
ENGINEERING PROGRAMME

2021-2022

Year 2 / Year 3

Specialisation option
Digital City

OD VILLE_NUMERIQUE

PROGRAMME SUPERVISOR

Myriam SERVIERES



Autumn Semester

Course unit	ECTS Credits	Track	Course code	Title
UE 73 / 93	12	Core course	INPRO INSIG PRURB SINBAD	Introduction to programming Geographic Information Systems Urban Issues DataBases
UE 74 / 94	13	Core course	ENJEU IGSIG MODUR MOURB P1URBANISTIC	Professional Applications GIS Engineering Urban Data Modeling Urban models: history and critical analysis Project

Spring Semester

Course unit	ECTS Credits	Track	Course code	Title
UE 103 / 83	14	Core course	BIMOD IMAGURBA P2URBANISTIC PLURB REPVI	Building Information Modeling Image analysis and processing Project Urban policies City Representation

ENGINEERING - OD VILLE_NUMERIQUE

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

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)

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 VILLE_NUMERIQUE

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

Geographic Information Systems [INSIG]

LEAD PROFESSOR(S): Myriam SERVIÈRES

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 concept : 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 1.0)

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

ENGINEERING - OD VILLE_NUMERIQUE

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

Urban Issues [PRURB]

LEAD PROFESSOR(S): Myriam SERVIERES / Pascal JOANNE

Objectives

The organic metaphor which compares the city to a living being and the mechanistic metaphor which sees it as a multiform and multi-scale system of flows and exchanges, show on the one hand mankind's fascination with the phenomenon of urbanisation, and on the other hand, summarise its great complexity. As an introduction to the following modules, this course aims to capture some of the keys to this complexity and attempt to explain what makes the city today. It will highlight the problems of adaptation and reaction to natural and climatic phenomena in the urban environment.

Course contents

The course is divided into two main parts which are dealt with in parallel in the form of weekly lectures and tutorial work. A historical perspective, or "history of the city" describes and analyses the different ways in which cities are created. The second part of the course covers the main issues linked to the development of modern-day cities.

Course material

Assessment

Collective assessment: EVC 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	20 hrs	12 hrs	0 hrs	0 hrs	0 hrs

ENGINEERING - OD VILLE_NUMERIQUE

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

DataBases [SINBAD]

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
- Functional Modeling
- Relational Modeling Physical Modeling
- Relational Algebra
- Introduction to SQL
- Programming databases
- PL/SQL
- GIS and Spatial databases
- Introduction to noSQL and Big Data

Practical work includes databases creation and manipulation, writing programs in JAVA and Python, PLSQL programming.

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	14 hrs	4 hrs	12 hrs	0 hrs	2 hrs

ENGINEERING - OD VILLE_NUMERIQUE

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

Professional Applications [ENJEU]

LEAD PROFESSOR(S): Myriam SERVIERES

Objectives

The objective of this course is to present the professional uses of geotagged data through a series of lectures by companies, consulting firms or public stakeholders.

Course contents

Presentations from:

- OpenDataSoft
- Oslandia
- Siradel
- Auran
- ESRI
- OSM
- etc

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	30 hrs	0 hrs	0 hrs	0 hrs	2 hrs

ENGINEERING - OD VILLE_NUMERIQUE

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

GIS Engineering [IGSIG]

LEAD PROFESSOR(S): Jean-Yves MARTIN

Objectives

This course looks at the technologies underlying Geographic Information Systems in terms of programming, processing and Internet uses to manage the flow of geographic data.

Course contents

The course is divided in five chapters:

- XML and XML-based data (GML, CityGML, X3D, ...)
- Introduction to SDI
- Introduction to geolocalization
- Introduction to HTML and Javascript
- Visualisation tools (Leaflet, MapBox,, iTowns, ...)

Course material

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

ENGINEERING - OD VILLE_NUMERIQUE

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

Urban Data Modeling [MODUR]

LEAD PROFESSOR(S): Myriam SERVIERES

Objectives

The systemic and systematic analysis of a complex "object" such as the city requires the structuring of a huge set of spatio-temporal data. The objective of this course is, in a first part, to present different data models effectively implemented to organize and manipulate all the geolocalized or even time-stamped information involved. Then, in a second part, after a synthetic presentation of the ISO 37120 standard, to introduce methods and tools for the analysis of urban forms.

Following a presentation of the UML modeling tool and an introduction to conceptual models, students will be introduced to the use of thematic tools in the context of a computer-aided architectural design tool and the QGIS geographic information system. They will be invited, through practical exercises, to analyze typologies of urban data (provided, found or produced by the students) using different numerical tools.

