CENTRALE NANTES

ENGINEERING PROGRAMME

2022-2023

Year 1 - Fast track

PROGRAMME SUPERVISOR

Georges SALAMEH

Autumn Semester

Course unit	ECTS Credits	Course type	Course code	Title
UE71	6			
		Core course	FASTTRACK_EPS_S7	Sports
		Core course	FASTTRACK_FL2_S7	English
		Core course	FASTTRACK_FLE_S7	French Language
UE72	6			
		Core course	FASTTRACK_ALGPR_S7	Algorithms & Programming
		Core course	FASTTRACK_OFM_S7	Optimization
UE73	9			
		Core course	FASTTRACK_FINEL_S7	Finite Elements
		Core course	FASTTRACK_MATH1_S7	Maths I
		Core course	FASTTRACK_SNS_S7	Signal and Systems
UE74	9			
		Core course	FASTTRACK_CIVEN_S7	Civil Engineering
		Core course	FASTTRACK_ENERG_S7	Energetics
		Core course	FASTTRACK_ROBOT_S7	Robotics

Spring Semester

Course unit	ECTS Credits	Course type	Course code	Title
UE81	4			
		Core course	FASTTRACK_EPS_S8	Sports
		Core course	FASTTRACK_FL2_S8	English Language
		Core course	FASTTRACK_FLE_S8	French Language
UE82	11			
		Core course	FASTTRACK_MANAG_S8	Management
		Core course	FASTTRACK_STFT_S8	Internship
		Core course	FASTTRACK_STRENI_S8	Strategy, Entrepreneurship and Innovation
UE83	9			
		Core course	FASTTRACK_BDD_S8	Databases
		Core course	FASTTRACK_DATA_S8	Data Science & Machine Learning
		Core course	FASTTRACK_MATH2_S8	Maths II
UE84	6			
		Core course	FASTTRACK_BIOMEDIC_S8	Biological and medical aspects of human health
		Core course	FASTTRACK_FM_S8	Fluid Mechanics

Sports [FASTTRACK_EPS_S7]

LEAD PROFESSOR(S): Gildas GUIHENEUF-LALERE

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),
- physiological-directed activities (development of cardiopulmonary and muscular functions),
- organisation of sports events

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

English [FASTTRACK_FL2_S7]

LEAD PROFESSOR(S): Matthew BEALL

Objectives

Course description :
This is a course whose content resembles that of the 2nd and 3rd year engineers. This similarity, as well as smaller class size for more individual attention, eases the transition to the 3rd year engineering program.

In short, these classes' aim is to maintain English language knowledge while improving certain speaking skills that will render communication more fluid, both in and outside the professional world.

In order to respond to students' need to be quickly operational in French, certain concepts and expressions will be explained both in French and in English.

Course contents

Course content changes each year based on the following table (i.e. This is year A, so next year classes will be organized around Focus Groups and Team Building.

Year A
1st Semester-Journalism Studies
2nd Semester-Conference Organization

Year B
1st Semester-Focus Groups
2nd Semester-Team Building

Year C
1st Semester-Making a Pitch
2nd Semester-Intercultural Studies

Course material

Authentic written, televised, internet documents, as well as digital tools.

Assessment

Individual assessment: EVI 1 (coefficient 0.5)
EVI 2 (coefficient 0.5)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	0 hrs	16 hrs	0 hrs	0 hrs	0 hrs

French Language [FASTTRACK_FLE_S7]

LEAD PROFESSOR(S): Julie POURQUIER / Sonia PRIETO

Objectives

The objective is to familiarise international students with the French language and French culture through entertaining task-based communicative language teaching, focused on listening and speaking. Course objectives include the acquisition and reinforcement of vocabulary, syntax, and pronunciation in order to have the required knowledge to communicate in everyday situations and also to understand and follow courses in French in Centrale Nantes.
During the course, students acquire general skills: specific communicative competence, language competence (knowledge of grammar, syntax and phonology) as well as social and cultural knowledge enabling them to use the appropriate vocabulary in everyday situations. Sociolinguistic and pragmatic skills are also called upon.

