

---

# ENGINEERING PROGRAMME

2022-2023

Year 2 / Year 3

---

Specialisation option  
**Smart Positioning and  
Sustainable Mobility**

OD SMARTLOC

---

PROGRAMME SUPERVISOR  
Myriam SERVIERES



ENGINEERING - OD SMARTLOC

# Autumn Semester

Course unit	ECTS Credits	Track	Course code	Title
UE 73 / 93	12	Core course	MANAPROJ MSTAT OBJET PROJETSMARTLO C1 QCMSCRUM	Managing and project management Statistical data modelling Object Programming Scoping, definition of application scope Quality Design Modeling
UE 74 / 94	13	Core course	ANDROID MLOC PROJETSMARTLO C2	Mobile application development Positioning Methods Solution design

# Spring Semester

---

Course unit	ECTS Credits	Track	Course code	Title
UE 103 / 83	14	Core course	EXPERT PROJETSMARTLO C3	Expertise targeted to the needs of the project Mock-up, deliverables, promotion

## ENGINEERING - OD SMARTLOC

Year 2 / Year 3 - Autumn Semester - Course Unit 73 / 93

# Managing and project management [MANAPROJ]

*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 habits of highly efficient people, S. Covey
- Power and organization, Michel Crozier

### Assessment

Collective assessment: EVC 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

## ENGINEERING - OD SMARTLOC

Year 2 / Year 3 - Autumn Semester - Course Unit 73 / 93

# Statistical data modelling [MSTAT]

*LEAD PROFESSOR(S): Eric LE CARPENTIER*

### Objectives

This course addresses the characterization and the processing of random signals by means of statistical tools. It provides the theoretical foundations used in practical problems to estimate a quantity of interest and to retrieve sought information.

Applications concern: biomedical signal and image processing (diagnosis, tools to assist the disabled), music signal processing (recording, restoration, coding), positioning systems, etc.

At the end of the course the students will be able to:

- Provide a statistical description of a random process
- Solve a statistical estimation problem in a practical situation
- Derive a numerical algorithm to calculate and to characterize the solution

### Course contents

- Probability theory: random vectors, density, mean, variance.
- Time analysis, frequency analysis: random signals, autocorrelation, power spectral density.
- Classical estimation, Bayesian estimation: maximum likelihood (ML) estimation, minimum mean square error (MMSE) estimator, maximum a posteriori (MAP) estimator, linear minimum mean square error (LMMSE).
- Markov chains, Markov processes.
- Statistical filtering: Bayes, Kalman, particles.

### Course material

[1] Probability, Random Variables and Stochastic Processes. A. Papoulis, S.U. Pillai. Mc Graw Hill.

[2] Fundamentals of Statistical Signal Processing, Vol.1: Estimation theory, S. Kay, Prentice Hall.

### 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	10 hrs	10 hrs	10 hrs	0 hrs	2 hrs

## ENGINEERING - OD SMARTLOC

Year 2 / Year 3 - Autumn Semester - Course Unit 73 / 93

# Object Programming [OBJET]

*LEAD PROFESSOR(S): Jean-Marie NORMAND*

### Objectives

The objective of this course is for students to be able to program 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 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  
 Introspection

Addendum:  
 Packages  
 Threads in Java  
 Graphical User Interface in Swing

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

## ENGINEERING - OD SMARTLOC

Year 2 / Year 3 - Autumn Semester - Course Unit 73 / 93

# Scoping, definition of application scope [PROJETSMARTLOC1]

*LEAD PROFESSOR(S): Myriam SERVIERES*

### Objectives

Definition and implementation of the SMARTLOC option deliverables.

### Course contents

Scope, Definition of the application's perimeter

### Course material

### Assessment

Individual assessment: EVI 1 (coefficient 1)

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

## ENGINEERING - OD SMARTLOC

Year 2 / Year 3 - Autumn Semester - Course Unit 73 / 93

# Quality Design Modeling [QCMSCRUM]

*LEAD PROFESSOR(S): Myriam SERVIÈRES*

### Objectives

The course covers three key topics in enterprise IT development: Software Engineering, Databases, and IT Development Methods. The database part of the course will not be taken by SmartLoc students but will be "replaced" by advanced training in the Agile SCRUM development method.

