Programs 3A-S2

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01/09/2017

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MAT3054 - STATISTICS

Cycle:	Foundation	**Location:**	Paris-Ivry/Laval
Unit:	MATHEMATICS AND COMPUTER SCIENCE	**Weighting:**	1.5
Semester:	2		
Language:	French		
Number of hours:	21 h	**Lectures/Tutorials:**	0 h
		Lectures:	9 h
		Tutorials:	12 h
		Practicals:	0 h
		Project:	0 h
		Workshop:	0 h

Module summary:

This module aims to enable students to structure and represent information contained in a data set, and to obtain certain specific information (or a data model) from a population, using measures taken on a population sample.

Learning objectives	**Students will be assessed on their ability to...**
Digitally characterising a statistical series	Determine means, medians, mode, quantiles, moments, scope, variance, standard deviation, and mean absolute deviation.
Graphically representing a statistical series	Trace a histogramme, a bar chart, and the cumulative numbers and frequencies chart.
Estimating a mean or frequency by a point estimate or confidence interval	Determine a degree of confidence for a mean or frequency estimated from a sample.
Comparing two frequencies or two means for two populations	Determine a degree of confidence for the difference between the outputs from two different machines.
Using an adjustment test and an independence test, using the Chi-squared distribution	Find the distribution for the variable studied. Determine the intensity of a link between two qualitative variables.
Using an affine function to correctly adjust a scatter plot	Determine the parameters for a linear adjustment model.

Contents: Reminder of descriptive statistics: characterising position,

	dispersion and form. Making a point estimate of a mean or proportion. Estimating a mean or proportion with a confidence interval. Comparing means or proportions for two independent populations. Chi2 goodness-of-fit test and test of independence Linear adjustment. Simple linear regression by the Ordinary Least Squares method. ANOVA (ANalysis Of VAriance).
Pre-requisites:	No pre-requisites
Learning methods:	Lectures, Tutorials, Practicals
Assessment:	Final exam, project report
Hardware/software/support materials:	R software
Bibliography:	
Keywords:	Descriptive statistics, point estimate, estimate by confidence interval, comparison tests, Chi2 independence and adequacy tests.

INF3043 - ALGORITHMICS, COMPUTABILITY AND COMPLEXITY

Cycle:	Foundation	**Location:**	Paris-Ivry/Laval
Level:	1	**Semester:**	2
Unit:	Mathematics and Computer science	**Weighting:**	1
Language:			
Number of hours	21 h	**Lectures/Tutorials:**	0 h
		Lectures:	9 h
		Tutorials:	12 h
		Practicals:	0 h
		Project:	0 h
		Workshop:	0 h

Module summary:
This module aims to help students to understand the concepts of computation and complexity in computer programming, and to enable them to answer the following three questions:
- Algorithmics: what is computation?
- Computability: can everything be computed?
- Complexity: what is the efficient way to compute?

To answer these questions, the module introduces the basics of finite automata theory, including the concepts of finite automata, formal language and grammar.
It also deals with the theory of decidability and computability, in particular through the concept of the Turing machine and decidable questions.
Finally, it defines the first elements of algorithmic complexity theory, i.e. the concepts of complexity in time and space and complexity classes.

Learning objectives	**Students will be assessed on their ability to...**
Understand the meaning of computation in the context of computer science and logic.	Discover the concepts of formal language and grammar. Present different computation models (finite automata, Turing machine). Another perspective on automatons: the Kripke models and verifications on system performance.
Determining whether a problem is decidable or computable.	Present the concepts of decidable vs. assessable problems. Present the concepts of coding and representation. Understand that not all problems are decidable.

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Contents:	1) Finite automata theory - formal language and algebra grammar - finite deterministic and non-deterministic automatons, regular expressions, pumping lemma - Turing machines - Kripke structures 2) Decidability and computability theory - decidable vs. assessable problems -coding and representation - problem decidability and universal Turing machine - existence of an undecidable problem: the stop problem 3) Algorithmic complexity theory - assessment of problem complexity, O and o concepts - problem solvable with deterministic or non-deterministic approaches - time complexity: classes P, NP, EXPTIME, NEXPTIME - spatial complexity - complete NP problem - use of problem complexity in cryptology: public key systems
Pre-requisites:	Linear algebra, function limits and asymptomatic behaviour.
Learning methods:	Lectures and Tutorials
Assessment:	Final exam and assignments
Media:	Moodle, PPT presentations
Bibliography:	LINZ Peter. Introduction to Formal Languages and Automata (5th edition), Jones and Barlett, 2011. SIPSER Michael Sipser, Introduction to the Theory of Computation (3rd edition). Cengage Learning, 2012. PÉRIFEL Sylvain. Complexité algorithmique. Ellipses, 2014. (available on line: www.liafa.univ-paris-diderot.fr/~sperifel/complexite.pdf sous la licence creative commons)
Keywords:	Algorithmics, Computability, Complexity, Finite automaton, Formal language, Turing machine, Problem class

INF3113 - SOFTWARE ENGINEERING AND GLPOO PROJECT

Cycle:	Foundation	**Location:**	Paris-Ivry/Laval
Unit:	MATHEMATICS AND COMPUTER SCIENCE	**Weighting:**	2
Language:	French		
Number of hours	24 h	**Lectures/Tutorials:**	0 h
		Lectures:	12 h
		Tutorials:	9 h
		Practicals:	9 h
		Project:	15 h
		Workshop:	0 h

Module summary:
Understanding the main concepts of object-oriented programming, for analysis, design and programming.
Implementing a unified and/or agile software development process.
Competence objectives:
- Good knowledge of Java
- Good knowledge of UML notation
- Good knowledge of an IDE
- Good knowledge of agile programming
- Good knowledge of testing
- Ability to work in a team