Course contents

- UML notation and applicaiton to geographical data models
- Introduction to spatio-temporal data models and presentation of the MADS model
- CityGML presentation
- Public space analysis : urban indicators production based of visual perception
- modelization exercices

Course material

- Worboys, M., Hearshshow, H., & Maguire, D. (1990). Object-Oriented Modeling for Spatial Databases. Journal of GIS vol. 4, No. 4, 369 - 383.
- Modélisations spatio-temporelle multi-échelle des données dans un SIG urbain, Chams-Eddine Zaki, Thèse de doctorat, 2011.
- Parent, Christine, Spaccapietra, Stefano, Zimányi, Esteban, Conceptual Modeling for Traditional and Spatio-Temporal Applications - The MADS Approach, Springer-Verlag Berlin Heidelberg, 2009.
- <http://www.citygml.org>

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	13 hrs	17 hrs	0 hrs	0 hrs	2 hrs

ENGINEERING - OD VILLE_NUMERIQUE

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

Urban models: history and critical analysis [MOURB]

LEAD PROFESSOR(S): Daniel SIRET / Myriam SERVIERES

Objectives

Since the 1960s, and alongside the development of digital tools that allow for their implementation, different models have been proposed and tested to analyze different aspects of urban reality and to suggest its transformation. Inevitably simplistic, these urban models expressed many points of view on how to design cities, in terms of both understanding their present states as well as anticipating future developments. This course aims to present the main families of urban models, to understand their origin, to analyze the epistemological foundations and to put into perspective their contemporary uses.

Course contents

8 sessions with different specialists :

Session 1 - Introduction to the model concept

Sessions 2 & 3 - Transportation, flow, urban mobilities models

Sessions 4 & 5 - urban territories models and spatial dynamics

Sessions 6 & 7 - Model use in city planning services

Session 8 - Conclusive workshop and evaluation

Course material

Nicolas Bouleau. Philosophies des mathématiques et de la modélisation: Du chercheur à l'ingénieur. L'Harmattan, 1999.

Pascal Nouvel. Enquête sur le concept de modèle. PUF, 2002.

Nicolas Bouleau. La modélisation critique. Éditions Quae, 2014.

Assessment

Collective assessment: EVC 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	24 hrs	8 hrs	0 hrs	0 hrs	0 hrs

ENGINEERING - OD VILLE_NUMERIQUE

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

Project [P1URBANISTIC]

LEAD PROFESSOR(S): Vincent TOURRE

Objectives

The project allows students to implement the knowledge and skills acquired during the specialisation. The project topics are proposed by companies working in the field of geomatics and by researchers at the Nantes Research Centre for Urban Architecture (CRENAU). The project is conducted in two parts, with two deliverables, one at mid-project and the other at project completion.

Example of projects:

- Study of the Nantes University Hospital site with a view to its rehabilitation
- Analysis of the Bicloo (self-service bicycle) tracks in Nantes
- Efficient implementation of trees in the canopy plan in Lyon to create cool paths
- Visualisation of travel patterns in urban cooling systems for a research project (AAU laboratory)

Course contents

- Project choice: October
- Mid-project deliverable: January
- Final deliverable: March

Course material

According to project topic

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

ENGINEERING - OD VILLE_NUMERIQUE

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

Building Information Modeling [BIMOD]

LEAD PROFESSOR(S): Vincent TOURRE

Objectives

This course presents the BIM "Building Information Modeling" with a practical approach and the intersections of a teacher in architecture and professional speakers.

Course contents

- Introduction: Definition, Origin, Objectives, Link to Design Phases and Territorial Scale (GIS)
- Modeling: Building BIM mock-up with REVIT
- Coordination: Information exchange and data formatting;
- Synthesis: Cross-referencing of information from different batches;

Course material

Assessment

Collective assessment: EVC 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	24 hrs	8 hrs	0 hrs	0 hrs	0 hrs

ENGINEERING - OD VILLE_NUMERIQUE

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

Image analysis and processing [IMAGURBA]

LEAD PROFESSOR(S): Myriam SERVIERES

Objectives

The objective of this course is to present tools for image processing and computer vision. Processing and image analysis are essential remote sensing tools for assessing the development and evolution of urban space and build GIS content automatically or after manual processing.

Course contents

- Image processing for the production of geographic data
- Introduction : what is computer vision ?
- Image Formation - Geometric Primitives - Cameras
- Image processing
- Features detection
- Shape recognition
- Introduction to Remote sensing and Multispectral demultiplexing

Course material

Computer Vision, Algorithms and applications, Richard Szeliski, Springer, 2011 (<http://szeliski.org/Book/>)
 Digital Image Processing, R.C. Gonzalez and P. Wintz, Addison-Wesley Publishing Company, 1987
 Précis d'analyse d'images, M. Coster et J.L. Chermant, Presses du CNRS, 1989
 Acquisition et Visualisation des images, André Marion, 1997

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	18 hrs	12 hrs	0 hrs	0 hrs	2 hrs

ENGINEERING - OD VILLE_NUMERIQUE

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

Project [P2URBANISTIC]

LEAD PROFESSOR(S): Vincent TOURRE

Objectives

The project allows students to implement the knowledge and skills acquired during the specialisation. The project topics are proposed by companies working in the field of geomatics and by researchers at the Nantes Research Centre for Urban Architecture (CRENAU). The project is conducted in two parts, with two deliverables, one at mid-project and the other at project completion.

