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HIGHER EDUCATION CAPACITY BUILDING

Erasmus+ Project

New curricula in Precision Agriculture using GIS technologies and sensing data

(CUPAGIS)

COURSES/PROGRAM DESCRIPTION

Name of the program: Professional Master in "Advanced Technologies for Precision Agriculture "

University: Abdelhamid Ibn Badis of Mostaganem

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Program of Semester 1: Master in "Advanced Technologies for Precision Agriculture"

Course title: **Yield sensors for precision agriculture**	**University:** Abdelhamid Ibn Badis of Mostaganem, Algeria
Degree: Master	**Standard period of study:** Semester 1 (October -March)
Web link of the university: www.univ-mosta.dz	
Web link of the program: www.univ-mosta.dz/projet-cupagis/	
Credit points (ECTS): 05	**Teaching language:** English and French
Contact (email): mansour.abed@univ-mosta.dz	

Course description:
This course covers information on sensor technologies for precision agriculture (PA) applications and their use in this field. The knowledge acquired is necessary to understand, use and exploit the sensors, in general, and those of yield, in particular, as input agricultural data for the development of precision agriculture.

Objectives:
At the end of this course, the students should be able to:
- Make the right choice of sensor to use for a given application by determining its physical principle, the nature of the signal at its output and its operating principle, whether passive or active,
- Read the information from the different sensors,
- Solve problems related to measurements,
- Perform measure and regulations based on programmable circuits (Arduino, Raspberry..),
- Design monitoring systems based on sensors of different types,
- Collect data and provide useful information for the evaluation phase of the PA cycle.

Prerequisites:
Some elementary bases on analog electronics and prerequisites on electrical and electronic sensors are recommended.

Course title:	**Remote Sensing**	**University:**	Abdelhamid Ibn Badis of Mostaganem, Algeria
Degree:	Master	**Standard period of study:**	Semester 1
Web link of the university:	http://www.univ-mosta.dz		
Web link of the program:	Distance learning program (Moodle) of the University of Mostaganem: http://e-fsnv.univ-mosta.dz/		
Credit points (ECTS):	4	**Teaching language:**	French
Contact (email):	tahar.farah@univ-mosta.dz		

Program description:

This remote sensing course will provide to students understanding of location, quantifying and monitoring the dynamics of agricultural cropping systems based on maps and satellites images processing. The program of this course is as follows:

1. Physical and technological bases of remote sensing,
2. Interaction of Electromagnetic Radiation (EMR) with the atmosphere,
3. Interaction of Electromagnetic Radiation (EMR) with the earth (vegetation, soil and water),
4. Remote sensing sensors
5. Notions of resolution (spatial, spectral, radiometric and temporal),
6. Notions of reflectances and emissions of objects on the ground

Objectives:

The students will be prepared to images processing and mapping of agricultural land and footbridges. They will discover the remote sensing sensors and how they can use them for agriculture applications.

Prerequisites:

Basic knowledge of mathematics, physics, computer science, biology, climatology, meteorology, hydrogeology and agronomy.

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Course title: **Plant and crop stress (1)**	**University:** Abdelhamid Ibn Badis of Mostaganem, Algeria
Degree: Master	**Standard period of study:** Semester 1 (October -March)
Web link of the university: www.univ-mosta.dz	
Web link of the program: www.univ-mosta.dz/projet-cupagis/	
Credit points (ECTS): 04	**Teaching language:** French
Contact (email): djamel.mahiout@univ-mosta.dz	

Program description:

Students will learn specific terminology of plant pathology, its historical components, and the diversity of symptoms presented by diseased plants. It analyses the relationship between symptomatology, damage and yield losses. Then we introduce student to abiotic diseases, and how we identify the parameters that condition their severity and their specificity in relation to non-parasitic diseases: climatic, edaphic, trophic and atmospheric factors. And another chapter provide the learner with the techniques used to identify a pathogen by presenting the main diagnostic steps. It also presents the main symptoms observed in diseased plants and the circumstances surrounding their appearance. The student will learn all the elements to be analysed during the diagnosis of a disease and the diagnostic steps. The method of taking samples in the field and the methods of isolating pathogens. A chapter is devoted to Detection of plant diseases by imaging sensors: In this chapter we introduce the student to optical detection techniques to identify primary disease outbreaks and optical detection techniques, combined with advanced data analysis methods to be used for targeted disease control programs and site-specific pesticide applications. The student will gain an overview of sensor technologies currently used for automated detection and identification of host-pathogen interactions, sensors implemented in precision agriculture and plant phenotyping applications at different scales, from single cell to whole ecosystem and the different platforms that can be leveraged and, therefore, the different plant parameters that can be observed. This chapter focuses on current and future trends in plant stress detection.

