

**SYLLABUS**

**Master of Science « Agricultural Data Management and Decision Models »**

**Vol : 490 h**

**Academic Year ECTS : 60 ECTS**

**6-months internship: 30 ECTS**

<b>Semester 1</b>		
<b>Agriculture and the advent of Big Data</b> (30h, 3 ECTS)	<b>Mathematical Modeling and Computer Science Department</b> (30h, 4 ECTS)	
<b>Data Quality Management in Agriculture</b> (30h, 4 ECTS)	<b>Data Analysis applied to agriculture</b> (30h, 5 ECTS)	
<b>Software Engineering</b> (40h, 5 ECTS)	<b>Survey Methods</b> (30h, 4 ECTS)	<b>Cross Fields I</b> (50h, 5 ECTS)

## **SEMESTER 1**

<b>Unit 1 Code AGD</b>	<b>Agriculture and the advent of Big Data</b>		<b>Coordinator S.TAÏBI</b>
	<b>Total</b>	<b>ECTS</b>	
	<b>30h</b>	<b>3</b>	

### **TRAINING OBJECTIVES**

The aims are to learn the concepts of French Agriculture. . In addition, will have an overview of information systems in France and over the world. As intellectual property rights management takes an important part in data management, data law concepts will be taught.

### **PRE-REQUISITES**

None

### **PROGRAM**

An overview of Agriculture  
Information system in Agriculture  
Sources and reliability of Data in several agriculture sectors  
Agricultural data property rights

### **ASSESSMENT MODALITIES**

		<b>Coefficients</b>				<b>ECTS</b>
		<b>Workshop</b>	<b>Continuous assessment</b>	<b>Project</b>	<b>Final Exam</b>	<b>3</b>
<b>AGD</b>		50%		50%		

<b>Unit 2</b> <b>Code : ITDM1</b>	<b>Mathematical Modeling and Computer Science Department</b>		<b>Coordinator</b> <b>J.Dantan</b>
	<b>Total</b>	<b>ECTS</b>	
	<b>30h</b>	<b>4</b>	

## TRAINING OBJECTIVES

The Information Technology Data Management 1 (ITDM1) Course Unit deals with data format standards as well as relational databases.

## PRE-REQUISITES

Excel basics

## CONTENTS

Data sources in agriculture

- Sensors, communications protocols/networks

Data exchange standards in agriculture

- XML, JSON, opendata, web of data

Relational Database Management Systems (RDBMS) course

- Database modeling
- Work on Excel and Access Database creation
- SQL requests

## ASSESSMENT MODALITIES

		<b>Coefficients</b>			<b>ECTS</b>
		Workshop	Continuous assessment	Project	Final Exam
<b>ITDM1</b>			50%		4
<b>ITDM2</b>				50%	

<b>UNIT 3</b> <b>Code DMAG</b>	<b>Data Quality Management in Agriculture</b>		<b>Coordinator</b> <b>S.TAÏBI</b>
	<b>30h</b>	<b>4</b>	

## TRAINING OBJECTIVES

This course leads to exploring and summarizing datasets and how Automate reports, know which tools to use, and explore, clean databases, and on which you can practice techniques and communicate to stakeholders .

The aims are to prove the accuracy of data using applied, descriptive and inferential statistics

## PRE-REQUISITES

Basic Statistics

Basic Probability Theory

## PROGRAM

- Nonparametric Statistics
- Data Processing
- Sampling Strategy for Big Data
- Applied Statistics

## ASSESSMENT MODALITIES

		<b>Coefficients</b>			<b>ECTS</b>
		<b>Workshop</b>	<b>Continuous assessment</b>	<b>Project</b>	<b>Final exam</b>
<b>DMAG</b>	DMAG1		50%		4
	DMAG2			50%	

<b>Unit 4</b>  <b>Code :DAAG</b>	<b>Data Analysis applied to agriculture</b>		<b>Coordinator</b>  <b>Salima TAÏBI</b>
	<b>Total</b>	<b>ECTS</b>	
	<b>30h</b>	<b>5</b>	

## TRAINING OBJECTIVES

The students are able to organize and analyze the information contained in large databases, whether numeric, textual or geographical.

## PRE-REQUISITES

Linear Algebra  
Analysis of Variance

## PROGRAM

- Principal component Analysis
- Factor Analysis
- Cluster Analysis
- Discriminant Analysis
- Software Analysis R/SPSS

## ASSESSMENT MODALITIES

		Weighting			ECTS
		Workshop	Continuous assessment	Project	
<b>DAAG</b>	<b>DAAG1</b>			30%	5
	<b>DAAG2</b>		20%		
				50%	

<b>Course Unit 5</b> <b>Code : SE</b>	Software Engineering		<b>Coordinator</b>  <b>J.Dantan</b>
	<b>Total</b>	<b>ECTS</b>	
	<b>40h</b>	<b>5</b>	

## TRAINING OBJECTIVES

The Software Engineering (SE) Course Unit deals with the classical software architectures present in the information systems of the companies, and more particularly the web architectures. It also deals with programming of software (Python) and automation of tasks in Excel (VBA).

