

SHAKE THE FUTURE.



ENGINEERING PROGRAMME

SPECIALISATION

COMPUTER SCIENCE
AUTUMN SEMESTER

DATABASES

COMPUTER SCIENCE, ENGINEERING PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Jean-Yves MARTIN

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
- Introduction to SQL
- Programming databases
- PL/SQL
- Notions of BI
- Spatial databases

Course material

Databases, Relational Modeling, SQL, Spatial Databases

Keywords

Links with other programmes

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	14 hrs	4 hrs	12 hrs	0 hrs

SOFTWARE ENGINEERING

COMPUTER SCIENCE, ENGINEERING PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Myriam SERVIERES

Objectives

To acquire the fundamentals in Software Engineering and Project Management.

Course contents

The course is structured around two major themes:

- 1) Software Engineering
 - Software development methods (specifications, lifecycle, planning, quality, production, acceptance)
 - Analysis, specification and design models, (Jackson diagrams, Entity-Association, NIAM, UML, etc.)
 - Software Engineering processes and activities.
- 2) Project Management

Fundamentals of software project management

Upon completion of the course, students are expected to be able to design and model software and write specifications.

Course material

Modélisation objet avec UML, Pierre-Alain Muller, Best of Eyrolles, 2005.
UML2 et les design patterns, Craig Larman, Pearson Education, 2005.
Software Engineering 8, Ian Sommerville, Addison Wesley, 2007.
Le génie logiciel et ses applications, Ian Sommerville, InterEdition, 1988.
SADT, David A. Marca, Clement L. McGowan, McGraw-Hill Book Company, 1988.
Processus d'ingénieries du logiciel, méthodes et qualité, Claude Pinet, Pearson Education, 2002.
UML2, Benoit Charroux, Aomar Osmani, Yann Thierry-Mieg, Pearson Education, 2005.

Keywords

Programming Languages, Algorithmics and data structure, Project Management, UML

Links with other programmes

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	22 hrs	8 hrs	0 hrs	0 hrs

DISCRETE MATHEMATICS

COMPUTER SCIENCE, ENGINEERING PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Jean-Sebastien LE BRIZAUT

Objectives

The objectives of the course are to show the variety of tools needed for information coding and to enhance student understanding of graph algorithms. The course will also introduce other underlying theoretical computer science elements of the other Computer Science courses.

Course contents

- Introduction to information coding,
- Theoretical foundations of coding theory and its history,
- Application examples, associated algorithms.
- Error correcting codes,
- Cryptography.
- Graphs
- Introduction to graph theory (shortest paths, minimum cover, flow, layout).

Course material

Coding theory, cryptography, graph theory, paradigms

Keywords

Links with other programmes

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	20 hrs	10 hrs	0 hrs	0 hrs

OBJECT ORIENTED PROGRAMMING

COMPUTER SCIENCE, ENGINEERING PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Jean-Marie NORMAND

Objectives

The objective of this course is for students to be able to programme in an object-oriented language. It will introduce the main concepts of object-oriented programming (encapsulation, inheritance, polymorphism) to model them using UML (Unified Modelling Language), and put them into practice with Java language. Then, the course will focus on the major classes of data structures and algorithms based on the implementation in Java. Finally, some specific mechanisms will be covered such as Java interfaces and exceptions. The course consists of lectures as well as numerous practical sessions.

Course contents

- Introduction to Java
- Object-oriented concepts
- Data structures and how to use them in Java
- Abstract classes and methods, Interfaces
- Generics and Exceptions
- Graphical User Interface in Swing

Course material

Keywords

object-oriented programming, Java, modelling

Links with other programmes

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	10 hrs	0 hrs	20 hrs	0 hrs

FUNCTIONAL PROGRAMMING

COMPUTER SCIENCE, ENGINEERING PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Didier LIME

Objectives

We study the functional programming paradigm, wherein the results are given not by executing a sequence of instructions, but by evaluating a functional expression.

