SHAKE THE FUTURE.

CENTRALE NANTES

ENGINEERING PROGRAMME

COMMON-CORE CURRICULUM

YEAR 1

SPRING SEMESTER

Établissement public sous tutelle du
ministère de l'Enseignement supérieur, de la Recherche et de l'Innovation

GROUPE **CENTRALE**

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ENGINEERING MATHEMATICS

YEAR 1 CORE CURRICULUM, ENGINEERING PROGRAMME
SPRING SEMESTER

Professor: Françoise FOUCHER

Objectives

Mathematical knowledge in order to solve problems in engineering:

- To formulate a mathematical problem to approximate, simulate, predict unknown quantities
- To know and apply numerical methods, deterministic or statistical methods
- To set up numerical resolution on computers using numerical computation software (Matlab)
- To know how to analyze results, quantize errors and uncertainties

Course contents

- Introduction to numerical analysis, examples, finite difference method
- Direct methods to solve linear systems
- Iterative methods to solve linear systems
- Iterative methods to approximate eigenvalues
- Optimization without constraint, least squares, gradient methods
- Optimization with constraints, Lagrange multipliers, KKT conditions, gradient, Uzawa and penalization methods, case of linear problems
- Introduction to probabilistic modeling, examples
- Probability, random variables, laws
- Statistics, parameter estimators, confidence intervals, linear regression
- Lagrange and Hermite, interpolation, cubic splines, continuous and discrete least squares approximation
- Numerical integration, Newton-Cotes formulas, Gauss formulas

Course material

Grégoire Allaire. Analyse numérique et optimisation. Ellipses, 2005.
Philippe Barbé et Michel Ledoux, Probabilité, EDP Sciences, 2007.
Maîtine Bergounioux. Optimisation et contrôle des systèmes linéaires. Dunod, 2001.
Michel Bierlaire. Introduction à l'optimisation différentiable. PPUR, 2006.
P.G. Ciarlet. Introduction à l'analyse numérique matricielle et à l'optimisation. Masson,1988.
Benjamin JOURDAIN, Probabilités et statistiques, Ellipses, 2009.
Patrick Lascaux, Analyse numérique matricielle appliquée à l'art de l'ingénieur, Tome 1, Tome 2, Dunod
Ali Mansour, Probabilités et statistiques pour les ingénieurs, Hermès Science publications, 2007.
Michel Minoux. Programmation mathématique. 2ème édition, Lavoisier, 2008.
Jerôme Pagès, Pierre Cazes, Statistiques générales pour utilisateurs 1 Méthodologie, PAGES Jerôme, CAZES Pierre, Presses Universitaires de Rennes, 2005.

Keywords

Numerical analysis, iterative methods, linear systems, eigenvalues, optimization, gradients algorithms, Lagrange multipliers, KKT conditions, probability, random variable, expectation, estimation, regression, interpolation, cubic splines, approximation, numerical integration

Links with other programmes

Modelling approaches in mechanical engineering
From measurement to control
Product Design and Development
Algorithms and programming

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	**8**	**16 hrs**	**44 hrs**	**12 hrs**	**0 hrs**

FROM MEASUREMENT TO CONTROL

YEAR 1 CORE CURRICULUM, ENGINEERING PROGRAMME
SPRING SEMESTER

Professor: Eric LE CARPENTIER

Objectives

A signal is a physical quantity which evolves over time. A system is a causal relationship between input signals (or excitations) and output signals (responses). A controlled system is a system, which is driven by an autonomous process, which tunes inputs according to the desired behavior of the outputs. To operate, such a process needs a measure of the output signals. This measure is given by sensors, and can be discrete (an event occurs or does not occur, e.g. a limit temperature is reached, this is a discrete event) or continuous (e.g. a temperature). The control process implements an algorithm, the control law, which computes the excitations, which can be discrete (a gate is open or closed) or continuous (a gate position).