Course contents

Being able to speak about oneself and one's academic career.
Speaking about the city, changes in lifestyle, the city of tomorrow.
Talking about young people's food choices, new food trends.

Grammar: past tense, relative pronouns, pronouns, future and conditional tenses, hypotheses, logical connectors, use of the subjunctive

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Algorithms & Programming [FASTTRACK_ALGPR_S7]

LEAD PROFESSOR(S): Hugues DIGONNET

Objectives

Learn the fundamental concepts of algorithmics, with practical implementation in C++ (without object-oriented notions). Topics cover algorithmic complexity, abstract data types, functions, recursion and pointers, as well as several frequently used containers: vectors, lists and trees. Typical algorithms will be presented (searching, sorting etc). Practical work will be undertaken in C++.

Course contents

- Algorithms vs. program, some definitions related to algorithms
- Imperative programming: variables, branches, loops, pointers and pseudo-code.
- C++ language (basics only)
- Writing classical and recursive algorithms using different data structures.

Course material

- Algorithms in a Nutshell, 2e - George Heineman, Gary and Stanley Selkow / OReilly
- Introduction to Algorithms - Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein / MIT Press
- The C++ Programming Language [4th Edition] - Bjarne Stroustrup / Addison-Wesley

Assessment

Collective assessment: EVC 1 (coefficient 0.2)

Individual assessment: EVI 1 (coefficient 0.8)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	6 hrs	8 hrs	16 hrs	0 hrs	2 hrs

Optimization [FASTTRACK_OFM_S7]

LEAD PROFESSOR(S): Fouad BENNIS

Objectives

The lecture presents different theoretical and computational aspects of a wide range of optimization methods for solving a variety of problems in mechanical engineering. The main objective of this courses is to give the students the ability to formalise, select the appropriate method, implement the optimisation problem and then analyse the results in order to take the best decision regarding the objectives, variables and the constraints.

Course contents

Basic concepts of optimization,
Gradient based methods,
Evolutionary algorithms,
Simulated Annealing
Multi objective optimization methods,
Robust optimization methods,
Multidisciplinary optimization problems,
Programming aspects,

Practical Work: exercises and project on the design optimisation of mechanical product, manufacturing process or system.
The students will be able to: Understand different theoretical and computational aspects of a wide range of optimization methods,

Use of optimization toolbox.

Course material

R. Fletche, Foundation of structural optimization.
Mitchell Melanie : An Introduction to Genetic Algorithms

Assessment

Collective assessment: EVC 1 (coefficient 0.5)

Individual assessment: EVI 1 (coefficient 0.5)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	14 hrs	0 hrs	16 hrs	0 hrs	2 hrs

Finite Elements [FASTTRACK_FINEL_S7]

LEAD PROFESSOR(S): Domenico BORZACCHIELLO

Objectives

-Understand the need for approximation methods for solving complex boundary value problem
-Have a basic understanding of linear elasticity
-Understand the concepts of interpolation, discretization and operator assembly as applied to digital methods
-Derive a discrete formulation from a continuous formulation
-Know how to program the basic functionality of an FE code
-Be able to solve problems with commercial software such as Ansys and Abaqus

Course contents

This course was divided in 7 sessions of 4h and one 2h session (exam excluded). To avoid having excessively long theory sessions, all 4h classes were divided into theory and lab. The lab sessions have been introduced after the theory concepts were explained, with the exception of lab session 1 (complete FE problem would be required to understand everything, but the objective is the introduction to FE computer software).

Course material

Reference book: “The finite element method. Volume 1: The basis”. O.C. Zienkiewicz & R.L. Taylor
Course slides.
Lab session documents.
ANSYS student (free license, available from their website. Limited to 32k DOF).
Matlab code “elas2D”.