The objectives are:

- understanding the specificity of the functional approach (immutability, referential transparency, higher-order functions, etc.)
- being able to understand a functional program
- being able to write a functional program
- being able to take some distance with the naive recursive style, and implement the more advanced concepts based, in particular, on higher order functions.
- mastering the basics of the Haskell language

Course contents

We recall and develop the foundations of the functional approach i.e., composition and recursion, and progress to more advanced concepts including:

- Types of parameterized algebraic data
- Higher-order functions
- Generics
- Non-strict evaluation and infinite structures
- Functors, applicative functors and monads.

These concepts are illustrated and implemented using Haskell language.

Course material

Keywords

Functional programming, Haskell, genericity, recursion, higher-order functions

Links with other programmes

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	14 hrs	16 hrs	0 hrs	0 hrs

PROJECT: SOFTWARE DEVELOPMENT PROJECT

COMPUTER SCIENCE, ENGINEERING PROGRAMME SPECIALISATION

AUTUMN SEMESTER

Professor: Myriam SERVIERES

Objectives

The aim of this project is to build an application, using the concepts covered during the lectures.

Course contents

This course is a project undertaken in pairs. Emphasis is placed on project management, the quality of the deliverable, documentation of the source code and the results.

Projects change every year. They can include web development, specific software development, etc.

Course material

Keywords

Links with other programmes

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

INDUSTRIAL SOFTWARE DEVELOPMENT

COMPUTER SCIENCE, ENGINEERING PROGRAMME SPECIALISATION

AUTUMN SEMESTER

Professor: Guillaume MOREAU

Objectives

This course is run jointly (except for lab work) for the Computer Science and Virtual Reality specialisations. It aims to provide methods and tools for the development of industrial quality software. This includes unit and integration tests, version management, code metrics, continuous integration services and design patterns. It will also be an opportunity to extend the students technical knowledge.

To account for the different skills sets between the Computer Science and Virtual Reality specialisations, lab work will use java language for the former and C++ for the latter (with an adapted tool set). All notions covered in lectures will be applied practically in lab sessions.

Course contents

- Group work in computer science
- Version management
- Software tests
- Unit testing
- Advanced build tools and continuous integration
- Code metrics

Course material

Keywords

Links with other programmes

Pre-requisites: C++ Programming for the Virtual Reality specialisation or Object Oriented Programming for the Computer Science specialisation.

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	10 hrs	22 hrs	0 hrs	0 hrs

SYSTEMS AND NETWORKS

COMPUTER SCIENCE, ENGINEERING PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Morgan MAGNIN

Objectives

This course aims to provide the fundamentals of systems and networks. The first part of the course defines what is an operating system, the services to be expected and principal components. The second part of the course presents the problems of data-processing networks (general concepts, overview, challenges, customer-server, groupware, security).

Course contents

The course is divided into two main chapters:

1) Introduction to Operating Systems

- Main functions of an operating system,
- material architecture of information processing systems

2) Networks

- general concepts
- Data Transmission
- Network Technology Ethernet, Token Ring, FDDI, ATM
- ISO Architecture
- TCP/IP Architecture
- Internet and the World Wide Web
- Network administration
- Data security

Course material

Keywords

Links with other programmes

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	24 hrs	6 hrs	0 hrs	0 hrs

LANGUAGE THEORY

COMPUTER SCIENCE, ENGINEERING PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Didier LIME

Objectives

The objective of this course is to introduce a number of fundamental theoretical models of Computer Science, through the notions of languages and compilation.

Course contents

The course follows the classical approach to compilation, extending to the Turing machine models.

- 1) Lexical analysis, regular expressions, and finite automata
- 2) Syntax analysis, formal grammars, and pushdown automata
- 3) The link between languages and algorithms, and Turing machines
- 4) Semantic analysis and attributed grammars
- 5) Code generation

These notions are illustrated and put into action through the use of the flex, bison, and galgas compiler compilers.

Course material

Alfred V. Aho, Monica S. Lam, Ravi Sethi. Compilers: Principles, Techniques, and Tools (2nd edition). Addison Wesley. 2006

P. Dehornoy. Complexité et Décidabilité, Springer-Verlag, 1993.

M. Sipser. Introduction to the Theory of Computation, PWS Pub. Co., 1996.

Keywords

Formal languages, automata, Turing machines, compiling

Links with other programmes

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	20 hrs	10 hrs	0 hrs	0 hrs