## PRE-REQUISITES

Data format standards.

## CONTENTS

Client-server, component-based architectures, multitier architectures, Model View Controller, Web services: Service-Oriented Architectures (SOA), REST, cloud computing.

Algorithmic, object-oriented programming, variables, logical tests, loops, functions, Human/computer interaction with Python programming language.

Automating repetitive tasks in Excel via Visual Basic for Applications (VBA) macros: procedures, variables, logical tests, loops, linking VBA with Excel sheets, forms

## ASSESSMENT MODALITIES

		Weighting			ECTS
		Workshop	Continuous assessment	Project	
SE	<b>SE1</b>		20%		5
	<b>SE2</b>			50%	
	<b>SE3</b>		30%		

<b>Unit 6</b> <b>Code : SUME</b>	<b>Survey Methods</b>			<b>Coordinator</b>  <b>S.TAÏBI</b>
	<b>Total</b>	<b>ECTS</b>		
	<b>30h</b>	<b>4</b>		

## TRAINING OBJECTIVES

The aim is to work on a survey project and to develop an experimental design to provide knowledge about a topic, to get a response to a problematic.

## PRE-REQUISITES

Sampling Methods  
Data Analysis

## PROGRAM

- Methods of collecting data in survey cases
- Unstructured Data/
- Multiple Correspondence Analysis
- Survey data Analysis/ Data Consumer
- Text mining: social network analysis

## ASSESSMENT MODALITIES

		<b>Weighting</b>				<b>ECTS</b>
		Workshop	Continuous assessment	Project	Final exam	4
<b>Codes</b>	<b>SUME</b>			100%		

<b>UNIT 7</b> <b>Code : CF1</b>	<b>Cross Fields I</b>			<b>Coordinator</b>  <b>S.TAÏBI</b>
	<b>Total</b>	<b>ECTS</b>		
	<b>50h</b>	<b>5</b>		

## TRAINING OBJECTIVES

Big data will amounts a disruption in agricultural life, and then overhaul of working methods, so the objective of this unit course is to study methods of management. Foreign students can learn French Langage.

## PRE-REQUISITES

None

## PROGRAM

- Rural sociology, an approach in Connected Agriculture
- Project management
- French language (social network)

## ASSESSMENT MODALITIES

		<b>Coefficients</b>				<b>ECTS</b>
		Workshop	Continuous assessment	Project	Final exam	5
	Exam 1	50%				
	Exam 2			50%		



## Semester 2

**Mechanised Agriculture  
(40h, 4 ECTS)**

**Information Technology Data  
Management  
(30h, 4 ECTS)**

**Machine Learning Methods  
(40h, 6 ECTS)**

**Modeling Methods  
(20h, 3 ECTS)**

**Quantitative Image  
Analysis  
(30h, 4 ECTS)**

**Cross Fields II  
(40h, 3 ECTS)**

**Data Project for  
Agriculture  
(50h, 6 ECTS)**

## Semester 2

<b>UNIT 8</b> <b>Code : MAG</b>	<b>Mechanised Agriculture</b>			<b>Coordinator</b>  <b>S.TAIBI</b>
	<b>Total</b>	<b>ECTS</b>		
	<b>40h</b>	<b>4</b>	<b>20h video conference</b>	

### TRAINING OBJECTIVES

By understanding the concepts of precision farming, students will develop strategies for future new cases.

### PRE-REQUISITES

None

### PROGRAM

- Digital agriculture
- Micro parcels experimental designs
- Modulation of doses in the fields and associated equipment
- Precision agriculture decision making tools

### ASSESSMENT MODALITIES

		<b>Weighting</b>				<b>ECTS</b>
		Workshop	Continuous assessment	Project	Final exam	4
	MAG1		20%		50%	
	MAG2	20%				

<b>Course 9 Unit Code : ITDM2</b>	<b>Information Technology Data management</b>		<b>Coordinator  J.Dantan</b>
	<b>Total</b>	<b>ECTS</b>	
	<b>30h</b>	<b>4</b>	

## TRAINING OBJECTIVES

The Information Technology Data management 2 (ITDM2) Course Unit deals with databases for big data as well as computer security

## PRE-REQUISITES

Relational databases (ITDM1 course unit)

## CONTENTS

- Relational databases compared with Big data technologies.
- Distributed file systems, Hadoop.
- Parallel, distributed, massive data processing with Map Reduce.
- NoSQL/NewSQL databases: column, key-value, document, graph.
- Extract/Transform/Load (ETL)
- Query languages and applications for Big Data.
- Data Visualisation tools.
- Vulnerabilities, protection-privacy / security policies, cryptography

## ASSESSMENT MODALITIES

		<b>Weighting</b>				<b>ECTS</b>
		Workshop	Continuous assessment	Project	Final exam t	
	ITMD1				70%	4
	ITDM2			30%		

<b>Unit 10</b> <b>Code : MLM</b>	<b>Machine Learning Methods</b>			<b>Coordinator</b>  <b>S.TAÏBI</b>
	<b>Total</b>	<b>ECTS</b>		
	<b>40 h</b>	<b>6</b>		

## TRAINING OBJECTIVES

This kind of methods will allow to create algorithms and build predictive models and decision support tools. These technics are very powerful and robust for Big Databases.