Nowadays, the measure of physical signals is always a voltage. This voltage can be obtained continuously over time (continuous time signal) or sampled (discrete time signals). The control process works on discrete times. Modern implementation faces the following conflicts:

- physical signals are in continuous time, but their measures are discrete time: this is the sampling process;
- the measure of continuous valued physical signals belongs to a finite set: this is the quantization process;
- automatic control laws are often theoretically derived in continuous time, but implemented in discrete time.

This course covers the:

- technological aspects of sensors;
- introduction to the automatic control of discrete and continuous event systems;
- practical consequences of sampling and quantization.'

Course contents

A) Sensors

1) Measurement and instrumentation
   - role of measurement in modern systems driving
   - units, normative aspects
2) Sensors
   - general principles
   - metrological characterization
3) Conditioning
4) Signal digitizing
5) Data transmission
   - analog transmission
   - connection using bus (RS232, USB, CANÖ)
6) Instrumentation software (LabView)

B) Signal representation. Dynamical systems modeling and control

1) Discrete time and continuous time signals
   - Fourier, Laplace, z
   - sampling and Shannon theorem.
2) Discrete time and continuous time LTI systems modeling
   - transfer, state space
   - poles, zeroes, stability
   - frequency response
   - sampling
3) Control theory
   - from open loop to closed loop
   - Control with 2 degrees of freedom (compensator, precompensator)
4) Closed loop nominal and robust stability
5) Closed loop nominal and robust performances
6) PID controllers

C) Discrete events systems

1) Combinatory logic
2) Sequential logic
   - synchronous and asynchronous models
   - flip-flop, counter, decoder
   - finite state machine
3) Control
   - programmable devices: API, FPGA
   - languages: ladder diagram, Grafcet, VHDL

Course material

Les capteurs en instrumentation industrielle. Georges Asch, Editeur: Dunod
LabVIEW: Programmation et applications. Francis Cottet, Editeur: Dunod
G.C. Goodwin, S.F. Graebe, M.E. Salgado, Control System Design. Prentice Hall, 2001.
S.Skogestad, I.Postlewaite. Multivariable Feedback Control, Analysis and Design. Second Edition, Wiley, 2005.
Ph. de Larminat, Automatique appliquée (2e Édition revue et augmentée). Collection Hermes Science, Edition Lavoisier, Paris, 2009
P. Borne, G. Dauphin-Tanguy, J.P. Richard, F. Rotella, I. Zambettakis, Analyse et Régulation des processus Industriel, tome 1 Régulation Continue. édition Technip, 1993.
Modern Signals and Systems, H. Kwakernaak, R. Sivan, Prentice Hall.
Signaux et systèmes linéaires, Cours, Y. Thomas, Masson.
Signaux et Images sous matlab, G. Blanchet et M. Charbit, Hermès

Keywords

Signal. System. Control. Automation. Discrete event. Sensors. Sampling. Quantization.

Links with other programmes

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	8	26 hrs	26 hrs	20 hrs	0 hrs

Algorithms and Programming

Year 1 Core Curriculum, Engineering programme
Spring Semester

Professor: Myriam SERVIERES

Objectives

- Algorithms: learn basic algorithms without reference to a programming language
- Programming: learning methods and programming tools, and IT project management

Course contents

Algorithms:

- problem analysis,
- algorithmic structures,
- simple and structured data types,
- functions.
- data organization: file processing, sort algorithms.

Imperative C++ programming:

- algorithmic structures translation,
- subroutines, header files, libraries,
- input / output stream,
- project management,
- programming tools.

Group project to implement the acquired knowledge.