Learning objectives	**Students will be assessed on their ability to...**
Discussing a technical design using a standard representation technique	Use UML in practical assignments, assessed work and projects
Understanding and using the agile method	Manage (or take part in) a project using agile management
Understanding and mastering code management tools	Use SVN and Git, github, in projects and assignments
Understanding and mastering the main design patterns	Use GOF patterns in practical assignments, assessed work and projects
Understanding and mastering good development practises	Use TDD, 3T, Xp conventions in practical assignments, assessed work and projects

Contents:

Java
UML

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Eclipse
Testing tools JUnit, TDD, 3T
HMIs: Swing, Mockup
Design patterns
Computer-assisted design: JDBC, JPA, CVS
Agile methods: Scrum, Xp, Kanban
Maven Jenkins
System Control Manager: Subversion, Git

Pre-requisites:	Object-oriented development with Java (Java module) INF3031 - DATA BASES
Learning methods:	Lectures, Live Coding, Practicals Project
Assessment:	Written exam with no documents or computer, assignments
Media:	Lectures and practicals: http://icauda.com/cours.php, Java, Eclipse, Maven, SVN, Subversion, GitHub, Projector
Bibliography:	http://www.icauda.com/
Keywords:	Java, software engineering, object-oriented programming, UML, Xp, Agile, Scrum

INF3040 - SYSTEM ADMINISTRATION

Cycle:	0	**Location:**	Paris-Ivry/Laval
Unit:		**Weighting:**	2
Language:			
Number of hours	21 h	**Lectures/Tutorials:**	0 h
		Lectures:	3 h
		Tutorials:	0 h
		Practicals:	18 h
		Project:	0 h
		Workshop:	0 h

Module summary:
Administering operating systems in a Business LAN environment

Learning objectives
- Installing, configuring and using a Active Directory © (A.D.)
- Interconnecting client hardware and software (Linux, Windows, printers) and interacting with the A.D.
- Managing the updates, logbooks and backups
- Troubleshooting

Students will be assessed on their ability to...
- Direct in-class assessment (quizoodle)
- Assessment questionnaire at the end of the module (on Moodle platform or paper)

Contents:
Administering operating systems in a Business LAN environment

Pre-requisites:
Operating systems (INF3039)
IP networks (INF3037)
IP networks practicals (LAB3418)

Learning methods:
- Presentation of the administrator's role,
- Duties in terms of security and ethics,
- The A.D. philosophy,
- Installing and configuring an A.D.,
- Implementing a standard architecture (users, Windows unit, shared directories, DNS, DHCP, NTP),
- Deploying an update by GPO (connection window, certificate),
- Presentation of the Linux/Windows interconnection principles (Kerberos),

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- Integrating a Linux unit,
- Implementing a IT equipment management system (GLPL, OCS Inventory, logging, WSUS, Puppet),
- Implementing backups (shared directories, logbooks, etc.).

Assessment:

Media:

Bibliography:

Keywords:

INF3131 - DATA BASES 2

Cycle:	Foundation	**Location:**	Paris-Ivry/Laval
Unit:	MATHEMATICS AND COMPUTER SCIENCE	**Weighting:**	2
Language:	French		
Number of hours	18 h	**Lectures/Tutorials:**	0 h
		Lectures:	9 h
		Tutorials:	0 h
		Practicals:	9 h
		Project:	0 h
		Workshop:	0 h

Module summary:
Presentation of different DBMS, relational concepts, modelling, advanced SQL data base query language features, including stored procedures with several variants in common use in business contexts (Oracle, MySQL, SQL Server, etc.)

Learning objectives	**Students will be assessed on their ability to...**
Understanding SQL language and designing relational data base logic diagrams. - Designing conceptual and relational data base models. - Developing procedures stored in procedural language. - Understanding the techniques used in the end-to-end development of an application, using a data base.	- Assessment by tutorial reports - Knowledge assessment questionnaire (multiple choice exam on the creation of data structure models)

Contents:

- Introduction to data bases and modelling
- Introduction to SQL - creating tables, constraints
- Finding data in a table - selecting, projecting, aggregating
- Finding data in several different tables - internal and

	external joints, set operators - Ordering and presenting data - sorting, windowing, examples of implementation - Fuzzy searches - finding the "best equivalence" and searching on keywords (tags) - Changing data - transactions, insertions, deletions, updates, changing data from a file, updating data in one table using data from another - Functions, Procedures and Triggers - Optimising indexing operations - Views, safety and access rights
Pre-requisites:	Programming basics
Learning methods:	Lectures, Tutorials, Practicals
Assessment:	Assessment in the tutorials + final exam Practicals mark (mini project)
Media:	Powerpoint + PDF versions, Projector
Bibliography:	(optional book in English) Faroult, Stéphane. SQL Success Database Programming Proficiency. Londres: RoughSea, 2013.
Keywords:	DBMS, SQL

INF 3034 - MOBILE PROGRAMMING

Cycle:	Advanced	**Location:**	Paris-Ivry/Laval
Unit:	MATHEMATICS AND COMPUTER SCIENCE	**Weighting:**	1.5
Language:	French		
Number of hours	21 h	**Lectures/Tutorials:**	0 h
		Lectures:	0 h
		Tutorials:	0 h
		Practicals:	18 h
		Project:	0 h
		Workshop:	0 h

Module summary:
Mastering the basics of mobile programming under Android

Learning objectives	**Students will be assessed on their ability to...**
Mastering the basic tools required to create a graphic interface on Android.	Use Android Studio to create an application with the basic tools (Intent, LinearLayout, RelativeLayout, RecyclerView, Fragment & Activity, ActionBar, ListView).
Understanding activity life cycles, the sandpit concept, Fragments and Manifest operations. Understanding the concept of service and implement a basic version.	Become aware of the use and main operating mechanisms of Android, through specific examples of implementation of components of a User interface. Discover the use of services and their operation through an http API REST query.

