CENTRALE NANTES

ENGINEERING PROGRAMME

2025-2026

Year 2 / Year 3

Specialisation option

Computer Science for Information Systems

OD INFOSI

PROGRAMME SUPERVISOR

Jean-Yves MARTIN

Autumn Semester

Course unit	ECTS Credits	Track	Course code	Title
UE 73	12	Core course	BDONN GELOG MADIS OBJET	DataBases Software Engineering Discrete Mathematics Object Oriented Programming
UE 74	13	Core course	ADATA MEDEV_INFOSI PAPPL PRWEB SECUR	Data Analysis Industrial Software Development Project: Software Development Project Web Programming Systems and Data security

Spring Semester

Course unit	ECTS Credits	Track	Course code	Title
UE 83	14	Core course	DEVMO INRES PGROU SYRES SYSIN	UI-UX Design and mobile Dev Sustainable Computing Group Project Systems and Networks Information Systems

DataBases [BDONN]

LEAD PROFESSOR(S): 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
- Relationnal Databases
 + Functional Modeling, Relational Modeling, Physical Modeling
 + Relational Algebra
 + Introduction to Normal Forms
 + Introduction to SQL
 + Programming databases with java, python and PL/SQL
- Notions of BI
- Introduction to noSQL and Big Data
  + Introduction to mongoDB
  + Introduction to Cassandra, CHEBOTKO Diagramme

Practical work consists in a projet that requires database modelling and creation, SQL requests, programming in java, triggers implementation, use of MongoDB database through python and java programs.

Skills developed through this course

- C2 : Analyse a complex system from all angles (scientific, economic, human, social) and propose a solution
  - C2C1 : Represent and model
    - Intermediate
    - Proficient
  - C2C2 : Solve and arbitrate
    - Intermediate
    - Proficient
  - C2C3 : Think and act in an unpredictable and uncertain environments
    - Intermediate
    - Proficient

Skills assessed through this course

- C2 : Analyse a complex system from all angles (scientific, economic, human, social) and propose a solution
  - Intermediate
  - Proficient

Sustainable Development Goals (SDGs) covered by this course

Industry, innovation and infrastructure / Quality education

Sustainable Development and Social Responsibility Positioning

The objective is to provide all students the ability to choose suitable infrastructure and to model problems effectively and responsibly.

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
French	3	10 hrs	10 hrs	10 hrs	0 hrs	2 hrs

Software Engineering [GELOG]

LEAD PROFESSOR(S): Myriam SERVIÈRES

Objectives

To acquire the fundamentals in Software Engineering and Project Management.

Course contents

The course is structured around several major themes:
- Software development cycles (specifications, life cycle, planning, quality, specifications, production, acceptance),
- Analysis, specification and design models with a particular emphasis on UML,
- Fundamentals of IT project management,
- Introduction to Agile development (Scrum) and DevOps.

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.
Processus d'ingénieries du logiciel, méthodes et qualité, Claude Pinet, Pearson Education, 2002.
UML2, Benoit Charroux, Aomar Osmani, Yann Thierry-Mieg, Pearson Education, 2005.

Skills developed through this course

- C3 : Manage complex programmes or change responsibly
  - C3C1 : Design a project/programme
    - Intermediate
    - Proficient
  - C3C2 : Manage/lead a project/programme
    - Intermediate
    - Proficient
  - C3C3 : Finalise and leverage feedback
    - Intermediate
    - Proficient
- C2 : Analyse a complex system from all angles (scientific, economic, human, social) and propose a solution
  - C2C1 : Represent and model
    - Proficient
  - C2C2 : Solve and arbitrate
    - Proficient
  - C2C3 : Think and act in an unpredictable and uncertain environments
    - Proficient

Skills assessed through this course

- C2 : Analyse a complex system from all angles (scientific, economic, human, social) and propose a solution
  - Intermediate
  - Proficient

Sustainable Development Goals (SDGs) covered by this course

Industry, innovation and infrastructure / Quality education

Sustainable Development and Social Responsibility Positioning

This Software Engineering course contributes to sustainable development objectives by training students in the analysis, modeling and design of structured and reliable software systems, in relation to the full life cycle of a software project. It contributes to Sustainable Development Goal No. 4 (Quality Education) by promoting the acquisition of fundamental and advanced skills in software engineering, through established methods and tools that can be applied throughout professional life.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	22 hrs	8 hrs	0 hrs	0 hrs	2 hrs

Discrete Mathematics [MADIS]

LEAD PROFESSOR(S): Jean-Sebastien LE BRIZAUT

Requirements

Binary calculation.
Matrix calculation.
Basics of probability.

Objectives

The objective of this course is to provide a number of mathematical tools used in solving computer problems.
- To show the diversity of tools needed in information coding
- To introduce some elements of theoretical computer science underlying the other courses of the computer science specialisation.