Course material

Algorithms Courses with 957 exercises and 158 problems - 3rd edition, Thomas Cormen, Charles Leiserson, Ronald Rivest, Publisher Dunod Collection sup Sciences

C langage, ANSI, Brian Kernighan, Dennis M. Ritchie, Publisher Dunod Collection sup Sciences

Keywords

Algorithms: data structure, sort algorithms
Programming: imperative programming, pointers

Links with other programmes

Information Systems

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	4	6 hrs	14 hrs	18 hrs	0 hrs

ENGINEERING ELECTIVE - BIOLOGY

YEAR 1 CORE CURRICULUM, ENGINEERING PROGRAMME
SPRING SEMESTER

Professor: Sophie LIMOU

Objectives

This introductory course is divided into 4 themes: Biology, Bioinformatics, Applied Biology, and Health Applications:

1) Biology covers the major physiological functions of life ('macro' level) and an introduction to genetics (molecular level).
2) The biotechnological revolutions that have taken place over the past 10 years in the biomedical field (eg genomics, transcriptomics, proteomics, metagenomics, digitization of medical records) have led to a paradigm shift marked by the advent of big data in healthcare. The use of digital tools is, therefore, essential today to be able to process, analyse, understand and integrate biomedical data. The bioinformatics class familiarises students with the Unix environment and the Bash/Shell code, as well as providing an introduction to R programming, a language widely used in statistics and data mining. This class is taught mainly in tutorial format.
3) Towards the end of the course students undertake an applied biology project in order to apply the knowledge acquired biology into the development of a bioinformatic tool in R (tool and interface). An individual report is expected from each student.
4) Finally, speakers from Nantes University Hospital will give several lectures to introduce the students to biomedical engineering applications. The objective of these conferences is to present the different fields of application of engineering skills in the biomedical field. Topics covered for the 2017-2018 year include precision medicine for the treatment of multiple sclerosis (Prof. PA Gourraud), biomedical imaging to maximize IVF (Dr. David L), and of blood vessel regeneration (Dr. C Levisage).

Course contents

While lectures are essential in biology to present new concepts (17 hours of lectures included), active learning is also proposed in the form of flipped classrooms, the use of online courses (MOOC), a conference system, and an applied biology project (6 hours of lab work).

Students are actively involved in the learning process and will deliver two presentations in small groups on a physiology topic and genetics issue.

As well as external speakers, the teaching team comprises Dr. Sophie Limou (in charge of the course) and Dr. Aurélien Sérandour. Mr. Jean-Baptiste Alberge (PhD student) will contribute to the R programming class.

Course material

Keywords

Links with other programmes

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	4	17 hrs	13 hrs	6 hrs	0 hrs

ENGINEERING ELECTIVE - INFORMATION SYSTEMS

YEAR 1 CORE CURRICULUM, ENGINEERING PROGRAMME
SPRING SEMESTER

Professor: Morgan MAGNIN

Objectives

The goal of this course is to address the modelling and design of complex systems. The added value of engineers with general vocational training is their ability to understand the complexity of systems at the interface between different disciplines. To do that, the engineer has to be able to build a global, abstract and shareable view of the system he designs.

In particular, information systems are central to any kind of social or scientific structure (companies, schools, hospitals, etc.) - they deal with the development, use and management of an organizations infrastructure. An information system is literally a structured set of services, methods and tools that can answer questions relative to a specific organization or domain.
Databases are one of the major underlying components of information systems: they store and process data as a permanent memory. Understanding the differences behind information systems, databases and Excel is thus crucial.

The course aims to develop skills in modeling and analysis of complex systems. It provides the essential knowledge in the field of information systems: design, deployment and their daily management. In such a context, databases require major attention. We present the main principles for modeling a system under the form of a database and give an introduction to relational algebra.

Finally, the course focuses on the legal issues surrounding information systems and databases: we give an overview of the European laws applying to such systems (with regard to data processing and rights resulting from the creation of databases, etc.)

Objectives of the course in terms of skills development:

- Knowing how to design a global, abstract and shareable view of a physical or logical system
- Mastering the manipulation of digital data:
- Acquiring data
- Structuring data
- Searching for information
- Presenting the results in summary form (reporting)
- Understanding the challenges of big data
- Applications to various industrial case-studies

Objectives of the course in terms of knowledge:

- Modelling language (physical or logical system)
- Query language
- Methodological approach
- Legal issues

Course contents

1) Modelling of complex systems
   - System-oriented approach
   - Modeling organizations
   - Modeling languages (UML, SysML)
   - Application to various industrial case-studies

