program

ENSEA – Semester 7 - English-Taught Track

Edition 2023

ENSEA Second Year Syllabus – International Program
First year of Master or Graduate studies
Signal processing and Computer Science Majors

Level	**First year of Master's Degree/Graduate/Semester 7**		
Period	Fall semester (September to January)		
Language of tuition	English		
ECTS	30		
Courses	Code	Course	ECTS
	COMPUTER_S7_MAJ	**Computer Science as Major [Composed of:]**	**6**
	DTI_2501	Microprocessors	
	DTI_2502	Object-oriented programming: JAVA	
	DTI_2506	Network fundamentals	
	DTI_2507	System programming	
	DTI_2508	Lab work	
	SIGNAL_S7_MAJ	**Signal Processing as Major [Composed of:]**	**6**
	DTI_2201	Digital Signal Processing II	
	DTI_2202	Digital Communications	
	DTI_2206	Random signals	
	ELECTRONICS_S7_MIN	**Electronics as Minor [Composed of:]**	**4**
	DEE_2301	Electronic Systems II	
	AUTOMATION_S7_MIN	**Automation as Minor [Composed of:]**	**4**
	DA_2401	Energy Conversion I	
	MANAGEMENT_PROJECT_S7	**Management & Project [Composed of:]**	**6**
	DEE_2701	Project	
	DSH_2601	Responsible and sustainable management	
	LANGUAGES_S7	**Languages [Composed of:]**	**4**
	DSH_2101	English	
	DSH_2106	French for international students	

ENSEA Second Year Syllabus – International Program
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COMPUTER_S7_MAJ Computer Science as Major (6 ECTS)

DTI_2501 Microprocessors(Lectures: 16h / Tutorial classes: 8h / Lab: 16h)
This advanced module allows the understanding of the different components of a system based on a microcontroller. The objective is reached using a guided-project using a STM32 controller and peripherals.
- Interruption/exception transfer mechanism: interruption types, vectorization, interruption masking and management.
- Microcontroller peripherals: microcontroller architecture, peripherals memory, clock, timer, ADC, DAC, extern peripherals.
- Link with C language.

DTI_2502 Object-oriented programming: JAVA(Lectures: 6h / Tutorial classes: 14h / Lab: -h)
The module focuses on the object-oriented programming basis using JAVA language. The learning is done through practice guided by the development of an application. This module is complementary to the S5 C language module.
- Classes, instances, references
- Encapsulation, access
- Inheritance, polymorphism
- Error management, exceptions
- Graphical interface, events management
- Object-oriented design, design patterns

DTI_2506 Network fundamentals (Lectures: 6h / Tutorial classes: 6h / Lab: -h)
The course focuses on the design of communicating applications using a data transmission
protocol. TCP/IP and internet network are the main targets.
- General ideas of communication protocols
- OSI model, norms
- Local networks, access, routing
- TCP/IP protocol

DTI_2507 System programming (Lectures: 6h / Tutorial classes: 6h / Lab: -h)
The course focuses on programming system applications offering services to other applications. Communication between application is explained, together with multiprocesses
programming.
- Input and output at low level (open, clos, read, write, fctl)
- Pipe, socket
- Process creation (fork, exec)

DTI_2508 Lab work (Lectures: -h / Tutorial classes: -h / Lab: 16h)
The lab work consists in developing a data server accessible through the network. FTP server, HTTP, IRC.

SIGNAL_S7_MAJ Signal Processing as Major (6 ECTS)

DTI_2201 Digital Signal Processing II (Lectures: 16h / Tutorial classes: 18h / Lab: 16h)

The first module focused on characterizing discrete-time signals and digital filter in time and frequency domains. This advanced module allows:
- The analysis of the frequency contents of a signal, the definition of SNR
- The characterization of the filters (linear phase, phase shifter) effect on spectrum
- The design of the filter / its transfer function to extract the wanted signal or attenuate the unwanted components
- The implementation of the designed filter
- The quantification of the enhancement brought by filtering in terms of SNR and periodogram
Illustrations will be made on ECG signals, images… Lab work on Matlab focuses on design and implementation of filters, comparison between average and AR(1) filtering.

DTI_2202 Digital Communications (Lectures: 8h / Tutorial classes: 8h / Lab: 8h)

This module presents the digital techniques of signal transmission. The objective is to allow the students to characterize a simple communications system and determine its main performances. Lab work uses a simulation software for communications systems.

- Digital Baseband transmission: digital information representation, limited bandpass channel, intersymbol interferences, eye diagram, channel with Gaussian addition-noise, binary error rate.
- Digital modulations: main modulations principles (ASK, FSK, PSK, QAM), trajectories, constellations, spectrum efficiency, demodulation techniques, modulation performances in presence of noise.
- Introduction to channel-coding: linear-bloc codes, Hamming distance, syndrome, decoding and error correction.

DTI_2206 Random signals (Lectures: 12h / Tutorial classes: 12h / Lab: 16h)

After a general introduction on random continuous and discrete-time processes, the second order model in stationary case is only discussed using time-discrete signals. The characterization, filtering and model of signals originating from physical phenomena (speech, pressure measurement, communication signals) are viewed thanks to statistical tools.