The objectives of this course will be:

- Acquire the basics of Software Engineering and IT Project Management.
- Master the Agile SCRUM method of developing IT projects.
- Develop by mastering the tools and methods that allow building industrial quality software applications.

Following this course, the acquired skills should allow to:

- Design and model software and write specifications.
- Follow the AGILE principles of software development
- Collaborate on software development, and automated test suites, and ensure the quality of the code.

### Course contents

1. Software engineering. We will cover here:

- Software development cycles: specification, life cycle, planning, quality, specification, production, acceptance.
- UML design models: use cases, class diagrams, sequence diagrams, state-transition diagrams, and activity diagrams.

2. IT development methods. We will discuss version control tools, unit testing, and code metrics.

3. Courses and practical work on the implementation of an agile method SCRUM for the development of applications

### Course material

### Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	5 hrs	23 hrs	0 hrs	0 hrs	2 hrs



## ENGINEERING - OD SMARTLOC

Year 2 / Year 3 - Autumn Semester - Course Unit 74 / 94

# Mobile application development [ANDROID]

*LEAD PROFESSOR(S): Myriam SERVIÈRES*

### Objectives

The objective of this course is to present the basics of Android programming with its specificities: learn how to develop on Android Studio, create its graphical interface taking into account the specificities of developments on mobile. The course is based on practical work and the implementation of the GeolocPVT application and the practical implementation of location calculations in Android.

### Course contents

- Basics of mobile development in Android Studio (8h)
- Graphical interface (4h)
- GeolocPVT architecture (4h)
- Practical application of location calculation in Android (4h)

### Course material

### Assessment

Individual assessment: EVI 1 (coefficient 1)

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

## ENGINEERING - OD SMARTLOC

Year 2 / Year 3 - Autumn Semester - Course Unit 74 / 94

# Positioning Methods [MLOC]

*LEAD PROFESSOR(S): Myriam SERVIERES*

### Objectives

Introduction to GNSS positioning techniques and methods

### Course contents

This course will introduce the techniques and methods of GNSS (Global Navigation Satellite System) positioning (GNSS architecture, coordinate systems, signal types). It will present GNSS receivers and the methods to go from a signal to a navigation solution. Finally, it will introduce inertial navigation in order to move towards localization solutions using a multi-sensor + GNSS fusion and to allow fine pedestrian navigation. This course will be entirely given by V. Renaudin from UGE.

### Course material

### Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	2	0 hrs	16 hrs	0 hrs	0 hrs	0 hrs

## ENGINEERING - OD SMARTLOC

Year 2 / Year 3 - Autumn Semester - Course Unit 74 / 94

### Solution design [PROJETSMARTLOC2]

*LEAD PROFESSOR(S): Myriam SERVIÈRES*

#### Objectives

Definition and implementation of the SMARTLOC option deliverables.

#### Course contents

Solution design

#### Course material

#### Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	9	0 hrs	0 hrs	0 hrs	174 hrs	0 hrs

## ENGINEERING - OD SMARTLOC

Year 2 / Year 3 - Spring Semester - Course Unit 103 / 83

### Expertise targeted to the needs of the project [EXPERT]

*LEAD PROFESSOR(S): Myriam SERVIERES*

#### Objectives

Expert courses focused on the project's application perimeter.

#### Course contents

#### Course material

#### Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

## ENGINEERING - OD SMARTLOC

Year 2 / Year 3 - Spring Semester - Course Unit 103 / 83

# Mock-up, deliverables, promotion [PROJETSMARTLOC3]

LEAD PROFESSOR(S): Myriam SERVIÈRES

### Objectives

Definition and implementation of the SMARTLOC option deliverables.

### Course contents

Design, deliverables, valorization

### Course material

### Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	10	0 hrs	0 hrs	0 hrs	200 hrs	0 hrs