2) Information Systems
   - Introduction to information systems: link between IS and organization
   - Design, modeling, deployment, operation
   - Organization, methods and tools for a company
   - Legal issues applicable to information systems and databases

3) Databases: relational algebra and modeling
   - Manipulation of data models
   - Introduction to SQL
   - Towards the decision IS and Business Intelligence
   - Presentation of the different "business" and challenges of information systems and databases in companies

Course material

Course syllabus available on the school online learning platform
Alain Faisandier. Systems engineering. Conference at AIP-PRIMECA Congress. April 2011.
Documentation from PostgreSQL. http://docs.postgresqlfr.org/
SysML Open Source Specification Project. http://www.sysml.org/

Keywords

system analysis, information systems, databases, European legal requirements and obligations, modelling, design, relational algebra, multitier architecture, client-server approach

Links with other programmes

The Algorithms and Programming course teaches students a number of central concepts about the rigorous design of algorithms. The Informations Systems course offers a complementary view of the challenges of IT within an organization with regard to system modeling and data manipulation.

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	4	16 hrs	10 hrs	10 hrs	0 hrs

ENGINEERING ELECTIVE - ELECTRONICS, ELECTRIC ACTUATORS, EMBEDDED SYSTEMS

YEAR 1 CORE CURRICULUM, ENGINEERING PROGRAMME
SPRING SEMESTER

Professor: Malek GHANES

Objectives

Embedded systems are increasingly present across all industrial sectors (automotive, avionics, electrical traction, robotics, renewable energy etc). This course aims to present how to make embedded computer control systems that are in most applications inseparable from converter-machine-electronic-microcontroller associations. The three aspects of these systems are presented: the most common types of electric motors and generators, electronics and power electronics, microcontrollers, both in terms of hardware and software.

Course contents

- Introduction: historical evolution from the first electric machines to microcontrollers.
- Single-phase sources, three-phase and static transformers.
- Components of power electronics.
- Converters: choppers, inverters, rectifiers.
- Motors and DC generators
- Engines and conventional induction motors
- Asynchronous motors
- Models and advanced machine controls.
- Equated electronic assemblies.
- Modeling diodes.
- Modeling bipolar transistors.
- Periodic Interrupts
- Introduction to embedded computing.
- Description of microcontrollers.
- Inputs / outputs.
- Analog inputs.
- PWM output.

Course material

D. Grenier, F. Labrique, H. Buyse. Electromécanique - convertisseurs d'énergie et actionneurs, Dunod, Collection: Sciences Sup, 2009.

J. Chiasson, Modelling and High-Performance Control of Electric Machines, IEEE series on Power engineering, Wiley-Interscience, ISBN 0-471-68449-X, 2005.

C. Le Trionnaire, J.-P. Picheny, Génie électrique vademecum d'électrotechnique, Ellipses - Technosup, ISBN13: 978-2-7298-6101-8 2010.

P. Mayé, Moteurs Electriques pour la robotique, Dunod, Techniques et Ingénierie, EAN13: 9782100700363, 2013.

Albert Paul Malvino, David J. Bates, Principes d'électronique, Dunod, 2008, EAN13: 9782100516131

P. Molinaro, A. Chriette, électronique analogique: traitement des composants et circuits, Ellipses Technosup, 2013, ISBN-13: 978-2729882273.

C. Valens, Maîtrisez les microcontrôleurs à l'aide d'Arduino, Publitronic-Elektor, 2013, ISBN-13: 978-2866611903.

F. Schaeffer, Programmation en C des microcontrôleurs RISC AVR, Editeur : ELEKTOR PUBLITRONIC, 2009, ISBN-13: 978-2866611699.

Keywords

Electrical energy converter, power electronics, electric motor, electric generator, control, dipole, quadrupole, diode, bipolar transistor, MOSFET, microcontroller, embedded computing, input / output programming.