Objectives:

The objective of this course is to introduce students to methods of using sensors for the detection, identification and quantification of plant diseases. These sensors evaluate the optical properties of plants in different regions of the electromagnetic spectrum and are able to use information beyond the visible range. They allow the detection of early changes in plant physiology due to biotic and abiotic stresses, due to changes in tissue colour, leaf shape, transpiration rate, canopy morphology…etc.

Prerequisites:

Knowledge of French and English languages. Basic knowledge of plant physiology and plant pathology, some knowledge of electronics.

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Course title: **Image analysis and industrial vision for precision agriculture.**	**University:** Abdelhamid Ibn Badis of Mostaganem, Algeria
Degree: Master	**Standard period of study:** Semester 1 (October -March)
Web link of the university: www.univ-mosta.dz	
Web link of the program: www.univ-mosta.dz/projet-cupagis/	
Credit points (ECTS): 05	**Teaching language:** English and French
Contact (email): mostefa.merah@univ-mosta.dz	

Course description:

This course introduces students to the theory, applications and techniques of image analysis and computer vision for precision agriculture; it also provides students with an understanding of the issues involved in the development of image analysis and artificial vision. The course first introduces the "low level" image processing algorithms that are necessary for "medium level" vision or feature extraction. It continues with "high-level" algorithms such as pattern recognition, analysis and 3D modeling of objects and scenes. This course will also emphasize the practical integration of image analysis and machine vision, and related applications for precision agriculture.

Objectives:

At the end of this course, the students should be able to:

• Understand and master basic knowledge, theories and methods in image processing and computer vision and other distinctive features, stereo, motion and object recognition;
• Have an understanding of the software required to develop successful imaging and processing of this image;
• Analyze, evaluate and review existing practical computer vision systems;
• Identify, formulate and solve image processing and computer vision problems
• Identify basic concepts, terminology, models and methods of computer vision and image processing:
• Choose and apply image data processing methods related to image filtering, image enhancement, segmentation, classification and representation;
• Review image processing techniques for computer vision;
• Explain the analysis of shapes and regions;
• Design and develop practical and innovative image processing and computer vision applications or systems;
• Acquire your own experience through theoretical and programming exercises.

Prerequisites:

Basic concepts of mathematical analysis and linear algebra, digital image processing.

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Course title: **Global Navigation Satellite Systems.**	**University:** Abdelhamid Ibn Badis of Mostaganem, Algeria
Degree: Master	**Standard period of study:** Semester 1 (October -March)
Web link of the university: www.univ-mosta.dz	
Web link of the program: www.univ-mosta.dz/projet-cupagis/	
Credit points (ECTS): 05	**Teaching language:** English and French
Contact (email): Hadjira.benoudnine@univ-mosta.dz	
Course description: The proposed course presents a review of the main global navigation satellite systems (GNSS). These systems include satellite constellations in Earth orbit that broadcast their position in space and time, while networks of ground stations and receivers calculate ground positions by trilateration. The application of GNSS in the field of agriculture will be studied. Location, navigation and time synchronization play a vital role in surveying and precision farming. The activities and perspectives of this course are aimed at the study and practical implementation of GPS in the delimitation of plots, navigation and the control of equipment in agriculture.	
Objectives: At the end of this course, the students should be able to: • Understand basic knowledge, theories and methods of GNSS systems positioning • Understand basic knowledge, theories and methods for Global Positioning System (GPS) • Have an understanding of the software and hardware required to Global Positioning System (GPS) • Master the use of GPS receivers in standard and differential modes • Be able to make decisions on the purchase of GPS receivers suitable for precision agronomy	
Prerequisites: Basic concepts of mathematics, electronics and computer science,	