Contents:

This module focuses on the basics of mobile programming and its paradigms through the production of a mobile application interfaced with a web server (provided or created under module INF4041).
The practical assignment will use Android.
The theoretical knowledge will be provided as the practical work progresses to allow students to permanently relate theory and practise.
The project will be based on an idea freely chosen by the student and approved by the teachers. The project will recover API REST data and display them in Android views using the tools introduced during the practicals.

Pre-requisites: None

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Learning methods:	Practicals
Assessment:	Project:
Media:	Overhead projector, Computer, Power-point
Bibliography:	
Keywords:	Smartphone, Mobile programming, Android.

INF3041 - INTRODUCTION TO THEMES COVERED IN THE MAJORS

Cycle:	Engineer	**Location:**	Paris-Ivry/Laval
Unit:	MIF3BS2 – Mathematics and Computer science	**Weighting:**	2
Language:	French		
Number of hours	21 h	**Lectures/Tutorials:**	0 h
		Lectures:	15 h
		Tutorials:	6 h
		Practicals:	0 h
		Project:	0 h
		Workshop:	0 h

Module summary:
Discovering the themes covered in the majors

Learning objectives Identifying general IT security issues in the following areas: - user behaviour, - corporate security, - data security.	**Students will be assessed on their ability to...** - Direct in-class assessment (quizoodle) - Assessment questionnaire at the end of the module (on Moodle platform or paper)
Contents:	**A) Cybersecurity (9h)** - Definition of IT security (3h) - Introduction to cryptography (3h) - Introduction to virology (3h) **B) Artificial intelligence (6h)** Introduction to artificial intelligence and its applications **C) Artificial intelligence (6h)** Introduction to virtual reality and its applications
Pre-requisites:	- INF3039: Operating systems - INF3037: IP networks
Learning methods:	Lectures - LAB
Assessment:	Digital questionnaires (Moodle platform)
Media:	- Presentations with commentaries - LAB with feedback, - Overhead projector - Linux

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Bibliography:

Keywords: SSI – ANSSI – RSSI – Virology – Cryptology – SSH – SSL – PKI – SHA - MD5

PLU3193 - SCIENTIFIC AND TECHNICAL PROJECT

Cycle:	Foundation	**Location:**	Paris-Ivry/Laval
Unit:	PHYSICS, ELECTRONICS AND SYSTEMS	**Weighting:**	4
Language:	French		
Number of hours	45 h	**Lectures/Tutorials:**	0 h
		Lectures:	0 h
		Tutorials:	10 h
		Practicals:	0 h
		Project:	35 h
		Workshop:	0 h

Module summary:
Designing a complex system (with interacting sub-systems): Defining, Modelling, Simulating/Testing, Validating the model on a prototype, Explaining the model, Comparing with the end-product, Proposing improvements, Implementing the system, Improvements
Promoting the project

Learning objectives	**Students will be assessed on their ability to...**
Defining a problem and the limits of a subject	Framework document presenting the subject of the project.
Identifying the problems to be solved	Submission of a project framework presenting a relevant and coherent breakdown of the different stages in the implementation of the project.
Controlling group dynamics Organising the work Working in teams	Organisation of regular follow-up meetings for the team to present a progress report, the breakdown of tasks between the memb next stages.

Contents:

The Engineering Sciences project is designed to confront the student with project planning in engineering projects, to develop team work, communication techniques and collaborative work.
The students make up teams of 4 to 5 and choose the field that they want to work on.

The project

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1. The aim is to create an application or an experiment that meets the medium-term needs of a business, an NGO or an educational organisation. It is based on a scientific and technical study of the project, using practical company experience on similar projects.

2. Designing a complex system (with interacting sub-systems): Defining, Modelling, Simulating/Testing, Validating the model on a prototype, Explaining the model, Comparing with the end-product, Proposing improvements, Implementing the system, Improvements Promoting the project.

3. Implement project management techniques: each group has to organise and structure its project.

Pre-requisites:

Learning methods:

- Project-based learning: contact with the supervisor and autonomous work.
- Team work and use of a collaborative work space.
- Project management.

Assessment: Report with oral presentation

Media:

Bibliography:

Keywords: Projects, group work, collaborative work, project-based learning, anti-plagiarism checks, innovation, intellectual honesty, project leadership, critical mind, project monitoring, planning, deadlines, Pert, Gant, meeting minutes, reporting, progress assessment, implementation, oral presentation, feedback.

SYS3042 - AUTOMATION

Cycle:	Foundation	**Location:**	Paris-Ivry/Laval
Unit:	PHYSICS, ELECTRONICS AND SYSTEMS	**Weighting:**	2
Language:	French		
Number of hours	36 h	**Lectures/Tutorials:**	0 h
		Lectures:	27 h
		Tutorials:	9 h
		Practicals:	0 h
		Project:	0 h
		Workshop:	0 h

Module summary:
This module focuses on the fundamentals of automation applied to the study and design of linear system servo-controlled systems, according to specifications in terms of stability, speed and accuracy. The modules deals with the transfer function and different types of controllers (PID, phase lead and lag) for continuous-time and discrete-time systems. The concepts are put into practise through exercises based on the study of real physical systems and by handling the associated computation and simulation software (Matlab-Simulink).