- Random process. Second-order properties, covariance function
- Stationarity. Correlation function, application to delay estimation.
- Power spectral density and z-density. Example: detection of a sine wave inside noise.
- Mean estimator, autocorrelation estimator. Ergodism, estimators quality.
- PSD estimation: correlogram, periodogram. Wiener-Khintchine theorem, average
periodogram, windowing.
- Linear filtering of processes. Interferences formula, multipath communication.
- Processes model. AR, ARMA model, vocal tract model.

ELECTRONICS_S7_MIN Electronics as Minor (4 ECTS)

DEE_2301 Electronic Systems II(Lectures: 16h / Tutorial classes: 18h / Lab: 16h)
This module focuses on analog electronics functions and fundamental concepts. At the end of the module, the students are able to design most of analog electronic circuits.
- First harmonic approximation. Transistor model using this approximation. Non-linear behavior of amplifiers, distortion.
- Oscillators
- Phase-locked loop. Static, dynamic state, sequential detector loop
- Transmission lines model. Behavior in transient state.

AUTOMATION_S7_MIN Automation as Minor (4 ECTS)

DA_2401 Energy Conversion I (Lectures: 16h / Tutorial classes: 18h / Lab: 16h)
This course allows the study of the main static converters structures used in Power Engineering (chopper, switched-mode power supply) and presents the speed control in DC motors.
- Power semi-conductor devices and magnetic devices
- DC Power sources: batteries. Filtering.
- Chopper: step down, two-/four-quadrant, inductive storage, Single Ended Primary Inductor Converter (SEPIC)
- Speed variation of a DC motor powered by a four-quadrant chopper
Lab work are dedicated to Flyback and Forward power supplies, reversible chopper, inverter.

MANAGEMENT_PROJECT _S7 Management & Project (6 ECTS)

DEE_2701 Project (Lectures: -h / Tutorial classes: -h / Lab: 48h)
The project takes place in S7 and S8. It embodies a truly important step for the Engineer student in his studies. It is indeed the first experience over a long period of designing and realizing a prototype which involves real industrial or research constraints.
The objective is to let the student work as if he was in a R&D department. Starting from an idea, he has to
- Develop a global vision of the system
- Write a design brief
- Design the prototype
The student will encounter issues such as reading past years work from other students, writing reports, choose and buy devices for the prototype. At the end of S7, the student has an oral defense to present his work until then.

The ecological footprint of the product is studied from its design to its production. The components used are sourced by verifying that the most favorable environmental and social standards are used (ROHS, ISO 14001, etc.).

The project topics are spread on all the Engineering & Research fields of ENSEA.

DSH_2601 Responsible and sustainable management of project activities in a normative environment (Lectures: 6h / Tutorial classes: 18h / Lab:-h)

The first part of the course allows students to deepen the project approach on :
- The project realization phase: operational planning by breaking down the project into work packages (WBS), management of responsibilities (OBS/RACI) and the diagram of
deliverables and flows.
- The monitoring and control phase: project monitoring and coordination resources (human, material, financial) with deliverables and milestones (PERT, GANTT and agile management tools such as SCRUM, DMAIC). Project duration and costs by optimizing the triptych "Costs/Delays/Resources" in a SD/RS ENVIRONMENT
- The closing phase of the project with the project debriefing/feedback and the closing meeting.

In addition to the traditional tools, students are trained in tools for monitoring the project in relation to SD and CSR (Sustainable Development Logbook (Sustainable Development Logbook - SDLC®, tools for evaluating the environmental and environmental and societal risks of a project - risk rating matrix etc.)

The second part of the course is a practical application of the lessons of the module "Electronic project and its responsible and sustainable management". The objective is to reinforce the students' skills in the fields of standardization and responsible engineering.
In particular, the students deepen their knowledge of integrated environmental management system (QSE) and more particularly, the societal responsibility of an organization (CSR). The certification process of an organization is considered to introduce students to a continuous improvement approach.
The TDs favor an edutainment approach (or in the form of a serious game) by through the implementation, in an organization, of policies that integrate a sustainable management of the organization. The teaching in TD can also take the form of the realization of a CSR/Audit diagnosis (Management or Process).

LANGUAGES_S7 Languages (4 ECTS)

DSH_2101 English(Lectures: -h / Tutorial classes: 26h / Lab: -h)
The goal of this year is to prepare for the international experience, either academic or internship mobility. Focus will be given to resume and cover letter redaction, Business English, intercultural workshop, the way to speak in professional context or daily life, advanced notions on linguistic aspects. Workshops dedicated to different language certificates can be also suggested.

DSH_2106 FLE (French for foreigners) (Lectures: -h / Tutorial classes: 24h / Lab: -h)
The main goal of this class is training the foreign students through communication fundamentals for everyday life, proposing them an introduction to French culture and civilization and more advanced knowledge in order to work in a French company during the final internship period.