Assessment

Collective assessment: EVC 1 (coefficient 0.2)

Individual assessment: EVI 1 (coefficient 0.55)
EVI 2 (coefficient 0.25)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	15 hrs	0 hrs	15 hrs	0 hrs	2 hrs

Maths I [FASTTRACK_MATH1_S7]

LEAD PROFESSOR(S): Marie BILLAUD

Objectives

The aim of this course is to introduce numerical analysis methods for solving mathematical problems such as linear and non-linear equations, differential equations, and curve fitting.

Prerequisites: Basic concepts of analysis and linear algebra (see program of Foundation Master)

Course contents

1. Complements of matrix analysis : localization of eigenvalues, matrix norms.
2. Solution of systems of linear equations: direct methods (Gauss, LU), iterative methods (Jacobi, Gauss-Seidel).
3. Solution of non-linear equations: bisection method, fixed-point method, Newton's method.
4. Interpolation and approximation: Lagrange and Hermite interpolation, piecewise interpolation, best approximation, least squares approximation.
5. Numerical integration: quadrature formulas, composite method.
6. Numerical methods for differential equations: Euler's method, Runge-Kutta methods.

Course material

[1] Allaire, G., Kaber, S.M., Numerical linear algebra, Springer (2008)
[2] Quarteroni, A, Sacco, R., Saleri, F. Numerical mathematics, Springer (2000)

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	12 hrs	14 hrs	4 hrs	0 hrs	2 hrs

Signal and Systems [FASTTRACK_SNS_S7]

LEAD PROFESSOR(S): Eric LE CARPENTIER

Objectives

- To interpret the spectral representations of signals
- To understand the time sampling of signals (sample rate, anti-aliasing filter etc.)
- To model a system using the transfer functions language
- To model a system using the state space language
- To switch from one representation to the other
- To link the physical phenomena to the parameters of these representations (stability, response velocity etc.)
- To simulate these mathematical representations with adapted scientific software tools (Matlab, Simulink)

Course contents

- Analysis of continuous-time and discrete-time signals
  - o Fourier, Laplace and z transforms
  - o Sample, hold, quantization, Shannon theorem
- Modelling of continuous-time and discrete-time linear time invariant (LTI) systems
  - o Transfer function, state space representation
  - o Poles, zeros, stability
  - o Time response, frequency response
  - o Sampling
  - o Simulation (Matlab Simulink)
  - o First-order and second-order systems
- Design of an actual digital control implementation
  - o Analog to Digital Converter, Digital to Analog converter
  - o Sample and hold
  - o Link with the previous mathematical representations
- Lab work
  - o A codec based on the Fourier transform
  - o Spacecraft control simulation

Course material

- Modern Signals and Systems, H. Kwakernaak, R. Sivan, Prentice Hall.
- Signals and Systems, R. Baraniuk, http://www.eng.ucy.ac.cy/cpitris/courses/ece623/notes/SignalsAndSystems.pdf
- Signal processing. Introduction to signals and systems theory, E. Le Carpentier, https://hippocampus.ec-nantes.fr/mod/resource/view.php?id=9179

Assessment

Collective assessment: EVC 1 (coefficient 0.5)

Individual assessment: EVI 1 (coefficient 0.5)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	16 hrs	0 hrs	14 hrs	0 hrs	2 hrs

Civil Engineering [FASTTRACK_CIVEN_S7]

LEAD PROFESSOR(S): Rana AL NEMER

Objectives

The objectives of this course is to discover the civil engineering materials (mainly soils and concretes) and to analyse the main related issues

Course contents

- The CIVENG course is an introduction to the civil engineering materials.
- The course is divided in 7 practical sessions. The student will test two materials used and designed by the civil engineers: soils and concretes.
- Concerning concretes, the practical sessions will adress the manufacturing of fresh mortar and concrete specimens. Students will study the mechanical behavior of cured concrete (deformability, strength, destructive and non-destructive tests). They will also analyze the setting times of cement pastes and the workability of mortars of different mix designs.
- Concerning the soils, the practical sessions will adress the experimental identification of soils (consistency) and the study of the hydromechanical soil's behaviour (permeability, shear strenght and settlement).