Learning objectives	**Students will be assessed on their ability to...**
Modelling a system in order to design a servo-controlled system	Tutorial exercises on linearisation and the use of Laplace transform to convert a physical model (electrical and mechanical equations) into a transfer function. Tutorial exercises on the concept of servo control and servo system analysis: identification of physical sub-systems (sensor, controller, system to be servo-controlled, etc.), transition from a physical system description to a functional diagram and a block diagram, etc.
Proposing a controller suitable for the servo-controlled system and able to produce pre-determined performance levels	Tutorial exercises on different types of corrective actions (P, I, D) and the computation of the performance achieved. Each student suggests the controller best suited for the performance targets. Simulation exercises (using Simulink) on the implementation of different controller types.
Handling different computation and simulation tools for system automation (Matlab and Simulink)	

Contents: Content common to 3A and CFA:

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A. Introduction General structure of a servo-controlled system, servo-controlled system performance, models

B. Linear continuous time systems
1. Definition and properties: linearity, invariance, causality
2. Representation of continuous linear systems
2.1 Time domain representation: ordinary differential equations, linearisation, response to test signals
2.2 Frequency domain representation: Laplace transforms, properties, usual transforms, initial value and final value theorems, transfer function, frequency response, Bode diagrams, Black and Nyquist
3. 1st order systems: mechanical and electronic engineering examples, time domain representation, frequency domain representation
4. 2nd order systems: mechanical and electronic engineering examples, time domain representation, frequency domain representation
5. Servo-controlled system performance
5.1 General servo-controlled system structure: block diagrams, open and closed loop transfer functions
5.2 Stability: definition, stability conditions, pole map, Routh criterion, feedback criterion in Black and Nyquist planes, stability margins, robustness
5.3 Accuracy: accuracy at constant speed, position, speed and acceleration errors, system class, constant disruption errors, integrator effect, dynamic accuracy, overshoot
5.4 Speed: time up to speed, response time at 5% and n%
6. Controller synthesis: corrective actions, proportional controller, proportional derivative lead controller, proportional integral lag controller, PID controller, synthesis with a Black-Nichols chart, simplified tuning with the 1st Ziegler-Nichols method
Additional Y3 content:
Practical PID tuning, lead and lag controllers, applications on a real-life system (saturations, anti wind-up devices).

C. Discrete time systems
1. Discretisation of a continuous signal (Shannon distribution, zero order hold - sampler)
2. Recurrence equations, Z transform
3. Transfer functions
4. General structure of a servo-controlled system
5. Stability (stability criterion, use of continuous methods)
6. Accuracy
7. Control (using continuous methods)

Pre-requisites:

Mathematics: ordinary differential equations, usual function primitives and derivatives, integration by part, log and exponential functions (limits, derivatives), complex

numbers (module, argument, representation in a complex plane

Learning methods:

- Tutorial / Computer-assisted tutorial 1 (3h): Speed servo control on a DC motor.
Modelling, open loop study, study of P and PI controllers. Application under Simulink (controller implementation).
- Tutorial 2 (3h): Regulating the level in a tank.
Block diagrams, stability study using different criteria, accuracy study, Black-Nichols diagram and chart.
- Tutorial / Computer-assisted tutorial 3 (3h): Study of an unknown servo-controlled system model.
Graphic resolutions, use of the Black-Nichols diagram and chart, study of closed loop performance Application under Matlab (using the Control System Toolbox).

Assessment:

Final exam and continuous assessment (questions on the course content and tutorial and practicals reports)

Media:

PPT presentations and course notes

Bibliography:

P. De Larminat, Automatique, Ed. Hermès
J. C. Chauveau, Systèmes asservis linéaires, Ed. Educalivre
J. J. Di Stefano, . J. Di Stefano, Systèmes asservis, Ed. Mc Graw-Hill

Keywords:

Servo-control, controller, control, dynamic systems

LAB3417 - SERVO-DRIVE CONTROL

Cycle:	Foundation	**Location:**	Paris-Ivry/Laval
Unit:	PHYSICS, ELECTRONICS AND SYSTEMS	**Weighting:**	2
Language:	French		
Number of hours	21 h	**Lectures/Tutorials:**	0 h
		Lectures:	0 h
		Tutorials:	0 h
		Practicals:	21 h
		Project:	0 h
		Workshop:	0 h

Module summary:
The aim is to control the angular position of a disk driven by a DC motor, using a potentiometer.
The first task will be to identify the transfer function for the geared motor-disk assembly by indicial response analysis.
The system will first of all be controlled by a simple potentiometer return.
This will then be improved by inserting a PID-type controller, first an analogue type (with operational amplifiers), then a digital type (on a MCU). A simulated corrected process is first carried out.

Learning objectives Analysing and correcting the behaviour of a system position-controlled by a DC motor.	**Students will be assessed on their ability to...** Create a diagram and analysis of a looped system servo-controlled by a DC motor. Compute the parameters of a PID controller. Estimate the effect of the controller in the system's static and dynamic response. Simulate and experiment the system with and without the controller.
Contents:	- Theoretical study of the system - Study of the models corrected by simulation (using Matlab/Simulink and PSPICE) - Experimental study: analogue control (by AOP) and digital control (by microcontroller) - Comparison of the results and synthesis
Pre-requisites:	SYS3042 - AUTOMATION
Learning methods:	2 x 9h and 12h projects

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Assessment:	Demonstration and final exam
Media:	
Bibliography:	
Keywords:	Servo-controlled positioning, Zeros and poles, gain, stability, static error, response time, open and closed loops, phase margin, indicial and impulse response, Bode diagram, Nyquist diagram. lead controllers, proportional actions, integral and derivative, Laplace and Z transfer functions, discretisation.