## PRE-REQUISITES

Sampling Methods  
Data Analysis  
R software

## PROGRAM

- Neural Networks
- Regression trees, bagging
- Support Vector Machine
- Random Forests
- Kernel Methods
- K-Nearest Neighbors
- Sparse Methods for high dimensional data
- Deep Learning

## ASSESSMENT MODALITIES

		<b>Weighting</b>			<b>ECTS</b>
		<b>Workshop</b>	<b>Continuous assessment</b>	<b>Project</b>	<b>Final exam</b>
<b>Codes</b>	<b>MLM1</b>	30%			6
	<b>MLM2</b>			70%	

<b>Unit 11</b> <b>Code : LNM</b>	<b>MODELING METHODS</b>			<b>Coordinator</b>  <b>Salima TAÏBI</b>
	<b>Total</b>	<b>ECTS</b>		
	<b>20 h</b>	<b>3</b>		

## TRAINING OBJECTIVES

This course deals with parametric and non-parametric model construction methods. For the temporal or climatic data we will describe the case of time series.

## PRE-REQUISITES

Sampling Methods  
 Linear Algebra  
 Data Analysis  
 R software

## PROGRAM

- General Linear Models
- Non Linear models
- Time Series Modeling

## ASSESSMENT MODALITIES

		<b>Weighting</b>				<b>ECTS</b>
		Workshop	Continuous assessment	Project	Final exam	3
Code	s		50%		50%	

<b>Unit Code : QIA</b>	<b>Quantitative Image Analysis</b>			<b>Coordinator  S. TAÏBI</b>
	<b>Total</b>	<b>ECTS</b>		
	<b>30 h</b>	<b>4</b>		

## TRAINING OBJECTIVES

The aim is to show how spatial data processing and visualization is implemented. A number of digital devices and systems are making 3D visualizations more accessible to create a mapping with QGIS software

## PRE-REQUISITES

Sampling Methods  
Data Analysis  
R software

## PROGRAM

- Signal Image Processing
- Mapping
- Data Visualization
- QGIS Software

## ASSESSMENT MODALITIES

		<b>Weighting</b>				<b>ECTS</b>
		Workshop	Continuous assessment	Project	Final exam	
<b>Code</b>	<b>QIA1</b>	50%				4
<b>QIA</b>	<b>QIA2</b>			50%		

<b>UNIT 12</b> <b>Code : CF2</b>	<b>Cross Fields 2</b>		<b>Coordinator</b>  <b>S.TAÏBI</b>
	<b>Total</b> <b>40h</b>	<b>ECTS</b> <b>3</b>	

### TRAINING OBJECTIVES

In fact data consumers are very useful for marketing studies. Such in the case of big data from social networks this course presents methods of text mining. The aim is to describe numerous models and frameworks to assist in strategic decision making in the context of complex environments and competitive dynamics.

### PRE-REQUISITES

None

### PROGRAM

IS Strategy / management, system integration  
Digital Marketing  
French Language (FLE)

### ASSESSMENT MODALITIES

		<b>Coefficients</b>				<b>ECTS</b>
		Work shop	Continuous assessment	Project	Final exam	
	CF21	50%			50%	3
	CF22					

<b>UNIT 13</b> <b>Code : DPAG</b>	<b>Data Project for agriculture</b>			<b>Coordinator</b> <b>S.TAÏBI</b> <b>J.DANTAN</b>
		<b>ECTS</b>		
	<b>50h</b>	<b>6</b>		

## TRAINING OBJECTIVES

Practical project whose subject is offered by either the teaching staff or a partner company.

## PRE-REQUISITES

All units

## PROGRAM

Practical project whose subject is offered by either the teaching staff or a partner company.

- Building a decision making tool for smart agriculture
- Development of innovative IT software

Duration: 4 hours per week.

The subjects are proposed by companies. For their assessment, students must submit a summary document and develop a poster.

A poster presentation session is scheduled.

During a "colloquium" the students present their works and exchange with a team of professionals

		<b>Coefficients</b>				<b>ECTS</b>
		Oral Presentation	Continuous assessment	Project	Final exam	6
DPAG		50%		50%		

### Partnership

ACTA  
 Agro Edi Europe  
 Capseine  
 COOP de France,  
 CRA Normandy  
 DEFISOL/INVIVO,  
 Inventiv IT  
 ISAGRI  
 IUNG Polish National Research Institute  
 PROAGRICA/F4F.