Links with other programmes

From Measurement to Control

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	4	18 hrs	10 hrs	12 hrs	0 hrs

ENGINEERING ELECTIVE - MATERIALS

YEAR 1 CORE CURRICULUM, ENGINEERING PROGRAMME
SPRING SEMESTER

Professor: Christian BURTIN

Objectives

This course offers an introduction to the science of materials. It provides the necessary grounding to make an informed choice of material according to the operational environment.

Course contents

Upon completion of this course the students should be able to:

- describe the highly ordered structure of crystal and its consequences for mechanical properties
- select a metal using a phase diagram
- understand the role of defects on the mechanical properties of materials
- know which solidification mechanisms increase the mechanical properties of materials
- take account of the specific characteristics of polymers - viscoelasticity, and of composite materials - anisotropy.

Course material

Des Matériaux, Jean Paul BAILON, Presses Internationales Polytechnique

Keywords

Links with other programmes

Modelling approaches in mechanical engineering

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	4	12 hrs	12 hrs	16 hrs	0 hrs

ENGINEERING ELECTIVE - APPLIED THERMODYNAMICS

YEAR 1 CORE CURRICULUM, ENGINEERING PROGRAMME
SPRING SEMESTER

Professor: Jean-Francois HETET

Objectives

- To understand the fundamental laws of thermodynamics.
- To apply these laws to study industrial processes involving energy transformation or transfer phenomena.
- To take account of the environmental impact of energy production and consumption.

Course contents

- History of the main ideas in thermodynamics.
- Laws of thermodynamics and selected elementary results: closed/open systems, perfect and real fluids - a phenomenological study.
- Energy transformations-compressors, nozzles, turbines
- Phase transitions: properties of mixtures, thermodynamic tables and diagrams.
- Thermodynamic cycles and thermal machines. Direct cycles: Carnot, Rankine, Hirn, reheating cycles, Joules cycle, Beau de Rochas and Diesel cycles. Introduction to turbocharging. Inverse compression cycles: Carnot and Joules cycles, heat pump, refrigeration and air conditioning. Humid air. Steam absorbtion cycles.
- Thermodynamics of unbalanced systems - general principles.

Course material

Thermodynamique et Energétique par M. BOREL (Presses Polytechniques Romandes)
Thermodynamique générale et application par R. KLING (Technip)
Thermodynamique par J.P. PEREZ (Masson)
Energétique par M. FEIDT (Dunod)
Introduction aux problémes énergétiques globaux par R. GICQUEL (Presses des Mines)

Keywords

Entropy, Enthalpy, Reversibility, Irreversibility, two phase flow, nozzle, Compressor, gas turbine, steam turbine, Cogeneration, heat pump, Conduction, Convection, radiation

Links with other programmes

Pre-requisite for more advanced specialisations.

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	4	16 hrs	24 hrs	0 hrs	0 hrs

Modern Languages 1 - English

Year 1 Core Curriculum, Engineering programme

Spring semester

Professor: Christine Evain & Spencer Hawkridge

Objectives

Acquisition and reinforcement of basic vocabulary, syntax, and pronunciation by both traditional means multimedia resources. The teaching approach is communicative meaning that the language is not only the subject matter of the course, it is also a means of communication that the students should appropriate in an optimal manner.

Course contents

The course activities cover a whole range of practical language and communication exercises that span written and oral comprehension and expression.

Written: multiple choice, gap filling, rephrasing;
Oral: awareness of registers, intonation, syntax as it applies to different situations, debates, linguistic consequences of cultural differences, using media, telephoning.

Course material

Preparation manuals for the various foreign language certificates. Written and televised press, internet, general civilization documents, numerical tools.