PHY3020 – FROM ATOMS TO ELECTRONIC COMPONENTS

Cycle:	Foundation	**Location:**	Paris-Ivry/Laval
Unit:	PHYSICS, ELECTRONICS AND SYSTEMS	**Weighting:**	2
Language:	French		
Number of hours	36 h	**Lectures/Tutorials:**	0 h
		Lectures:	36 h
		Tutorials:	0 h
		Practicals:	0 h
		Project:	18 h
		Workshop:	0 h

Module summary:

Atomic physics:
- Description of the basic principles
- Introduction to quantum physics and probability physics

Quantum physics:
- Understanding and solving a simple case (particle in a box) with a Schrödinger equation

Statistical physics:
- Understanding the difference between different distributions
- Understanding how the properties of bodies at real (macroscopic) scale are determined by their microscopic constituent parts (atoms, molecules, ions)

Solid state physics:
- Understanding the components and production of a semi-conductor
- Through a simulation assignment

Summary of the 3A physics module:
- Understanding technological applications of the future, based on the laws of physics studied in the 3A physics module

Learning objectives

Starting with the atom and moving through to the solid state, this module aims to show that to understand how various microelectronic components and

Students will be assessed on their ability to...

Atomic physics
- Atomic structure: Bohr's atom, spectral emission and absorption rays
- Quantum numbers: orbital quantification, spin, Zeeman effect, electronic configuration of atoms...
- Wave-particle duality, de Broglie wavelength, Davisson

embedded sensors work, you need to understand the atomic and quantum physics phenomena that regulate the microscopic properties of matter.	and Gerner's experiment - Heisenberg's uncertainty relations - Applications of atomic physics: study of a light spectrum, laser effect, introduction to nuclear physics... Quantum physics - Formalisations in traditional mechanics: Newton, Lagrange and Hamilton - Mathematical tools used in Quantum mechanics: Quantum operators, probabilities, square summable functions - Schrödinger's time evolution equation: particle in a stationary potential, potential well, potential barrier - Study of the basic quantum systems: harmonic oscillator with one degree of freedom, hydrogen atom, particle confined in space - Applications in quantum physics: Compton effect, Doppler effect, electronic diffraction, scanning tunnelling effect microscope (electronic microscope), field ion microscope, etc.
	Applying the equipartition of energy theorem to predict and estimate the internal energy of a physical system Using the Maxwell-Boltzman distribution functions to study molecular movement in an ideal gas
Explaining the link between the macroscopic properties of a body and the behaviour of its microscopic components.	
Explaining and interpreting black-body radiation. Describing the basic physical phenomena of a laser.	Apply Planck's laws to estimate photon density and energy density emitted by electromagnetic radiation. Apply Planck's laws to calculate the different characteristics of a laser, i.e. output power, temperature, etc.
Explaining and interpreting electron behaviour in solid states, in particular in intrinsic and extrinsic semi-conductors.	Identify and apply the appropriate laws to calculate the density of semi-conductor charge carriers Apply Fick's laws to calculate semi-conductor circulating currents
Contents:	Theme 1. Atomic physics - Atomic structure: Bohr's atom, spectral emission and absorption rays - Quantum numbers: orbital quantification, spin, Zeeman effect, electronic configuration of atoms... - Wave-particle duality, de Broglie wavelength, Davisson and Gerner's experiment - Heisenberg's uncertainty relations - Applications of atomic physics: study of a light spectrum, laser effect, introduction to nuclear physics...

Theme 2. Quantum physics
- Formalisations in traditional mechanics: Newton, Lagrange and Hamilton
- Mathematical tools used in Quantum mechanics: Quantum operators, probabilities, square summable functions
- Schrödinger's time evolution equation: particle in a stationary potential, potential well, potential barrier
- Study of the basic quantum systems: harmonic oscillator with one degree of freedom, hydrogen atom, particle confined in space
- Applications in quantum physics: Compton effect, Doppler effect, electronic diffraction, scanning tunnelling effect microscope (electronic microscope), field ion microscope, etc.

Theme 3. Statistical physics:
- The microscopic world
- Quantum characteristics of particles. Usual quantum energies. Bosons and fermions
- Introduction to large population physics: equilibrium, macroscopic and microscopic states of a system of N particles

Physical statistics premisses
- Reminder of classic thermodynamic principles
- Statistical entropy

Maxwell Boltzmann statistics
- Basic hypotheses of Maxwell Bolzmann statistics
- Maxwell-Bolzmann distribution. Partition function
- Applications of Maxwell-Bolzmann statistics: kinetic theory of gases; simple air pressure model, magnetisation, etc.

Quantum statistics
- Quantum statistics: basic hypotheses
- Bose Einstein statistics
- Fermi Dirac statistics
- Corrected Maxwell Boltzmann statistics

Applications of Quantum statistics
- Black-body radiation
- Wave-matter interaction
- LASER
- Phonons
- Electronic conduction

Theme 4. Solid state and semi-conductor physics
Overview of solid state electrons
Intrinsic semi-conductors
- Current examples: silicium and germanium
- Semi-conductor conduction: electron conduction, hole conduction, electron density in the conduction band, Fermi level position

Extrinsic semi-conductors
- P doping, N doping
- Fermi level

- Mass action relation
Application of semi-conductor properties
- The P-N junction
- Transistor effect
Transport phenomena in crystals
- Conduction band
- Diffusion band
- Fick's laws
- HALL effect

Pre-requisites: PHY3021

Learning methods: Lectures, tutorials, computer-assisted tutorials Preparatory work on hand-outs. Face-to-face tutorials with the tutors.

Assessment: Written exam. Knowledge tests. Computer-assisted simulation projects

Media: Handouts. Interactive online materials.