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).

Skills developed through this course

- C2 : Analyse a complex system from all angles (scientific, economic, human, social) and propose a solution
  - C2C1 : Represent and model
    - Intermediate
  - C2C2 : Solve and arbitrate
    - Intermediate

Skills assessed through this course

No skill observed

Sustainable Development Goals (SDGs) covered by this course

Life below water / Responsible consumption and production

Sustainable Development and Social Responsibility Positioning

For this introductory course on computer coding... there aren't any particularly standout learning objectives in the list. Since students sometimes get a little overwhelmed by the sheer number of objectives, I've chosen a default one to remind them of the key points.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	20 hrs	10 hrs	0 hrs	0 hrs	2 hrs

Object Oriented Programming [OBJET]

LEAD PROFESSOR(S): Jean-Marie NORMAND

Objectives

The objective of this course is for students to be able to program in the Java 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 interfaces, abstraction, generics, exceptions and introspection.

The course consists of lectures as well as numerous practical sessions. During the lab work, students realize a project that evolves to integrate all the notions discussed in the classes, the project runs throughout the whole course.

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
Reflexivity/Introspection

Addendum:
Packages
Threads in Java
Graphical User Interface in Swing

Skills developed through this course

- C2 : Analyse a complex system from all angles (scientific, economic, human, social) and propose a solution
  - C2C1 : Represent and model
    - Intermediate
  - C2C2 : Solve and arbitrate
    - Intermediate
  - C2C3 : Think and act in an unpredictable and uncertain environments
    - Proficient

Skills assessed through this course

No skill observed

Sustainable Development Goals (SDGs) covered by this course

Industry, innovation and infrastructure

Sustainable Development and Social Responsibility Positioning

The Computer Science for Information Systems course, which focuses on object-oriented programming, aligns with Centrale Nantes' commitment to sustainable development and social responsibility. It trains students to design robust, maintainable, and scalable software, promoting best practices in quality, reusability, and software efficiency. The course raises awareness of ethical issues, the reliability of information systems, and their organizational and societal impact. It thus contributes to responsible software engineering, consistent with the institution's Sustainable Development and Social Responsibility (DD&RS) label.

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
French	3	10 hrs	0 hrs	20 hrs	0 hrs	2 hrs

Data Analysis [ADATA]

LEAD PROFESSOR(S): Jean-Yves MARTIN / Mathieu RIBATET

Objectives

Learn and implement classical data analysis methods

Course contents

1- Introduction to modeling and basic concepts, data visualization
2- Unsupervised classification
3 - Principal component analysis
4- Linear regression

Skills developed through this course

- C2 : Analyse a complex system from all angles (scientific, economic, human, social) and propose a solution
  - C2C1 : Represent and model
    - Proficient
  - C2C2 : Solve and arbitrate
    - Proficient
  - C2C3 : Think and act in an unpredictable and uncertain environments
    - Proficient

Skills assessed through this course

No skill observed

Sustainable Development Goals (SDGs) covered by this course

Industry, innovation and infrastructure

Assessment

Collective assessment: EVC 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	14 hrs	18 hrs	0 hrs	0 hrs	0 hrs

Industrial Software Development [MEDEV_INFOSI]

LEAD PROFESSOR(S): Myriam SERVIÈRES

Objectives

This course aims to provide methods and tools for developing 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.

Lab work will use java language. 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

Skills developed through this course

- C3 : Manage complex programmes or change responsibly
  - C3C1 : Design a project/programme
    - Proficient
  - C3C2 : Manage/lead a project/programme
    - Proficient

Skills assessed through this course

No skill observed

Sustainable Development Goals (SDGs) covered by this course

Industry, innovation and infrastructure / Quality education

Sustainable Development and Social Responsibility Positioning

This Software Methodology course contributes to sustainable development objectives by training students in the methods and tools required for the development of industrial-quality software, based on structured and recognized professional practices. It addresses issues related to software quality, testing, continuous integration, version control and collaborative work, relying on current professional tools. It also raises awareness of the effects of technical debt on the maintainability, evolution and long-term sustainability of software systems. It contributes to Sustainable Development Goal No. 4 (Quality Education) by promoting the acquisition of fundamental and advanced skills in software engineering, and to Sustainable Development Goal No. 9 (Industry, Innovation and Infrastructure) through its grounding in practices and tools used in industrial digital contexts.

Assessment

Collective assessment: EVC 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	6 hrs	10 hrs	16 hrs	0 hrs	0 hrs

Project: Software Development Project [PAPPL]

LEAD PROFESSOR(S): Myriam SERVIÈRES

Objectives

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

Course contents

The 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.