Keywords

Managerial and cultural skills; communicative teaching approach; procedural methods; multimedia

Links with other programmes

Communication in French / Management / Corporate cultures

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
English	1	0 hrs	26 hrs	0 hrs	0 hrs

MODERN LANGUAGES 2

YEAR 1 CORE CURRICULUM, ENGINEERING PROGRAMME
SPRING SEMESTER

Professor: Frédéric Dorel

Objectives

Students will study one of the following languages in addition to English:

- French (for international students) – see below
- German
- Spanish – see below
- Italian
- Japanese
- Chinese
- Russian
- Arabic
- Portuguese

As well as for preparing the certificates required in English/French, the students will learn basic communication skills (enough to communicate on a daily basis at a non-specialist level) including the comprehension of the particular country's social, political and cultural context through written and televised press in their choice of modern language. The acquisition and reinforcement of basic vocabulary, syntax, and pronunciation by both traditional means and using multimedia resources. The teaching approach is communicative meaning that the language is not only the subject matter of the course, it is also a means of communication.

NB: International students whose native language is not French (and do not speak French fluently) must take French as a foreign language course and pass the TFI *Diplôme de Langue Française*. If their native language is not English, these students must also take the English course, a compulsory language at ECN.

Course contents

The course activities cover a whole range of practical language and communication exercises that span written and oral comprehension and expression. Preparation for language competence certificates: B2 in German, DELE in Spanish, TFI in French as a foreign language. Certificates in Italian, Japanese, Portuguese and Chinese are also available.

Written: multiple choice, gap filling, rephrasing;

Oral: awareness of registers, intonation, syntax as it applies to different situations, debates, study of unique situations, linguistic consequences of cultural differences, using media, telephoning.

Course material

Preparation manuals for the various foreign language certificates. Written and televised press, internet, general civilization documents, Numerical tools.

Keywords

Managerial and cultural skills; communicative teaching approach; procedural methods; numerical.

Links with other programmes

Communication in French / Management / Corporate cultures

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
According to choice	**1**	**0 hrs**	**26 hrs**	**0 hrs**	**0 hrs**

French

The classes are organised into workshops to alternate work on the four language skills in level groups:

- Theatre / song / oral expression / phonetics
- Film / cinema
- Media / oral comprehension (TV-radio)
- Written expression / news writing
- Grammar games
- Interculturalism / advertising / language register / idiomatic expressions
- CVs/ cover letters / job interviews / telephone skills
- TFI diploma

Common theme linking the workshops: production of interactive online news.

1) Theatre (all levels).
Work based on plays (Moliére, Cyrano) with emphasis on phonetics.
Beginner level: simple dialogue, production and roleplays.
Production: Arts column - video, reviews.

2) Cinema (advanced level):
Multimodal interpretation of a selection of French films (L'Auberge Espagnole, Entre les murs, Ressources Humaines, etc.).
Description of images, analysis, interaction (gestures etc)
Production: Arts column – cinema reviews, surveys, visit or exchange with ESMA film school.

3) Media (all levels):
Listening exercises adapted to different levels
Advanced level: work on caricatures (les Guignols).
Production: quiz or crosswords, Web-TV

4) Written expression (all levels):
Work on the different columns of a newspaper and the specific vocabulary, according to the group level.
Production: articles, ads

5) Grammar games (all levels):
Grammar work essentially using teaching aids, according to the group level.
Production: interactive platform game.

6) Interculturalism (advanced level):
Explore and debate cultural differences.
Work on language register and idiomatic expressions through advertising.
Production: advertising inserts, debates, Web-TV.

7) Job applications – job interview (advanced level):
Write a CV and cover letter – work on specific vocabulary.
Prepare a job interview.
Production: Job offers / 'ready to go' applications

8) TFI (advanced level):
Familiarise with the B2 certification format.
Alongside workshops work on field experiences:
Linguistic challenges https://monnantesamoi.wordpress.com
photo rally and information on monuments
weekend activity log
cinema and theatre outings + reviews and/or interviews
photo exhibitions with textual descriptions
surveys (student / leisure / holiday budgets)
sketches on the theme 'French characters'
technical vocabulary project: invention (Concours LEPINE)

Spanish

- Acquisition and reinforcement of the 4 competencies in written and oral expression & comprehension.
- Acquisition of vocabulary, syntax and pronunciation by both traditional means and through the use of digital resources.
- Discovery of the Spanish-speaking worlds.