Bibliography:

Mécanique Quantique, C.COHEN-TANNOUDJI, Hermann
Physique de l'Etat Solide. Charles Kittel – DUNOD.
Physique Statistique. B.Diu. HERMANN
Physique Statistique. R.ZITOUN - Ellipses

Keywords: Spectroscopy, Spectral ray, Balmer series, Zeeman effect, Quantised energy, Bound orbitals, Quantum numbers, Ground state, Excited state, Energy level diagram, Ionisation energy, Bohr Ray, De Broglie wavelength, Wave function, Wave equation, Phase speed, Group speed, Presence probability, Heisenberg's uncertainty relation, Schrödinger's equation, Wave packet.
Lagrangian, Hamiltonian, Bra vector, Ket vector, Square summable functions, Bound states, eigenstates, eigenvalues, eigenvectors, Avogadro number, Atoms, Molecules, Ions, Moles, Perfect gas, Pressure, Temperature, Specific molar heat, Kinetic energy, Degree of freedom, Equipartition theorem, Mean quadratic speed, Mean value, Distribution function, Normalisation condition, Maxwell-Boltzmann distribution, Gauss distribution, Phase space, Macroscopic state probability, Distinguishable particles, Indistinguishable particles, Bosons, Bose-Einstein distribution, Fermions, Fermi-Dirac distribution.
Black body, Planck's formula, Spectral energy density, Wien's Law, Spectral emittance, Stefan-Bolzmann Law, Quantum of energy.
Laser, Spontaneous emission, Stimulated emission, Spectral energy density, Population inversion, Metastable level, Optical pumping, Coherent light.
Insulators, Conductors, Semi-conductors, Permissible

band, Forbidden band, Fermi level, State densities, Doping, Impurities, Intrinsic operation, Extrinsic operation, P-N junction. Transistor. Field-effect transistor. Optoelectronics. Diffusion, Fick’s law.

HUM3093 - PERSONAL DEVELOPMENT PROJECT - IMPLEMENTATION

Cycle:	Foundation	**Location:**	Paris-Ivry/Laval
Unit:	PERSONAL DEVELOPMENT PROJECTS FOR ENGINEERS	**Weighting:**	1.5
Language:	French		
Number of hours	24 h	**Lectures/Tutorials:**	0 h
		Lectures:	0 h
		Tutorials:	0 h
		Practicals:	0 h
		Project:	24 h
		Workshop:	0 h

Module summary:
ESIEA's personal development projects are community-oriented and responsible, practical and realistic, rational and humanistic. They allow students to carry out a project over a whole academic year in a field of their choice (artistic creation, environmental protection, social and solidarity economy, not-for-profit associations, etc.). The project should address new issues and test the student's capacity to deal with complex challenges and develop transversal skills. The personal development projects allow students to develop both on a personal and a professional level.

Learning objectives **Students will be assessed on their ability to...**

Contents:

- Workshops: project management methods, advanced analysis (the three project phases: launch, implementation, outreach), drafting a pre-project report (the problems to be addressed, objectives, action plan and funding), how to present a project orally. Specific workshops: dissemination plan, replies from the recipient of an artistic project.
- Lectures: on a given theme each year (2014-2015:

	metamorphosis) and on current societal topics: women and science, solidarity initiatives, the digital ontophanic system, etc. - The project is supervised by professors, ESIEA alumni, professionals from industry and not-for-profit organisations. - Mentoring meetings (once or twice a semester): taking stock, project advancement, evaluation of the digital portfolio, recommendations...
Pre-requisites:	HUM2091
Learning methods:	Drafting the final report, presenting in public (personal development projects exhibition)
Assessment:	- Assessment of the written initial project and public presentation - Progress assessment (actual implementation compared to the student's initial progress objectives)
Media:	
Bibliography:	
Keywords:	Project, autonomy, responsibility, decision-taking, team, budget, planning, time management

ENT3113 - CAREER AIMS (AND TALKS BY PROFESSIONALS)

Cycle:	Foundation	**Location:**	Paris-Ivry/Laval
Unit:	PERSONAL DEVELOPMENT PROJECTS FOR ENGINEERS	**Weighting:**	1.5
Language:	French		
Number of hours	30 h	**Lectures/Tutorials:**	0 h
		Lectures:	18 h
		Tutorials:	12 h
		Practicals:	0 h
		Project:	0 h
		Workshop:	0 h

Module summary:
Preparation for the technical internship: updating one's CV; managing one's digital image and successful interviews.

Learning objectives	**Students will be assessed on their ability to...**
Perfecting their use of communication tools	Produce relevant and regularly updated CVs and cover letters
Preparing for interviews	Individual interviews with companies with an assessment grid
Managing their digital image	Update their e-portfolio on the social networks
Identifying an engineer's tasks and responsibilities	

Contents:

- Introduction to digital identity and digital identity management.
- Being aware of the impact of one's social media image on one's career prospects and advice on how to clean up, build or develop a social media image.
- Adapting CVs and cover letters to internship offers.
- Interviews with practising engineers.
- Conferences on different professional fields.

Pre-requisites: Students bring an initial version of their CV to the first class

Learning methods: Tutorials

Fact sheet update on 15/11/2019

Assessment:	CV, cover letter, continuous assessment, simulated interviews
Media:	Paper board (4) PPt Paper board (4)
Bibliography:	DUGAS Anne-Claire. « Objectif CV : le guide de la recherche d'emploi et des conseils carrière », http://www.aerocontact.com/ocv_entretien_recruteur/conseil_entretien_emploi.php?ID=105, (consulté le 6/09/14)
Keywords:	Career aims, e-portfolio, CV, cover letter, interviews

PLU3192 – SELF-ASSERTIVENESS AND CONFIDENCE BUILDING

Cycle:	Foundation	**Location:**	Paris-Ivry/Laval
Unit:	PERSONAL DEVELOPMENT PROJECTS FOR ENGINEERS	**Weighting:**	0.5
Language:	French		
Number of hours	12 h	**Lectures/Tutorials:**	0 h
		Lectures:	0 h
		Tutorials:	12 h
		Practicals:	0 h
		Project:	0 h
		Workshop:	0 h

Module summary:
This module aims to help students to work in a team Assertiveness by assessing one's strengths and weaknesses, learning to assert one's point of view, overcoming one's fears and changing behaviour.