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Course title:	**Geographic Information Systems (GIS)1**	**University:**	Abdelhamid Ibn Badis University Mostaganem, Algeria
Degree:	Master	**Standard period of study:**	Semester 1 (October -March)
Web link of the university:	http://www.univ-mosta.dz		
Web link of the program:	Distance learning program (Moodle) of the University of Mostaganem: http://e-fsnv.univ-mosta.dz/		
Credit points (ECTS):	4	**Teaching language:**	French
Contact (email):	tahar.farah@univ-mosta.dz		

Course description:

The Geographic Information Systems "GIS" course is organized two parts, the first one is presented during the first semester and consist on introduction to digital cartography and the topography, the geodesy (shape and evolution of the earth) and the spatiocartography (maps themes generated from satellite images) topographic objects of point, linear, polygonal (or surface) and volume types. Mainly, the following lecturer will be provided to students

1. Generalities on the concept of geomatics (techniques, functionalities and investigation tools),
2. Components, functionalities and applications of GIS,
3. Basic concepts of topography (2D and 3D), geodesy and cartography,
4. Introduction and applications of GIS and remote sensing data processing software,
5. Laboratory activities and practical works

Objectives:

At the end of this course, the students should be able to:

- Understand GIS and remote sensing
- Apply computer science and technology in geographic information processing
- Master the data processing software of GIS and remote sensing
- Be able to manipulate the GIS tool in decision-making situations in precision agriculture

Prerequisites:

Basic knowledge of mathematics, physics, computers, topography and cartography.

Course title:	**English for specific purposes I**	**University:**	Abdelhamid Ibn Badis University Mostaganem, Algeria
Degree:	Master	**Standard period of study:**	Semester 1 (October -March)
Web link of the university:	http://www.univ-mosta.dz		
Web link of the program:	Distance learning program (Moodle) of the University of Mostaganem: http://e-fsnv.univ-mosta.dz/		
Credit points (ECTS):	2	**Teaching language:**	English
Contact (email):	Meriem.mokhtar@univ-mosta.dz		

Course description:

The course is focused on the development of academic terminology. Graduates will have knowledge and understanding of advanced English, including the correct use of formal and informal English. The ESP is based on the design of specific courses to give response to the needs of students who, beyond the learning of the common language, require a practice regarding certain professional areas.

Objectives:

At the end of course, the students should be able to:

- Reading, writing and listening in English
- Conduct interactive discussions in English

Prerequisites:

Advanced English, Technical bases necessary for writing academic and understanding text

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Course title:	**Communication and legislation for Agriculture**	**University:**	Abdelhamid Ibn Badis University Mostaganem, Algeria
Degree:	Master	**Standard period of study:**	Semester 1
Web link of the university:	http://www.univ-mosta.dz		
Web link of the program:	Distance learning program (Moodle) of the University of Mostaganem: http://e-fsnv.univ-mosta.dz/		
Credit points (ECTS):	1	**Teaching language:**	French
Contact (email):	Abdelkader.feninekh@univ-mosta.dz		

Course description:
Students will discover the main communication techniques in business and the methodology for promoting their products as well the discovery of the Algerian legislation on Agriculture, import and export laws for agricultural products.

Objectives:
At the end of this course, the students should be able to:

- Understand the techniques of Communication for agricultural development
- Identify the agriculture crisis communication
- Understand the Agricultural laws in Algeria
- Understand the International laws for the import and export of agricultural products

Prerequisites:
No a priori knowledge is required except mastery of the language of instruction

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Program of Semester 2: Master in "Advanced Technologies for Precision Agriculture"

Course title: **Soil physical properties and their measurements**	**University:** Abdelhamid Ibn Badis of Mostaganem
Degree: Master	**Standard period of study:** Semester 2 (March- July)
Web link of the university: www.univ-mosta.dz	
Web link of the program: www.univ-mosta.dz/projet-cupagis/	
Credit points (ECTS): 05	**Teaching language:** French
Contact (email): benkhellifa@hotmail.com	
Course description: This course aims to make students discovering the physical proprieties of soil. In fact, soil physics plays an important role in precision agriculture with regard to the proper use of machinery and soil protection. Information about the most important physical properties of the soil and its relationship is provided with the principles of its measurement. Different methods of measuring soil compaction, soil moisture content or soil infiltration rate are investigated.	
Objectives: At the end of this course, the learner should be able to: - Understand the soil properties - Master the geotechnical reconnaissance and soil classification - Understand the soil water properties - Understand the soil infiltration parameters - Know the soil hydrodynamics and - Understand the thermal properties o	
Requirements: Knowledge of French and English. Some basic notions in Physics and Mathematics.	