Skills developed through this course

- C3 : Manage complex programmes or change responsibly
  - C3C2 : Manage/lead a project/programme
    - Intermediate
  - C3C3 : Finalise and leverage feedback
    - Intermediate

Skills assessed through this course

- C3 : Manage complex programmes or change responsibly
  - Intermediate

Sustainable Development Goals (SDGs) covered by this course

Industry, innovation and infrastructure / Quality education

Sustainable Development and Social Responsibility Positioning

This application project contributes to sustainable development objectives by placing students in a situation where they design and implement an application following professional software development practices. It contributes to Sustainable Development Goal No. 4 (Quality Education) by promoting the acquisition and application of technical, organizational and methodological skills through a pair-based project, including project management, deliverable quality and documentation. It also contributes to Sustainable Development Goal No. 9 (Industry, Innovation and Infrastructure) by raising awareness of the structuring, reliability and quality requirements expected in software projects developed in a variety of industrial and application contexts.

Assessment

Collective assessment: EVC 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	1	0 hrs	0 hrs	0 hrs	32 hrs	0 hrs

Web Programming [PRWEB]

LEAD PROFESSOR(S): Jean-Marie NORMAND

Objectives

The objective of this course is to provide students with the fundamentals of web programming.

It starts with HTML-CSS and JavaScript before witching to higher level frameworks.

Students will thus have to program a small but functional Web application using:
- Spring (Java)
- ReactJS/NodeJS

This course includes a number of practical sessions devoted to working with frameworks and building Web applications.

Course contents

This course includes lectures and lab work.

Lectures:
- Introducing HTML, CSS and Javascript
- PHP
- J2EE
- Web servers
- Notions of Web Programming Frameworks

Lab work:
- HTML, Javascript, AJAX
- SPRING
- ReactJS/NodeJS

Skills developed through this course

- C2 : Analyse a complex system from all angles (scientific, economic, human, social) and propose a solution
  - C2C2 : Solve and arbitrate
    - Intermediate

Skills assessed through this course

No skill observed

Sustainable Development Goals (SDGs) covered by this course

Industry, innovation and infrastructure

Sustainable Development and Social Responsibility Positioning

The Web Programming course within the Computer Science for Information Systems option aligns with Centrale Nantes' commitment to sustainable development and social responsibility. It aims to train students in the design of accessible, secure, and high-performance web applications, while integrating the principles of digital sobriety and user inclusion. The course raises awareness of ethical issues, data protection, and the environmental impact of digital services. It thus contributes to the

responsible and sustainable design of web information systems, consistent with the institution's Sustainable Development and Social Responsibility (DD&RS) label.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	4 hrs	4 hrs	22 hrs	0 hrs	2 hrs

Systems and Data security [SECUR]

LEAD PROFESSOR(S): Jean-Yves MARTIN

Objectives

The objective of this course is to give students an understanding of computer security, cybersecurity, and copyright. For this, each of these aspects is covered by a professional in the field, who addresses the basic concepts, the tools used in practice, and illustrates his or her point with examples.

Course contents

- Introduction to internet security, main attacks, encryption, and main mechanisms. Introduction to LDAP authentication.
- Security from an administrative perspective. Security planning, RSSI, Using security audit.
- Security from a company audit perspective.
- Security from a technical point of view. Main attacks: how we can protect computers and software.
- Security from a legal point of view. CNIL, software licenses. RGPD.
- Personal data protection.

Skills developed through this course

- C2 : Analyse a complex system from all angles (scientific, economic, human, social) and propose a solution
  - C2C2 : Solve and arbitrate
    - Proficient
  - C2C3 : Think and act in an unpredictable and uncertain environments
    - Intermediate
    - Proficient

Skills assessed through this course

No skill observed

Sustainable Development Goals (SDGs) covered by this course

Quality education

Sustainable Development and Social Responsibility Positioning

The objective is to provide all students the knowledge and the tools to manage the security of information systems in the scope of protecting users data.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	20 hrs	10 hrs	0 hrs	0 hrs	2 hrs

UI-UX Design and mobile Dev [DEVMO]

LEAD PROFESSOR(S): Vincent TOURRE

Objectives

UI-UX : Learn the principles of creating a User Interface (UI) taking into account user experience (UX).
Mobile development: Learn the logic behind the creation of a mobile application for the Android platform.

Course contents

User Interfaces:
- History of interfaces
- Interaction styles
- User experience
- Visual perception
- Ergonomic criteria

Mobile development:
- Production process of an Android application
- Programming activities in JAVA

Interface/mobile development project to practise the concepts (two students).

Skills developed through this course

- C1 : Design and prototype innovative systems that create value
  - C1C1 : Develop
    - Intermediate
  - C1C2 : Dare
    - Intermediate

Skills assessed through this course

- C1 : Design and prototype innovative systems that create value
  - Intermediate

Sustainable Development Goals (SDGs) covered by this course

Industry, innovation and infrastructure

Sustainable Development and Social Responsibility Positioning

Human-computer interfaces can account for more than half of the development costs of an IT project and are difficult to maintain and upgrade. The course outlines the steps involved in designing interfaces to improve their efficiency and facilitate their evolution.