Learning objectives	**Students will be assessed on their ability to...**
- Learning to be a good team player - Assessing one's strengths and weaknesses to improve self-confidence - Understanding how self-assertion works and its challenges - Learning how to assert one's views in a meeting - Being proactive to overcome one's fears and change one's behaviour	Quizz

Contents:	This module aims to help students work better in a team. Assertiveness by assessing one's strengths and weaknesses, learning to assert one's point of view, overcoming one's fears and changing behaviour.
Pre-requisites:	No particular pre-requisites
Learning methods:	Basic principle: student-centred approach enabling each student to progress by assessing their strengths and

	weaknesses. Each student will be invited to design their own action plan to improve their team working ability, their time management and set clear priorities. Examples of content: - Assessing one's strengths and weaknesses to improve self-confidence: What can you say and do in a team? What are you afraid of: being ignored, humiliated, rejected? - Understanding how self-assertion works: Behaviour and personality, Analysing other people's behaviour, putting feelings in words - Conflict management: Dangers, types and sources of conflict, conflictual behaviour - Ways to better assertiveness: "Broken record" technique, D.E.S.C. method... with Exercises!
Assessment:	Participation, quiz
Media:	PowerPoint, Software, overhead projector
Bibliography:	
Keywords:	Personal development, Team work, Time management, Prioritising, Asserting oneself

LAN3082AN - ENGLISH AND TOEIC

Cycle:	Foundation	**Location:**	Paris-Ivry/Laval
Unit:	PERSONAL DEVELOPMENT PROJECTS FOR ENGINEERS	**Weighting:**	3
Language:	English		
Number of hours	21 h	**Lectures/Tutorials:**	0 h
		Lectures:	0 h
		Tutorials:	21 h
		Practicals:	0 h
		Project:	0 h
		Workshop:	0 h

Module summary:
The primary objective of this module is students' acquisition of the language of engineering in its widest sense: IT but also renewable energies, construction, and so on. Practice using this language in their writing and speaking through in-class individual and group exercises as well as assignments to complete as homework, will allow students to express themselves with greater ease in the world of work. Students produce scientific language in a context relevant to them by writing a report of their work on the "Projet Scientifique et Technique" level 3 and also give a formal presentation of this before a jury.

Learning objectives	**Students will be assessed on their ability to...**
Being able to write a professional report to describe a project in a simple clear and formal style.	Several lessons on report writing, followed by student production of technical/scientific activity report based on 3rd year scientific project.
Being able to cite text and images using the Harvard method of citation, or another method of citation, in a consistent fashion.	Several lessons on the rules of citation, followed by student production of technical/scientific activity report based on 3rd year scientific project.
Being able to understand normal English on a scientific topic and to explain the content to a third person.	Lessons using authentic video as a basic for work on understanding and describing.
Being able to describe a sequence of linked events using precise and accurate English; able to describe	

technical choices based on notions of suitability and performance.
Able to present a complex project to a non-technical audience clearly and concisely using appropriate language and spoken in an understandable way.

Being able to present a complex project to a non-technical audience clearly and concisely using appropriate language and spoken in an understandable way.	Able to present a complex project to a non-technical audience clearly and concisely using appropriate language and spoken in an understandable way.
Contents:	- The language of engineering in its largest sense: IT but also renewable energies, construction, and so on. - Reading articles on entrepreneurs and innovative companies from the print media; watching similar reports from television. - Multiple writing assignments with instructor feedback. - Preparation of a clear, professional report of scientific activity. - Preparation of a clear, professional oral presentation of scientific activity with slides.
Pre-requisites:	English level B1-B2 according to the Common European Framework of Reference for Languages (CEFR)
Learning methods:	An eclectic method appealing to all language-learning styles: work on written and oral comprehension, exercises in class and at home to help students require the automatic reflexes necessary to language production, pair and group work, presentations. Work on laptops and/or in computer labs to produce texts (elements of scientific report, presentation slides) in real time.
Assessment:	Continuous assessment based on work done both in class and at home, final evaluation based on scientific report (individual) and oral presentation (in pairs).
Media:	Photocopies, CDs and DVDs, documents (text, audio, audiovisual) taken from the Internet, Language laboratory, CD and DVD players, laptops, video projectors, televisions, document projectors
Bibliography:	Most materials are developed for the specific needs of our students by the English teaching team at ESIEA. The following textbook may be used: IBBOTSON, Mark. Cambridge English for Engineering. Cambridge: Cambridge UP, 2008.
Keywords:	English, engineering, report writing, presentations, slides

Fact sheet update on 15/11/2019

LANXX84XX - SECOND FOREIGN LANGUAGE, FFL, ADVANCED ENGLISH

Cycle:	Transition	**Location:**	Paris-Ivry/Laval
Unit:	PERSONAL DEVELOPMENT	**Weighting:**	0
Language:	German - Chinese - Spanish - Japanese - Italian		
Number of hours	15 h	**Lectures/Tutorials:**	0 h
		Lectures:	0 h
		Tutorials:	15 h
		Practicals:	0 h
		Project:	0 h
		Workshop:	0 h

Module summary:
- Learning to communicate and interrelate with people in their own language
- Prepare for language certification tests (TOEIC, Goethe Zertifikat, Cervantes, etc.)
- Be able to use the grammatical structures of the chosen language so as to communicate simply and clearly

Learning objectives	**Students will be assessed on their ability to...**
Understanding texts in the target language, with the help of a dictionary.	Read authentic texts in the target language, in class and at home. Texts may also be published on the Moodle platform or sent via an on-line learning platform. The teacher may use some of these texts to make a graded assessment of students' reading skills.
Writing clear and comprehensible texts (e-mails, CVs, cover letters) in the target language with the help of a dictionary.	Write texts in the target language, in class and at home. The teacher may make a graded assessment of some of these written assignments.
Following a conversation or a brief audio-visual recording in the target language.	Listen to authentic recordings in the target language, in class and at home. Texts may also be published on the Moodle platform or sent via an on-line learning platform. The teacher may use some of these audio or audio-visual recordings to make a graded assessment of students' listening comprehension skills.
Making himself/herself clearly understood in the target language.	