Course title: **Monitoring of agricultural machinery**	**University:** Abdelhamid Ibn Badis of Mostaganem
Degree: Master	**Standard period of study:** Semester 2 (March- July)
Web link of the university: www.univ-mosta.dz	
Web link of the program: www.univ-mosta.dz/projet-cupagis/	
Credit points (ECTS): 05	**Teaching language:** French
Contact (email): benkhellifa@hotmail.com	

Course description:

This course is intended to provide students with the technical bases of precision agriculture in order to facilitate understanding and adoption in the case of the use of different agricultural machines both in pedagogy and in research and technology transfer. It comprises :

- The basic concepts of precision agriculture involving various agricultural machinery management concepts and
- Strategies for monitoring the quality of work from plowing to harvesting.

Fertilizer dose control, localized plant management and seed application are all topics addressed from agronomic, economic and environmental perspectives.

The advantages and disadvantages of applications and their executions.

Objectives:

At the end of this course, the learner should be able to:

- Understand and master measurement of relevant physical properties associated with agricultural machinery
- Discover the electronic sensors and monitoring systems
- understand hydraulic power system in agricultural machinery
- Understand the control systems and actuators in agricultural machinery
- Discover the relevant agricultural tractor subsystems and hitching tractors and implements
- Understand automatic guidance systems and tillage management systems
- Discover the seeders and planters
- Understand the seeding rate modification technology for precision agriculture and fertilizer spreaders
- Understand agricultural sprayers
- Discover technology for changing fertilizer application rates
- Understand relevant combine and forage harvester subsystems.
- Understand production Assessment Technology for Precision Agriculture

Requirements:

Global knowledge in agricultural equipment

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Course title: Plant and crop stress	**University:** University Abdelhamid Ibn Badis Mostaganem
Degree: Master 1	**Standard period of study: S**emester 2 (March –July)
Web link of the university: www.univ-mosta.dz	
Credit points (ECTS): 4	**Teaching language:** French
Contact (email): z.labdaoui@esa-mosta.dz	

Course description:
This course aims to prepare a new generation of students for professional careers, which will promote precision integrated strategies in the management of weeds, pests and diseases, in order to foster sustainable agriculture in Algerian agro-ecosystems. The course deals with the management of weeds, pests and diseases in agriculture with a view towards agro-ecological and food systems. Students will learn the ecological and epidemiological characteristics of weeds, pests and pathogens, while applying innovative and intelligent tools in particular GIS technologies. Integrated control strategies against bio-aggressors will be introduced and analyzed in depth, in particular against pests and weeds affecting the main crops in Algeria.

Objectives:
At the end of this course, the learner should be able to:

- Discovers methods for detecting and diagnosing the main crop pests
- Master strategies to control crop bio-aggressors and food quality and safety
- Master the detection and identification of weeds techniques
- Master the use of remote sensing of parasitic nematodes and fungal pathogens in soil

Prerequisites:
crop pest, crop protection

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Course title:	**Geographic Information Systems (GIS)2**	**University:**	Abdelhamid Ibn Badis University Mostaganem, Algeria
Degree:	Master	**Standard period of study:**	Semester 2 (March –july)
Web link of the university:	http://www.univ-mosta.dz		
Web link of the program:	Distance learning program (Moodle) of the University of Mostaganem: http://e-fsnv.univ-mosta.dz/		
Credit points (ECTS):	4	**Teaching language:**	French
Contact (email):	tahar.farah@univ-mosta.dz		

Course description:
The student having followed the course of Geographic Information Systems "GIS" will have acquired a competence in digital cartography allowing him to appreciate the topography (relief), the geodesy (shape and evolution of the earth) and the spatiocartography (maps themes generated from satellite images) topographic objects of point, linear, polygonal (or surface) and volume types.

Objectives:
At the end of this course, the students should be able to:

- Understand Geographic data acquisition modes
- Master the fundamental spatial notions
- Master the geographic Information Systems (GIS) flowcharts
- Use the Arcgis software

Prerequisites:
Basic knowledge of mathematics, physics, computers, topography and cartography.

