

**1. General information****Course:** NEW TECHNOLOGIES IN AGRONOMY**Code:** 60372**Type:** ELECTIVE**ECTS credits:** 4.5**Degree:** 411 - UNDERGRADUATE DEGREE PROGRAMME IN AGRICULTURAL AND FOOD ENGINEERING**Academic year:** 2023-24**Center:** 107 - E.T.S. OF AGRICULTURAL ENGINEERS OF C. REAL**Group(s):** 20**Year:** 4**Duration:** First semester**Main language:** Spanish**Second language:****Use of additional languages:****English Friendly:** Y**Web site:****Bilingual:** N**Lecturer:** PABLO ANTONIO MORALES RODRIGUEZ - Group(s): 20

Building/Office	Department	Phone number	Email	Office hours
San Isidro Labrador/0.17	PROD. VEGETAL Y TGIA. AGRARIA	926052710	Pablo.Morales@uclm.es	Tuesdays, Wednesdays and Thursdays from 12:00 to 14:00 hours. It is recommended to contact the professor previously.

Lecturer: JAIME VILLENA FERRER - Group(s): 20

Building/Office	Department	Phone number	Email	Office hours
E.T.S. Ingenieros Agrónomos CR/0.18	PROD. VEGETAL Y TGIA. AGRARIA		Jaime.Villena@uclm.es	Monday 12.00-15.00 h; Tuesday, Wednesday and Thursday 14.00-15.00 h.

2. Pre-Requisites

No prerequisites have been established. It is recommended to have studied Graphic Expression (first year) and Topography (second year).

3. Justification in the curriculum, relation to other subjects and to the profession

This subject is closely related to multiple subjects studied in the degree, as it is an optional subject in the last year of the degree and it introduces the student to new technologies in the world of agronomy. In addition, it is recommended to have taken the subjects of Graphic Expression (first year) and Topography (second year), it can be complemented with the subject of Infrastructure Planning and Agricultural Mechanisation (fourth year) and can be considered a basic subject for the Master's Degree in Agronomic Engineering.

Innovation and technological renovation in the agricultural sector involve transmitting knowledge to agricultural engineering professionals, as well as awakening interest and a spirit of innovation, cooperation with the science-technology-business system and the competitiveness of the productive structure.

Nowadays, the agricultural sector is undergoing a major transformation. Every day, sensors, instrumentation and working methodologies are emerging that can quickly and cost-effectively achieve the desired sustainability and competitiveness in many agricultural applications.

Some of the future professional activities that engineers of the future will have to carry out include: i) calculating vegetation indices and creating maps of inputs to be applied to each plot, ii) monitoring crops for precision irrigation programming and iii) making remote sensing maps compatible with agricultural machinery. To help with these and many other activities, we have tools for the processing (analysis and representation) of spatial data such as Geographic Information Systems (GIS) or Unmanned Aircraft Systems (UAS) and their associated technologies (software).

The use of this technology in precision agriculture is justified for different reasons, such as the fact that the images and information can be taken with UAS at the right moment, which allows them to adapt very well to the conditions of the crop or the fact that the images have a higher spatial resolution, capable of detecting weeds or monitoring diseases since they can be flown at low altitude.

The development of the subject provides future graduates with invaluable help in the development of work in the rural environment, complementing their training, from support in decision-making in the application of irrigation or crop treatments by thermography, topographical surveys, use of computer programmes, surveillance and general inspection, sampling and even application of certain treatments, monitoring of extensive livestock, leak detection in agri-food industries, etc., improving productivity and environmental sustainability.

4. Degree competences achieved in this course**Course competences**

Code	Description
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E45	Ability to know, understand and use the principles of knowledge of complementary subjects specialising in Agricultural Farming, with an open, multidisciplinary character and with direct application in the professional scope of the Agricultural Technical Engineer
G01	Knowledge of a foreign language
G03	Speaking and writing skills
G04	Analysis and synthesis capacity
G05	Organization and planning capacity
G07	Problem resolution
G08	Decision-making
G09	Ethical commitment and professional ethics
G10	Teamwork
G11	Interpersonal relationship skills
G13	Teamwork
G14	Autonomous Learning
G15	Adaptation to new situations
G16	Creativity
G17	Leadership
G18	Initiative and entreprising spirit
G19	Quality Motivation
G20	Environmental sensitivity
G21	Ability to apply practical knowledge
G22	Basic knowledge of the profession
G23	Ability to communicate with non-experts
G31	Ability to solve problems with creativity, initiative, methodology and critical thinking
G34	Ability to develop their activities, assuming a social, ethical and environmental commitment in tune with the reality of the human and natural environment.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Improve the capacity to integrate new technologies with the environmental impact within the agri-food sector, being sensitive to the capacity to participate in multidisciplinary initiatives or groups.

Possibility of autonomously expanding specific knowledge through the search for new applications or by developing those already acquired.

Acquire knowledge and skills in the use of specific tools that provide the student with a greater operational capacity of the acquired knowledge.

Identification and use of emerging technologies in the field of Agricultural and Agri-food Engineering.

Complement basic and specific training oriented to a certain specialisation with an open, multidisciplinary character and with direct application in the professional field.