Methods:

- Individual and group productions & presentations
- Written, digital and audiovisual tools
- 2 communicational approaches:

1) Monographical lectures on various engineering specialisations with active contributions from the students (debating, group and individual productions and presentations).
2) Multi-week projects on corporate cultures, engineering and techniques in Spanish-speaking cultures. Virtual - but realistic- projects producing the theoretical implementation of a professional activity.
Public presentations of the results.

SPORTS AND PHYSICAL EDUCATION

YEAR 1 CORE CURRICULUM, ENGINEERING PROGRAMME
SPRING SEMESTER

Professor: Hervé Guillo

Objectives

Sports and physical education contribute significantly to an engineer's physical, psychological, social and intellectual development, as well as to his/her general well-being. These activities:

- strengthen self-esteem,
- trigger a sense of competition and solidarity, team spirit and the desire to succeed,
- prepare for the demands of a career by fostering team and individual initiative,
- encourage a sense of responsibility related to positive characterisation and identity.

Course contents

Sports and physical education develop social communication through:

- various team activities (on small and large fields),
- autonomy projects (TA),
- physiological-directed activities (development of cardiopulmonary and muscular functions),
- organisation of sports events

Course material

Keywords

Links with other programmes

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	1	0 hrs	36 hrs	0 hrs	0 hrs

MANAGEMENT AND THE BUSINESS ENVIRONMENT

YEAR 1 CORE CURRICULUM, ENGINEERING PROGRAMME
SPRING SEMESTER

Professor: Laurence BERTHO

Objectives

Nowadays the skills of an engineer are not only scientific, technical, and managerial. An engineer also needs awareness of economic, legal, and financial issues. The aim of this course is to enable our future engineers to become more aware of their working environment.

In the second semester students are introduced to the main concepts in corporate finance and economics.

Course contents

1) **Finance:** Discovery of the tools and methods of corporate financial analysis.

2) Economics: macro and microeconomics, key elements of the international economy:

- Economic activity and its measurement
- The factors of production and productivity
- Income, consumption and savings
- Monetary creation and financing the economy
- Regulation of economic activity: the market and the State
- Contemporary economic and social imbalance
- Globalization and international trade
- Exchange, the international monetary system, globalization

Course material

Buigues P, Lacoste D: Stratégies d'internationalisation des entreprises: menaces et opportunités

Keywords

Finance, economics, organizations, production, currency, consumption, productivity, social and cultural competence, marketing mix, marketing research

Links with other programmes

All teaching departments and specialisations.

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	1	22 hrs	10 hrs	0 hrs	0 hrs

INDUSTRIAL STUDY PROJECT

YEAR 1 CORE CURRICULUM, ENGINEERING PROGRAMME
SPRING SEMESTER

Professor: Florent LAROCHE

Objectives

This course is an introduction to the engineering profession which provides students with an insight into the realities of the industrial world. The students are also exposed to group work and project management over a 6 month period.

Course contents

Students work in small teams in project mode on a real industrial problem in direct collaboration with a company.
Project management methods and scientific techniques are employed to solve the industrial problem and to manage the project.
During the project, students complete progress reports, compile a final report, design a poster and give an oral presentation of their results.

Course material

Keywords

Project Management – Organisation - Industry

Links with other programmes

Communication
All technical and scientific courses
First Year Internship
Project Management

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	1	0 hrs	0 hrs	0 hrs	32 hrs

First Year Internship

Year 1 Core Curriculum, Engineering programme
Spring Semester

Professor: Emilie POIRSON

Objectives

Students are tasked with finding and completing a 1-month internship in industry. The objective is for them to gain hands-on experience of manual work in industry.

Course contents

The internship takes place at the conclusion of the first year of study during July/August. Students are required to submit a written report on their internship and give a short oral presentation before their peers and a teaching panel.

Course material

Keywords

internship, manual work, industry

Links with other programmes

Industrial Study Project
Second year internship
Final year internship

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	0 hrs	0 hrs	0 hrs	0 hrs

NB Successful completion of the first year internship and the Civic Engagement leads to the award of three ECTS credits.