Course material

Assessment

Collective assessment: EVC 1 (coefficient 0.3)
EVC 2 (coefficient 0.2)

Individual assessment: EVI 1 (coefficient 0.5)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	2 hrs	0 hrs	28 hrs	0 hrs	2 hrs

Energetics [FASTTRACK_ENERG_S7]

LEAD PROFESSOR(S): Georges SALAMEH

Objectives

- To apply the fundamental laws of thermodynamics to study industrial processes involving energy transformation or transfer phenomena.

Course contents

- Energy transformations
- Phase transitions: properties of mixtures, thermodynamic tables and diagrams.
- Thermodynamic cycles and thermal machines.
- Direct cycles: Carnot, Rankine, Hirn, reheating cycles, Joule's cycle, Beau de Rochas and Diesel cycles.
- Introduction to turbocharging.
- Reverse compression cycles: Carnot and Joule's cycles, heat pump, refrigeration and air conditioning.

Course material

Energétique par F. Delrey et JF Hetet (cours à Centrale Nantes)
Thermodynamique et énergétique 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 problèmes énergétiques globaux par R. GICQUEL (Presses des Mines)

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	16 hrs	14 hrs	0 hrs	0 hrs	2 hrs

Robotics [FASTTRACK_ROBOT_S7]

LEAD PROFESSOR(S): Gaëtan GARCIA

Objectives

Give the necessary tools to model and localize conventional wheeled mobile robots.
Initiation to industrial robot manipulator programming.

Course contents

Mobile robots part

Modeling of wheeled mobile robots: constraint equations, classification of mobile robots by degree of mobility and steerability, posture kinematic model, configuration kinematic model, wheel motorization.
Localization: relative localization (odometry), absolute localization, localization sensors, localization by Extended Kalman filtering, observability analysis.

Robot programming part

Statistics about robot manipulators in the industry and application examples. Programming by teaching. Robot programming langages. The Val II and V+ langages. Advanced features of robot programming languages.

Course material

C. Canudas-de Witt, B. Siciliano, G. Bastin, G. (1996).
"Theory of Robot Control", chapter 7, pages 265–306. Springer-Verlag, London.

G. Garcia. "Wheeled mobile robots - Kinematic modeling", class document in book form available on Hippocampus.

G. Garcia "Mobile robots - Localization", class document in book form available on Hippocampus.

Assessment

Collective assessment: EVC 1 (coefficient 0.5)

Individual assessment: EVI 1 (coefficient 0.5)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	12 hrs	0 hrs	20 hrs	0 hrs	0 hrs

Sports [FASTTRACK_EPS_S8]

LEAD PROFESSOR(S): Gildas GUIHENEUF-LALERE

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),
- physiological-directed activities (development of cardiopulmonary and muscular functions),
- organisation of sports events

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	0 hrs	24 hrs	0 hrs	0 hrs	0 hrs

English Language [FASTTRACK_FL2_S8]

LEAD PROFESSOR(S): Matthew BEALL

Objectives

Course description :
This is a course whose content resembles that of the 2nd and 3rd year engineers. This similarity, as well as smaller class size for more individual attention, eases the transition to the 3rd year engineering program.

In short, these classes' aim is to maintain English language knowledge while improving certain speaking skills that will render communication more fluid, both in and outside the professional world.

In order to respond to students' need to be quickly operational in French, certain concepts and expressions will be explained both in French and in English.

Course contents

Course content changes each year based on the following table (i.e. This is year A, so next year classes will be organized around Focus Groups and Team Building.

Year A
1st Semester-Journalism Studies
2nd Semester-Conference Organization

Year B
1st Semester-Focus Groups
2nd Semester-Team Building

Year C
1st Semester-Making a Pitch
2nd Semester-Intercultural Studies

Course material

Authentic written, televised, internet documents, as well as digital tools.