Example of projects:

- Study of the Nantes University Hospital site with a view to its rehabilitation
- Analysis of the Bicloo (self-service bicycle) tracks in Nantes
- Efficient implementation of trees in the canopy plan in Lyon to create cool paths
- Visualisation of travel patterns in urban cooling systems for a research project (AAU laboratory)

Course contents

- Project choice: October
- Mid-project deliverable: January
- Final deliverable: March

Course material

According to project topic

Assessment

Collective assessment: EVC 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

ENGINEERING - OD VILLE_NUMERIQUE

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

Urban policies [PLURB]

LEAD PROFESSOR(S): Myriam SERVIERES / Nicolas BATAILLE

Objectives

Urban policies are more and more based on management logics that require advanced instrumentation to optimise flows, frame projects and ensure the involvement of the populations concerned... The objective of this course is to understand how territorial management logics call upon engineering elements, among others, in order to build, refine, representations intended to modify the state of things in the framework of public policies. The course is built according to two logics: one aims to problematize the equipment of public decision making and proposes a historical perspective of the technical-political dimension of urban planning; the other consists of several testimonies of professional actors involved in the elaboration of public policies. Evaluation is carried out by presentations in pairs, the subjects of which are negotiated (teacher - students).

Course contents

- * Introduction to urban policies
- * Engineering and participatory processes in local public action
- * The health crisis and the making of the city
- * Ecological transition, policies, and socio-economics: the example of the renovation of tertiary buildings
- * The challenges of a large metropolis: Greater Paris, actors, challenges, and controversies
- * Gender and the making of the city
- * Actors, issues, and processes in the test of the peri-urban factory
- * Conclusion, presentations and evaluation

The teaching of urban policies takes place in two main formats throughout the semester:

- Courses and testimonials from professionals involved in public policymaking;
- Workshop on the analysis of controversies in urban planning.

This workshop will be an opportunity to question the instrumentation of urban policies and their practical implementation in the context of interactions between expertise and socio-political dimensions based on cases. In addition, it will allow grasping the diversity of the actors involved in an urban planning project, their strategies and the associated organizational issues. The workshop work is intended to complement the course time. The implementation of a workshop over a long period of time with regular follow-up will allow the mobilization of the knowledge acquired during the course of this practical exercise. Thus, intermediate reports will be requested and a final work based on the handing over of a group file and the organization of a debate scene will allow evaluating the acquisition of skills.

Course material

Barthe, Y., Callon, M. & Lascoumes, P., 2001. Agir dans un monde incertain. Essai sur la démocratie technique, Seuil
Body-Gendrot, S., Lussault, M., Paquot, T. dir., 1999 La ville et l'urbain. L'état des savoirs, Paris, La Découverte
Choay, F., 1965, L'urbanisme, utopies et réalités. Une anthologie, Seuil
Choay, F., 1980, La règle et le modèle. Sur la théorie d'architecture et de l'urbanisme, Paris, Seuil
Claude, V., 2006, Faire la ville. Les métiers de l'urbanisme au XXème siècle, Marseille, Parenthèses
Cole, A. Guigner, S., Pasquier, R., 2011, Dictionnaire des politiques territoriales, Paris, ScPo
Dormois, R. 2015, Les politiques urbaines: histoire et enjeux contemporains, Presses universitaires de Rennes
Levy, J., Lussault, M. (dir), 2013, Dictionnaire de la géographie et des sciences de l'espace des sociétés, Paris, Belin

Assessment

Collective assessment: EVC 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	24 hrs	8 hrs	0 hrs	0 hrs	0 hrs

ENGINEERING - OD VILLE_NUMERIQUE

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

City Representation [REPVI]

LEAD PROFESSOR(S): Vincent TOURRE

Objectives

The city is represented in many ways, be it through the GIS or 3D representations for real estate development, through decision support indicators or artistic and cultural representations. This course will explore this multiplicity of representations in conjunction with technical progress (data modeling) and current usages (urban problems, applications), and a workshop to create maps will be done in association with the Urban Policy course.

Course contents

- Information visualisation
- Narrative city
- Digital city
- Text analysis: studies of concepts, methods and devices to represent urban data
- Workshop: design, creation and representation of an urban indicator

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	8 hrs	18 hrs	4 hrs	0 hrs	2 hrs