ENGINEERING PROGRAMME

2021-2022

Year 2 / Year 3

Specialisation option

Environment Mobility Health

OD EMS

PROGRAMME SUPERVISOR

Thomas LECHEVALLIER

Autumn Semester

Course unit	ECTS Credits	Track	Course code	Title
UE 73 / 93	12	Core course	CDCUML MANAPROJ PROJET1	Specifications and UML Project Management Framework of the project
		Track: Group 1	ADAIR ANDROID CAPTA INPRO INSIG RESPIRE SINBAD	Acquisition of air quality data Android and Programming Expert intervention on collection (including pollen) Introduction to Programming Geographic Information Systems Respiratory health and environmental exposure DataBases
UE 74 / 94	13	Core course	PROJET2	Project 2
		Track: Group 1	DEVMEP MOBIL	APP's development and production Mobility and journeys' planning

Spring Semester

Course unit	ECTS Credits	Track	Course code	Title
UE 103 / 83	14	Core course	EMS_PROJET3	Project 3

Specifications and UML [CDCUML]

LEAD PROFESSOR(S): Myriam SERVIERES

Objectives

This course focuses on giving the essential basics for the composition of a project specification and presenting some UML diagrams useful for the specification and design phases.

Course contents

- basics of writing specifications
- introduction to UML (mainly Uses Cases and class/object diagrams)

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	0.5	0 hrs	4 hrs	0 hrs	0 hrs	0 hrs

Project Management [MANAPROJ]

LEAD PROFESSOR(S): Thomas LECHEVALLIER

Objectives

A project is a collective and individual adventure. The division of labor, the diversity of any team, the confrontation with changes and decisions make it necessary to put in place a balanced management and the experienced use of project management.
The objective of the course is to give:
- the tools essential for the drafting of each key deliverable in a project approach: opportunity analysis, pre-framing, Go / NoGO, framing, quality plan, progress monitoring, arbitration note, report,. ..),
- the keys to project management (functions, habits, styles) in relation to the work of others, including change management and decision-making capacity while minimizing bias.

The learning will follow the standard chronology of a project, the practice will be based on the option projects on the first expected deliverables (Scoping).

Course contents

Course material

Assessment

Collective assessment: EVC 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	2	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Framework of the project [PROJET1]

LEAD PROFESSOR(S): Thomas LECHEVALLIER

Objectives

The objectives of this first project phase are mainly the appropriation of content, understanding previous work and setting project objectives for the current year.

Course contents

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3.5	0 hrs	0 hrs	0 hrs	90 hrs	0 hrs

Acquisition of air quality data [ADAIR]

LEAD PROFESSOR(S): Thomas LECHEVALLIER

Objectives

The course will teach the fundamentals of acquiring scientific data on the quality of outdoor air, depending on the particles sought, the instrumentation and the experimental environment. The practical work will allow the establishment of calibration and experimental collection protocols to ensure the quality of the data, the analysis and then a possible simulation.
Thematic
- Study of emerging pollutants in natural and urban environments
- Pollution in urban areas & transport

Course contents

1 - Field measurement

- Fidas PALAS for real-time PTX measurements
- Elpi
- Environmental measurement: Embedded Weather Station, Pyranometer
- BIRAL visibilimeter
- Test vehicle

2 - Laboratory measurement

- Physico-chemical (ICP, Chromatography) and mineralogical (DRX, EDX ...) analysis
- BET and BJH at N2: measurement of specific surfaces, adsorption isotherm, pore distribution of particles
- Analysis of pollutants: NOx, VOC ...
- Observation with a Scanning Electron Microscope (SEM)
- Measurement of visibility attenuation by fine particles (PTx)
- Carbonation chamber

3 - Intermediate scale physical modeling - Simulation and scientific calculation

- Aeraulic chamber to simulate the flow of particles subjected to environmental constraints
- Monitoring and measurement of the displacement field and the velocity field with the High frequency 3D Particle Image Velocimetry equipped with ratiometric PLif.
- Simulation of the flow in the wake of vehicles (PIV 3D HF).
- Various statistical calculation software (such as XL Stat, R ...) and DEM modeling (surf mapping ...)

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	2	0 hrs	30 hrs	0 hrs	0 hrs	2 hrs

Expert intervention on collection (including pollen) [CAPTA]

LEAD PROFESSOR(S): Thomas LECHEVALLIER

Objectives

This course is devoted to specific techniques for collecting pollen, as well as to the contribution of all the data collected from analysis, processing and optimization techniques. The work on the data will improve the model already created during the first EMS year, based on SIRANE (AIR - Atmosphere, Impact & Risk team of the Fluid Mechanics and Acoustics Laboratory of the Ecole Centrale de Lyon) . This course will be developed with teams from Centrale Nantes, Gustave Eiffel and Centrale Lyon.

Course contents

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	2	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Respiratory health and environmental exposure [RESPIRE]

LEAD PROFESSOR(S): Thomas LECHEVALLIER

Objectives

This teaching is devoted to learning the fundamental breathing functions of the human body, the pathologies existing on its functions, the inherent lifestyles, the instrumentation allowing to follow and relieve the patients, the objectives of prevention with the help. in particular connected objects, and the impact of the environment on the patient's entire ecosystem. The practical work will make it possible to test certain connected objects that can help with environmental prevention as well as to define a user profile for an application in relation to a patient file while scrupulously respecting the regulations on the security of medical data and the GDPR.