Assessment

Individual assessment: EVI 1 (coefficient 0.5)
EVI 2 (coefficient 0.5)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	0 hrs	16 hrs	0 hrs	0 hrs	0 hrs

French Language [FASTTRACK_FLE_S8]

LEAD PROFESSOR(S): Julie POURQUIER / Sonia PRIETO

Objectives

The objective is to familiarise international students with the French language and French culture through an entertaining task-based communicative language teaching, focused on listening and speaking. Course objectives include the acquisition and reinforcement of vocabulary, syntax, and pronunciation in order to have the required knowledge to communicate in daily life and also to understand and follow courses in French in Centrale Nantes.
During the course, students learn general skills: in particular communicative competences, linguistic competence (grammatical knowledge of syntax morphology, phonology), as well as social knowledge about how and when to use utterances appropriately. Sociolinguistic competence and pragmatic competences are also covered.

Course contents

Speaking about science and new technology.

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Management [FASTTRACK_MANAG_S8]

LEAD PROFESSOR(S): Thomas LECHEVALLIER

Objectives

The conference presents different theoretical and practical aspects of Management. The course will successively establish the theoretical framework with a practical application on projects and management contexts. The main objective of this course is to understand that management is a relationship of oneself towards others helped by techniques

Course contents

- Definition of Management,
- Know yourself,
- Know others,
- the role of manager,
- manage others,
- project management,
- change management,
- decision,
- some management tools.

Course material

- Industrial and General Administration, Henry Fayol
- The management toolbox, 2020
- The 7 habbits of highly efficient people, S. Covey
- Power and organization, Michel Crozier

Assessment

Collective assessment: EVC 1 (coefficient 0.5)

Individual assessment: EVI 1 (coefficient 0.5)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	16 hrs	14 hrs	0 hrs	0 hrs	2 hrs

Internship [FASTTRACK_STFT_S8]

LEAD PROFESSOR(S): Georges SALAMEH

Objectives

This internship which is carried out at the end of the first year of the fast-track program aims to apply the knowledge acquired during the year, within a company or a laboratory or a research organization.

Course contents

The internship should last at least 8 weeks. It can be performed in a company, or in a research department.

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	0 hrs	0 hrs	0 hrs	0 hrs	0 hrs

Strategy, Entrepreneurship and Innovation [FASTTRACK_STRENI_S8]

LEAD PROFESSOR(S): Thomas LECHEVALLIER

Objectives

The conference presents different theoretical and practical aspects on business strategy and the integration of innovation into traditional cycles. The course will successively establish the theoretical framework with a practical application on a project defined jointly with the students. The main objective of this course is to understand the need to work on the strategy in relation to the context and the objectives of the company to manage its activity and not suffer from it

Course contents

- Definition of strategy,
- Strategic positioning with a focus on the direct external influence of customers,
- strategy in action,
- strategic choices,
- entrepreneurship,
- the integration of innovation into the classic production cycle.

Course material

- Sources: Chandler, 1963,
- ME.Porter, 1996;
- H.Mintzberg, 2007,
- Exploring strategy, 2011,
- The Customers Toolbox 2020

Assessment

Collective assessment: EVC 1 (coefficient 0.5)

Individual assessment: EVI 1 (coefficient 0.5)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	16 hrs	14 hrs	0 hrs	0 hrs	2 hrs

Databases [FASTTRACK_BDD_S8]

LEAD PROFESSOR(S): Lucas LESTANDI

Objectives

The objective of this course is to understand the functioning of databases, from both theoretical and practical perspectives. Starting from relational algebra, we study the conceptual modeling of a more or less well defined problem and its transformation into a relational model and its operations through administrative tools or software. The focus lies particularly on the treatment of ill-posed problems, or the exploitation of poorly designed databases in order to prepare engineers for real situations.