Course title: **Mechatronics of objects in the field of agriculture**	**University:** Abdelhamid Ibn Badis of Mostaganem
Degree: Master	**Standard period of study:** Semester 2 (March –July)
Web link of the university: www.univ-mosta.dz	
Web link of the program: www.univ-mosta.dz/projet-cupagis/	
Credit points (ECTS): 05	**Teaching language:** French
Contact (email): chchmosta07@yahoo.fr	

Course description:

Both courses cover information on technologies concerning different stages in precision agriculture that involve a multitude of actors, a large number of data and information systems. The new technologies used in this field will lead to an intensification of agricultural information. This mass of heterogeneous information, by its quality (accuracy, scale, etc.), its nature (image, specific values, etc.), its origin and its moment of acquisition is certainly precious but can quickly become a very significant handicap and a source possible errors in decision-making for the management of cultivation work.

Objectives:

At the end of these two courses, the learner should be able to:

- Make the right choice of simulation software to use for a given application, the choice of equipment and their operating principle,
- Read the information and its use,
- Solve the problems related to modern agriculture,
- Carry out regulations and the operation of equipment,
- Design monitoring systems based on the choice of sensors of different types,
- Collect data and provide useful information for plant monitoring.

Requirements:

Some elementary bases on the equipment and prerequisites on the different types of sensors are recommended.

Course title:	**Application of Remote Sensing**	**University:**	Abdelhamid Ibn Badis University, Mostaganem, Algeria
Degree:	Master in spatial techniques and application, remote sensing option	**Standard period of study:**	Semester 1 and 2
Web link of the university:	http://www.univ-mosta.dz		
Web link of the program:	Distance learning program (Moodle) of the University of Mostaganem: http://e-fsnv.univ-mosta.dz/		
Credit points (ECTS):	4	**Teaching language:**	French
Contact (email):	tahar.farah@univ-mosta.dz		

Course description:

This course is a complement part for Remote Sensing course presented during Semester 1. In this course, the students will focus on the following lessons:.

1. Overview of some satellite image acquisition platforms (e.g. Sentinel),
2. Preprocessing, processing and analysis of satellite image,
3. Automatic image classification and calculation of spectral index,
4. Integration, formatting and export of remotely sensed data using GIS software.
5. Active remote sensing (radar images)
6. Integration and applications of radar data

Objectives:

The application of remote sensing course will

- Show learners how optical and radar images are acquired by ground and space-based on remote sensing sensors.
- Enable learners to download, correct, process and use satellite images in mapping,
- Allow students reconnaissance and monitoring the farmland
- Yield improvement of agricultural activities.

Prerequisites:

Basic knowledge of mathematics, physics, computer science, biology, climatology, meteorology, hydrogeology and agronomy.

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Course title:	**Economics for Precision agriculture**	**University:**	Abdelhamid Ibn Badis University Mostaganem, Algeria
Degree:	Master	**Standard period of study:**	Semester 2 (March-july)
Web link of the university:	http://www.univ-mosta.dz		
Web link of the program:	Distance learning program (Moodle) of the University of Mostaganem: http://e-fsnv.univ-mosta.dz/		
Credit points (ECTS):	2	**Teaching language:**	English
Contact (email):	Djamel.labdaoui@univ-mosta.dz		

Course description:

The course is focused on the economic theories and methodologies of precision agriculture. It will be presented through lectures, seminars and practical demonstrations and the analysis of economic data.

The main topics discussed during this course are:

- Introduction to knowledge of economics
- Growth and development
- Important economic factors for precision agronomy
- Forms of investment in precision agriculture
- Economic policies

Objectives:

The purpose of the course is to present to students the economic model related to the field of agronomy in Algeria and to give a general overview of precision agriculture (characteristics, technologies and practices).

It will focus on the economic efficiency of precision agriculture in terms of agricultural production system and agricultural production practices.