Course contents

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	2	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Android and Programming [ANDROID]

LEAD PROFESSOR(S): Myriam SERVIERES

Objectives

The objective of this course is, through practice, to see the basics of creating an Android application.

Course contents

- description of the application development process
- coding of a first "Hello world" application
- creation of an interactive interface and work on layouts
- Activity, Intents, debug and tests
- background and multi-window tasks

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	0.5	0 hrs	8 hrs	0 hrs	0 hrs	0 hrs

Introduction to Programming [INPRO]

LEAD PROFESSOR(S): Myriam SERVIERES

Objectives

The objective of this course is for students to be able to program in an object-oriented language, Java, and in Python.
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.
The second part of the course will recall the basics of Python covered in 'classes préparatoires' and through the use of Jupiter Notebook will allow the programming of functions, classes and the manipulation of data of a geographical nature.

Course contents

Introduction to Java and Python
Object-oriented concepts
Data structures and how to use them in Java and Python
Abstract classes and methods, Interfaces
Generics and Exceptions
Graphical User Interface in Swing (Java) and georeferenced data manipulation (Python)
[Bibliographie]
[Mots clés]
object-oriented programming, Java, Python, modelling
[Liens avec d'autres enseignements]
ALGPR, prerequisite for many computer classes

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	1.5	10 hrs	0 hrs	20 hrs	0 hrs	2 hrs

Geographic Information Systems [INSIG]

LEAD PROFESSOR(S): Myriam SERVIERES

Objectives

The objective of this course is to present Geographic Information Systems and their components (software, data, spatial analysis, cartography, standards, etc.).

Course contents

- Introduction to basic concepts: definition, vocabulary, data types, tools, projection systems, etc.
- Spatial analysis: concepts for raster and vector approaches, geographic information manipulation languages,
- The Spatial SQL language
- Practice:
 - QGIS: discover a GIS + georeference of old maps, produce vector data using editing tools,
 - OrbisGIS: spatial analysis based on vector information,
 - Smartphone: how to create and analyse a GPS track obtained with your smartphone ?
- GIS and web: discovery of GIS ecosystems applied to the web, in particular with the concept of Spatial Data Infrastructure (SDI) (architecture, standards, etc.)
- Cartography: theory with graphic semiology rules and with SLD / SE standards. Then practice, processing in a GIS in order to produce a cartography.

Course material

http://georezo.net/biblio.php

Assessment

Individual assessment: EVI 1 (coefficient 1)

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

DataBases [SINBAD]

LEAD PROFESSOR(S): Jean-Yves MARTIN

Objectives

To introduce the main elements for understanding databases, especially spatial databases which are used in Geographic Information Systems (GIS).

Course contents

This course is divided into 2 parts: theoretical and practical work.

The theoretical aspects include:
- Introduction to functional analysis
- The relational model theory
- From functional analysis to physical models
- Introduction to SQL
- Database security
- Introduction to PL/SQL
- GIS and spatial databases
- Introduction to XML and Spatial Data Infrastructure

Practical work includes
- Building, creating and using a database
- GIS use

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	2	14 hrs	4 hrs	12 hrs	0 hrs	2 hrs

Project 2 [PROJET2]

LEAD PROFESSOR(S): Thomas LECHEVALLIER

Objectives

Scope of application:
- Estimate the user's CO 2 emissions during their journey,
- Awareness of pollution (exposure and emission),
- Taking into account of traffic data,
- Taking into account disruptions to public transport,
- Long-term forecasts (1 week max),
- Automatic recalculation of the trajectory based on environmental changes and transport decisions finally taken by the user,
- Taking into account allergens such as pollen,
- Taking into account the price of the trip,
- Mobile capture of pollution data in real time,
- Mix of several means of transport (eg: car + bicycle) Geo-locate the user,
- Estimate exposure to pollution particles,
- User profile (favorite places, health profile),
- Estimated travel time.

Course contents

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	40 hrs	0 hrs

APP's development and production [DEVMEP]

LEAD PROFESSOR(S): Thomas LECHEVALLIER

Objectives

DEVMEP (Development and production of an application):
The course is the application of the knowledge acquired on the development of the expected application from professional specifications reviewed and validated by the project manager (Nantes University Hospital).

Course contents

The industrial stages of putting an application mock-up into production will be taught by practice with the learning of technical application architecture, portability, customer relations and confrontation with technological and functional trade-offs

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	4	0 hrs	32 hrs	0 hrs	72 hrs	0 hrs

Mobility and journeys' planning [MOBIL]

LEAD PROFESSOR(S): Thomas LECHEVALLIER

Objectives

The teaching will allow the setting up of experimentation on the mobility of people, and the modeling and simulation of the different modes of dispersions, integrating the passenger compartment and air filtering conditions (automobile, public transport, bicycle, pedestrian). The practical work will consist in the preparation of project experiments allowing the recovery of reliable geographic data on the defined routes.

Course contents

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	4	0 hrs	32 hrs	0 hrs	80 hrs	0 hrs

Project 3 [EMS_PROJET3]

LEAD PROFESSOR(S): Thomas LECHEVALLIER

Objectives

- Part of scientific monitoring provided by internal and external stakeholders of the ECN (Option City NUMERIQUE, Speakers on data processing and statistics, Mobility research, etc.), of the CHU de NANTES (Pulmonologist, Air quality expert interior, IT development expert), Gustave Eiffel University (Professor, Experts) and Air Pays de la Loire (Expertise and project management).

Course contents

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	14	0 hrs	0 hrs	0 hrs	160 hrs	2 hrs