Contents: Determined by the teacher. May include:

- Texts dealing with current affairs
- Audio-visual recordings
- Oral communication on personal or professional matters
- Written communication on personal or professional matters
- Grammar exercises
- Vocabulary extension exercises
- Oral presentations
- Interactive communication / debates

Pre-requisites: Students must already have a level of competence allowing them to follow the course.

Learning methods: General methodology adapted to all learning styles: written and oral comprehension work, practical exercises in class and at home to acquire the automatic reflexes needed to communicate fluently in writing and orally in the language, "real-life" situations, presentations in class.

Assessment: Continuous assessment based on the work done in class and at home, set assignments in class, presentations and oral exams, recording of individual speech, use of e-learning resources, as the case may be.

Media: Handouts, PPT presentations, Language laboratories, CDs and DVDs, on-line audio and audio-visual documents, authentic news media sources, "realia" (various target culture documents: tickets, programs, adverts, etc.)

Bibliography: Determined by the teacher.

Keywords: German, English, Chinese, Spanish, Italian, Japanese, Communication, CV, intercultural

MAN3306 - APIC

Cycle:	Foundation	**Location:**	Paris-Ivry/Laval
Unit:	PERSONAL DEVELOPMENT PROJECTS FOR ENGINEERS	**Weighting:**	0.5
Language:	French		
Number of hours	4.5 h	**Lectures/Tutorials:**	0 h
		Lectures:	0 h
		Tutorials:	0 h
		Practicals:	0 h
		Project:	0 h
		Workshop:	0 h

Module summary:
The APIC (Information and Communication promotion initiatives) module is designed to help you improve your communication skills. It has three aims:

1. Provide a theoretical and functional overview of different aspects of persuasive, interpersonal and strategic communication, designed to construct a message, deliver it at the appropriate moment, reinforce its argumentative content and adapt it to the receiver in order to leverage its effect.

2. Implement all the knowledge acquired in order to further the image and reputation of the school at events organized by the communication service.

3. Help to showcase the school's various voluntary societies initiatives and classroom projects (whether science-related or personal development projects).

Learning objectives **Students will be assessed on their ability to...**

Contents: Follow up of ideas studied and discussed in semester 1
- Theoretical aspects of communication techniques

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- Basic principles of Neurolinguistic programming
- Elaboration probability model, Maslow pyramid, cognitive theory, perception channels (emotional and rational)
- Persuasive rhetoric and communication: basic principles, methods and processes. Rhetorical discourse construction, credibility enhancing factors, formulation principles, laws of influence, etc.
- Non-verbal communication: attitude, body language and synchronisation
- Practical advice and general factors in ESIEA student communication situations
- Semester assessment

The assessment is based on both quantitative and qualitative criteria.

Each student must take part in at least one communication initiative promoting the School, putting into practice the techniques and advice given during the course. This can take the shape of:
- Participating in a school careers event, either in their former high school or in a high school near to his/her campus;
- Presenting the engineering profession in a high school classroom;
- Taking part in open days or mock examination days;
- Taking an active part in one of the careers exhibitions where the School has a stand;
- Writing articles (communication correspondent), producing photo or video reports, taking part in the School's web team;
- Helping to organize any promotional event organized by the School's Communication Service.

Pre-requisites:

Learning methods: Lectures and projects

Assessment: Project:

Media:

Bibliography:

Keywords:

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MAN3301 - PROJECT MANAGEMENT

Cycle:	Foundation	**Location:**	Paris-Ivry/Laval
Unit:	PERSONAL DEVELOPMENT PROJECTS FOR ENGINEERS	**Weighting:**	1
Language:	French		
Number of hours	15 h	**Lectures/Tutorials:**	0 h
		Lectures:	0 h
		Tutorials:	15 h
		Practicals:	0 h
		Project:	0 h
		Workshop:	0 h

Module summary:
This module is followed by module MAN 4302. Together, they aim to give students advanced practical knowledge of the key features of the Project Manager's and the Account manager's jobs.

Learning objectives	**Students will be assessed on their ability to...**
Planning a project in terms of time and cost, from the initial call for tenders to the signature of the contract with the Client.	Plan three different industrial projects.
Managing and monitoring a project from contract signature to final reception by the Client.	Manage and monitor three different industrial projects.
Understanding the maths and the tools used in the field of project management.	Use specific project management software tools, in particular MSProject 2012 on two industrial projects.
Learning to draft a report and present it to the Client. Learn to work in a team.	
Learning to work in a team.	Work in teams.

Contents:

This module is followed by module MAN 4302. Together, they aim to give students advanced practical knowledge of the key features of the Project Manager's and the

	Account manager's jobs.
Pre-requisites:	None
Learning methods:	See fact sheet
Assessment:	Industrial case study reports
Media:	Handouts, Blackboard and specific School software (MS Project 2012)
Bibliography:	None
Keywords:	Overall project management Technical project management Project management Planning Negotiating Project monitoring and management