Prerequisites:

Advanced English, Technical bases necessary for writing academic and understanding text

Course title:	**English for specific purposes II**	**University:**	Abdelhamid Ibn Badis University Mostaganem, Algeria
Degree:	Master	**Standard period of study:**	Semester 2 (March-july)
Web link of the university:	http://www.univ-mosta.dz		
Web link of the program:	Distance learning program (Moodle) of the University of Mostaganem: http://e-fsnv.univ-mosta.dz/		
Credit points (ECTS):	2	**Teaching language:**	English
Contact (email):	Meriem.mokhtar@univ-mosta.dz		

Course description:
The course is focused on the main courses on the Master program but presented in English such as

1. Soil Properties
2. Historic Perspectives of Precision Agriculture
3. Precision Irrigation Systems
4. Application of remote sensing methods
5. Precision Farming Economics

Objectives:
The purpose of the course is to enable students to communicate their English effectively in a scientific context especially of precision agriculture. Students are prepared to read and comprehend their own field materials in English without any or at least little difficulty

Prerequisites:
Advanced English, Technical bases necessary for writing academic and understanding text

Program of Semester 3: Master in "Advanced Technologies for Precision Agriculture"

Course title:	**Precision farming**	**University:**	Abdelhamid Ibn Badis University, Mostaganem, Algeria
Degree:	Master	**Standard period of study:**	Semester 3 (September –February)
Web link of the university:	http://www.univ-mosta.dz		
Web link of the program:	Distance learning program (Moodle) of the University of Mostaganem: http://e-fsnv.univ-mosta.dz/		
Credit points (ECTS):	5	**Teaching language:**	French
Contact (email):	Djamel.mahiout@univ-mosta.dz		

Course description:

This course is organized so that students will be more familiar with Precision farming, the main lessons are the following :

- Precision selection
- Electronic identification, on-board sensors, wireless communication: access routes to precision farming
- Precision breeding in cattle
- Precision farming in low-intensity systems
- Precision tools for horses
- Poultry animal health and welfare
- Monitoring of animals by Health markers.

Objectives:

This course will provide to students general understanding of Precision Animal Husbandry and specialized training. Main techniques and methods related to precision techniques applied to animal science will be analysed such as: precision management of livestock, precision feeding and computerized breeding management.

The precision monitoring of infectious and non-infectious diseases will presented.

Moreover, this course will provide training to learners (future executives) in the field of animal and/or livestock specialists, employable and adaptable, able to cope with complex issues to develop livestock and animal production sectors in Algeria

Prerequisites:

Basic knowledge of physiology of digestion and reproduction of farm animals and knowledge of animal health and prophylaxis.

Course title:	**Precision Irrigation Management**	**University:**	Abdelhamid Ibn Badis University, Mostaganem, Algeria
Degree:	Master	**Standard period of study:**	Semester 3 (September –February)
Web link of the university:	http://www.univ-mosta.dz		
Web link of the program:	Distance learning program (Moodle) of the University of Mostaganem: http://e-fsnv.univ-mosta.dz/		
Credit points (ECTS):	4	**Teaching language:**	French
Contact (email):	benkhellifa@hotmail.com		

Course description:

This course describe how to monitor and characterize the spatial and temporal variation of water dynamics in the soil-plant-atmosphere continuum and water consumption by plants. Mainly, the following topics will be discussed :

- Irrigation bases
- Basics of irrigation management
- Remote sensing applied to irrigation
- Variable irrigation technology
- Assessment of irrigation systems
- Automation of irrigation systems
- Fertigation

Objectives:

The objectives of this course are to analyse the variability of the soil cultivation system at field scale, to develop precision irrigation with prescription maps, to design and manage (also with the support of networks of sensors) of pressurized irrigation systems, in order to improve water, use efficiency and quality of agricultural products. The student will be able to acquire skills related to the use of calculation tools, statistical analysis and GIS, as well as the use of sensors to monitor the state of the ground and the crop water. In addition, the student will have technical and scientific language skills and the ability to interact with other professional personalities in team activities.

Prerequisites:

Prerequisites: comprehensive knowledge of the soil-plant-water continuum

Course title:	Data processing technologies for precision agriculture.	**University:**	Abdelhamid Ibn Badis University, Mostaganem, Algeria
Degree:	Master	**Standard period of study:**	Semester 3 (September –February)
Web link of the university:	http://www.univ-mosta.dz		
Web link of the program:	Distance learning program (Moodle) of the University of Mostaganem: http://e-fsnv.univ-mosta.dz/		
Credit points (ECTS):	5	**Teaching language:**	English -French
Contact (email):	Djazia.bendani@univ-mosta.dz		

Course description:

This course introduce to students the theory and techniques of data processing technologies for precision agriculture. Mainly, the following topics will be discussed :