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
French	3	12 hrs	10 hrs	8 hrs	0 hrs	2 hrs

Sustainable Computing [INRES]

LEAD PROFESSOR(S): Morgan MAGNIN

Objectives

Knowledge objectives:
- Concepts of digital responsability
- Technical tools associated with digital responsability
- Introduction to low-tech aspects of digital technology

Skills objectives:
- Apply the knowledge acquired to practical cases

Course contents

Part 1 - Digital Responsibility
- Presentation of the French Digital Responsibility label
- Digital Technology Fresk

Part 2 - Responsible Design: GR491
- GR491 Reference Framework
- Digital Accessibility

Part 3 - Low-tech aspects of digital technology

Part 4 – Implementation in practical cases

Course material

General accessibility improvement guidelines: https://accessibilite.numerique.gouv.fr
Course materials available on Hippocampus: http://hippocampus.ec-nantes.fr

Skills developed through this course

- C4 : Manage multidisciplinary and multicultural programme or project teams ethically and responsibly
  - C4C1 : Build self-awareness, self-development
    - Intermediate
  - C4C2 : Promote individual and team performance
    - Intermediate
    - Proficient
  - C4C3 : Lead transformation in one's organisation
    - Intermediate

Skills assessed through this course

No skill observed

Sustainable Development Goals (SDGs) covered by this course

Industry, innovation and infrastructure

Sustainable Development and Social Responsibility Positioning

The course aims to improve software infrastructure in order to implement tools that are more accessible (particularly to people with disabilities) and with increased awareness of the environmental impact.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	18 hrs	12 hrs	0 hrs	0 hrs	2 hrs

Group Project [PGROU]

LEAD PROFESSOR(S): Jean-Yves MARTIN

Objectives

The aim of this project is to have students work in groups in order to address design issues, code sharing, project planning, development.

Course contents

This course is a project undertaken in groups of 5 to 7 students.

Emphasis is placed on project reporting, project management, code sharing, 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.

Skills developed through this course

- C3 : Manage complex programmes or change responsibly
  - C3C1 : Design a project/programme
    - Proficient
  - C3C2 : Manage/lead a project/programme
    - Proficient
  - C3C3 : Finalise and leverage feedback
    - Proficient

Skills assessed through this course

- C3 : Manage complex programmes or change responsibly
  - Intermediate
  - Proficient

Sustainable Development Goals (SDGs) covered by this course

Quality education

Sustainable Development and Social Responsibility Positioning

The objective is to encourage students to work in groups on a concrete project in order to use tools adapted to group management.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	2	0 hrs	0 hrs	0 hrs	48 hrs	0 hrs

Systems and Networks [SYRES]

LEAD PROFESSOR(S): Jean-Yves MARTIN

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 4 chapters:
1 - Networks
+ General concepts, ISO Architecture, TCP/IP, Ethernet
2 - Introduction to Operating Systems
+ Main functions of the Operating System, Architecture
+ Commands in Terminal
3 - Cloud
+ General concepts
+ Main architectures
4 - Quantic Architectures
+ General concepts

Skills developed through this course

- C2 : Analyse a complex system from all angles (scientific, economic, human, social) and propose a solution
  - C2C2 : Solve and arbitrate
    - Proficient

Skills assessed through this course

No skill observed

Sustainable Development Goals (SDGs) covered by this course

Quality education

Sustainable Development and Social Responsibility Positioning

The objective is to provide all students the ability to understand the network architectures and choose the best infrastructures according to their constraints.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	22 hrs	8 hrs	0 hrs	0 hrs	2 hrs

Information Systems [SYSIN]

LEAD PROFESSOR(S): Jean-Yves MARTIN

Objectives

The aim of this course is to understand information systems, how they are built, how they can be analyzed.

Course contents

This course focus on following points :

- Structure and management of an Information System
- Cartography of an Information System, Urbanization of Information Systems
- Managing Information Systems Projects
- Data management.
- Risk management

Skills developed through this course

- C5 : Contribute to the development and deployment of a strategic corporate vision
  - C5C1 : Anticipate and commit
    - Intermediate
    - Proficient
  - C5C2 : Give meaning
    - Intermediate
    - Proficient
  - C5C3 : Develop and sustain
    - Intermediate
    - Proficient

Skills assessed through this course

No skill observed

Sustainable Development Goals (SDGs) covered by this course

Quality education

Sustainable Development and Social Responsibility Positioning

The objective is to provide all students the ability to understand and to to model informations systems in the scope of optimize them.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	20 hrs	10 hrs	0 hrs	0 hrs	2 hrs