Course contents

This course includes lectures, exercices and practical work.
Lectures will follow the following programme:
- Introduction to Databases
- Functional Modeling
- Relational Modeling Physical Modeling
- Relational Algebra
- Introduction to Normal Forms I
- ntroduction to SQL
- Programming databases PL/SQL
- Notions of BI
- ntroduction to noSQL and Big Data

Course material

Assessment

Collective assessment: EVC 1 (coefficient 0.5)

Individual assessment: EVI 1 (coefficient 0.5)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	12 hrs	4 hrs	14 hrs	0 hrs	2 hrs

Data Science & Machine Learning [FASTTRACK_DATA_S8]

LEAD PROFESSOR(S): Mathieu RIBATET

Objectives

The lecture presents different theoretical and computational aspects of statistical learning. The course will first set the theoretical framework on how one can «learn from data» ; next, different statistical approaches will be introduced (linear and logistic regression, lasso / ridge / elastic net regression, neural networks...). The main objective of this course is to understand the main theoretical aspect of the above statistical learning strategies as well as be able to conduct a whole analysis in practice.

Course contents

- Foundation of statistical learning
- A crash course on probability and statistics
- Linear models
- Logistic regression
- Regularized linear regression (lasso, ridge, ...)
- Neural networks
- Implementation aspects (on various data sets)

Course material

Hastie, T., Tibshirani, R. and J. Friedman The Elements of Statistical Learning

Faraway, J. Linear Models with R

Chollet, F. and Allaire, J.J. Deep Learning with R

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	20 hrs	0 hrs	12 hrs	0 hrs	0 hrs

Maths II [FASTTRACK_MATH2_S8]

LEAD PROFESSOR(S): Luisa ROCHA DA SILVA / Mazen SAAD

Objectives

This course is an introduction on the numerical approximation of partial differential equations (PDE) for solving diffusion and transport equations.
Prerequisites: MATH1, basic concepts of analysis and linear algebra

Course contents

Computation of solutions of diffusion, transport, wave equations
Finite difference methods (low and high-order) for second-order and first-order boundary value problems
An alternative: the characteristics method
Extension to finite volume methods
Consistency, stability, local error, convergence

Course material

A. Tveito, R. Winther: Introduction to PDE: a computational approach, Springer (1998)
Quarteroni, A, Sacco, R., Saleri, F. Numerical mathematics, Springer (2000)

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	22 hrs	0 hrs	8 hrs	0 hrs	2 hrs

Biological and medical aspects of human health [FASTTRACK_BIOMEDIC_S8]

LEAD PROFESSOR(S): Aurélien SERANDOUR / Sophie LIMOU

Objectives

Introduction to life and major biological concepts
Presentation of major recent biotechnological breakthroughs
Challenges for the future in health

Course contents

Introduction to life, Human Physiology, Cell and Molecular biology
Biotechnological breakthroughs in health: recent progress in molecular biology for health, medical genetics
Big data in health and development of bioinformatics, Project in R

Course material

Assessment

Collective assessment: EVC 1 (coefficient 0.4)

Individual assessment: EVI 1 (coefficient 0.6)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	16 hrs	8 hrs	6 hrs	0 hrs	2 hrs

Fluid Mechanics [FASTTRACK_FM_S8]

LEAD PROFESSOR(S): Sandrine AUBRUN

Objectives

The program contains essential skills needed by any engineer dealing with mechanics. The level achieved at the end of the program enables one to solve basic problems when fluids are present and to transfer them and interact with specialists, when relevant:
- Understand and interpret fluid flow phenomena
- Understand and interpret actions of fluids on objects
- Predesign a hydraulic installation

Course contents

1. Fluid properties and hydrostatic law
2. Static pressure loads
3. Perfect fluid dynamics. Bernoulli equation and applications
4. Closed-circuit flows. Generalized Bernoulli equation, Head loss. Circuits
5. Viscous fluid dynamics. Navier-Stokes equations. Similarities. Laminar and turbulent regime. Basics on boundary layer
6. Momentum equation and applications
7. Practical labs

Course material

Assessment

Collective assessment: EVC 1 (coefficient 0.4)

Individual assessment: EVI 1 (coefficient 0.6)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	12 hrs	12 hrs	6 hrs	0 hrs	2 hrs