- Examination of mono-variable and bi-variable statistical analysis and probability theory
- Collection and representation of information, scale and spatial resolution and calculation of uncertainty
- Multi-variable analysis
- Hierarchical and non-hierarchical clustering method (K-means)
- Analysis of variance (ANOVA)
- Regression and Generalized Linear Models
- Generalized linear and spatio-temporal models
- Spatio-temporal models
- Random variables Variogram analysis and kriging theory
- Cross-validation and solved exercises in R software

Objectives:

This course enables students to first understand and apply statistical techniques to read numerical agricultural numerical data, represent them, and then apply geometric or geostatic tools to estimate this information, allow them to understand, develop the relevant data and provide useful recommendations in the field of precision agriculture.

Prerequisites:

Basic concepts of mathematical analysis and linear algebra.

Course title:	**Web Technologies**	**University:**	Abdelhamid Ibn Badis University, Mostaganem, Algeria
Degree:	Master	**Standard period of study:**	Semester 3 (September –February)
Web link of the university:	http://www.univ-mosta.dz		
Web link of the program:	Distance learning program (Moodle) of the University of Mostaganem: http://e-fsnv.univ-mosta.dz/		
Credit points (ECTS):	4	**Teaching language:**	English -French
Contact (email):	mohamed.moussai@univ-mosta.dz		

Course description:
This course provides to students the computer knowledge and methods specific to web applications. The following topics will be discussed :

- Introduction aux technologies Web
- CSS
- XML et DTD
- JavaScript
- PHP

Objectives:
The objective of this course is to give students computer knowledge and methods specific to web applications. In its first part, this course deals with so-called “client-side” Web technologies, namely HTML, CSS and JavaScript. The main concepts are presented as well as the most used elements. The second part of this course is dedicated to server-side technologies where the PHP language is presented.

Prerequisites:
Basic concepts in programming

Course title:	**English for specific purposes III**	**University:**	Abdelhamid Ibn Badis University Mostaganem, Algeria
Degree:	Master	**Standard period of study:**	Semester 3 (September to February)
Web link of the university:	http://www.univ-mosta.dz		
Web link of the program:	Distance learning program (Moodle) of the University of Mostaganem: http://e-fsnv.univ-mosta.dz/		
Credit points (ECTS):	2	**Teaching language:**	English
Contact (email):	Meriem.mokhtar@univ-mosta.dz		

Course description:
The course is focused on the main courses on the Master program but presented in English such as

1. Plant and Crop Stresses
2. .Precision Agriculture
3. Geographic Information Systems
4. Global Navigation Satellite System
5. Yield sensors for precision agriculture

Objectives:
The course objective is to familiarize students with the terminology of precision agriculture. Graduates will also have increased knowledge of the common as well as specialized terminology and phraseology used in English within the academic environment, with emphasis on their subject areas.

Prerequisites:
Advanced English, Technical bases necessary for writing academic and understanding text

Course title:	**Entrepreneurship in Agriculture**	**University:**	Abdelhamid Ibn Badis University, Mostaganem, Algeria
Degree:	Master	**Standard period of study:**	Semester 3 (September –February)
Web link of the university:	http://www.univ-mosta.dz		
Web link of the program:	Distance learning program (Moodle) of the University of Mostaganem: http://e-fsnv.univ-mosta.dz/		
Credit points (ECTS):	1	**Teaching language:**	English -French
Contact (email):	Djamel.labdaoui@univ-mosta.dz		

Course description:
This course provides to students the basic tools for the understanding Entrepreneurship and procedures to establish their own start-ups. The following topics will be discussed :

- Operational preparation for employment
- Entrepreneurship and entrepreneurial spirit
- The profile of an entrepreneur and the profession of entrepreneur
- Find a good business idea
- Start and run a business
- Development of the business plan
- The Business Model and the Business Plan, Realizing your business project with the Business Model CanvasOperational preparation for employment

Objectives:
The objective of this course is to :
- Develop entrepreneurial skills in students;
- Sensitize students and familiarize them with the possibilities, challenges, procedures, characteristics, attitudes and skills that entrepreneurship requires;
- Prepare students so that they can, one day or another, create their own business or, at least, better understand their work in companies

Prerequisites:
No particular knowledge, except mastery of the language of instruction.