6. Units / Contents

Unit 1: 3D Printing

Unit 1.1 Introduction to 3D printing

Unit 1.2 The 3D printer: description and types

Unit 1.3 Materials for printing

Unit 1.4 Model creation

Unit 1.5 Laminating and printing models

Unit 2: Unmanned Aerial Systems (UAS) and their applications in agronomy

Unit 2.1 Introduction to UAS

Unit 2.2 Flight Systems: Principles of operation and piloting

Unit 2.3 Current UAS regulations

Unit 2.4 Forecast and flight schedule

Unit 2.5 Remote sensing and photogrammetry

Unit 2.6 Precision agriculture techniques using drones/UAS

Unit 3: Geographic Information Systems (GIS)

Unit 3.1 Introduction to GIS

Unit 3.2 Vector and raster models

Unit 3.3 Operations and analysis in vector models

Unit 3.4 Operations and analysis in raster models

Unit 3.5 Resolution of practical cases

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	E45 G01 G04 G05 G08 G13 G20 G22	0.58	14.5	Y	N	Participative master lecture in which theoretical concepts are analysed and specific topics of the programme are screened with the active participation of the students. Presentations and explanations are necessary for the understanding of the programme content. This activity will be assessed through performance in the corresponding

							exams and assignments.
Class Attendance (practical) [ON-SITE]	Problem solving and exercises	E45 G03 G04 G05 G07 G08 G10 G11 G13 G21 G22	0.5	12.5	Y	N	Lectures with active student participation in which problems will be solved and practical cases will be analysed. This activity will be assessed through performance in the corresponding exams and assignments.
Writing of reports or projects [OFF-SITE]	Self-study	E45 G01 G03 G04 G05 G07 G08 G09 G10 G11 G13 G14 G15 G16 G18 G19 G20 G21 G22	1.7	42.5	Y	N	Preparation of individual work with case studies on specific topics related to the subject, tutored by the professor. This activity is not recoverable. This activity will be assessed on the performance in the corresponding assignments and reports ("work" assessment system).
Study and Exam Preparation [OFF-SITE]	Self-study	E45 G01 G04 G05 G07 G13 G14 G16 G18 G19 G20 G21 G22	1	25	N	-	Non-attendance work by the student for the preparation of exams. This activity will be assessed in the exams and papers presented.
Final test [ON-SITE]	Assessment tests	E45 G03 G04 G05 G07 G08 G13 G15 G16 G19 G21 G22	0.1	2.5	Y	N	Practical and theoretical exams.
Class Attendance (practical) [ON-SITE]	Practical or hands-on activities	E45 G01 G03 G04 G05 G07 G08 G09 G10 G11 G13 G14 G15 G16 G18 G19 G20 G21 G22	0.5	12.5	Y	Y	Resolution of practical cases with computer and activities related to remote sensing and photogrammetry. This activity can be recovered in the extraordinary call. This activity will be assessed in the exams and assignments.
Project or Topic Presentations [ON-SITE]	Individual presentation of projects and reports	G03 G04 G05 G07 G08 G10 G13 G14 G17 G21 G22 G23 G31 G34	0.12	3	Y	N	Individual or group presentation of specific topics related to the subject. This activity is not recoverable. This activity will be evaluated through the performance in the assignments ("oral presentation of topics" evaluation system).
Total:			4.5	112.5			
Total credits of in-class work: 1.8			Total class time hours: 45				
Total credits of out of class work: 2.7			Total hours of out of class work: 67.5				

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System			
Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Projects	20.00%	20.00%	Continuous assessment: Individual or group work complementary to the activities. Creation of models and 3D printing, creation of orthomosaics, development of reports and case studies with GIS. Work of different modalities in continuous and non-continuous assessment.
Assessment of active participation	5.00%	0.00%	Participatory attendance and student motivation in theory and practical classes will be assessed.
Final test	70.00%	80.00%	Examination of theoretical and practical content.
Oral presentations assessment	5.00%	0.00%	Continuous assessment: Oral presentation of individual or group topics.
Total:	100.00%	100.00%	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

In principle, all students are considered to follow the continuous assessment mode. Students may change to the non-continuous assessment mode, provided that they have not completed 50% of the assessable activities, by giving prior notice to the professors. Once this 50% of evaluable activities has been reached or if, in any case, the class period has ended, the student will be considered to be in continuous assessment without the possibility of changing assessment mode.

Continuous assessment for the student will consist of a final test with theory and problems (70% of the overall mark); completion of assignments or reports (questionnaires/assignments, resolution of reports or assignments, 20% of the overall mark), assessment of active participation (5% of the overall mark) and oral presentations (5% of the overall mark).

The final exam will be divided into two blocks (Block I: Topic 1 and 2 and Block II: Topic 3), being necessary to obtain a grade higher than or equal to 40% of the mark in each of the two blocks mentioned. If these minimum scores are not reached, the overall grade in the minutes will correspond to the grade of the test, being a maximum of 4 (fail).

In order to pass the course, a minimum grade of 5 out of 10 in the overall grade is required.

Non-continuous evaluation:

Non-continuous assessment: On the date corresponding to the ordinary call, the student will take an exam (final test 80%) in which the theoretical and practical contents developed throughout the course will be evaluated, being necessary to obtain a minimum qualification of 4 out of 10. A Project proposed by the professors will also be assessed (Projects 20%). This work will be defended on the same date or on a date previously arranged for this purpose, where the student will answer the appropriate questions that justify their authorship.

In order to pass the course, a minimum grade of 5 out of 10 in the overall grade is required. Students who do not pass the course in the ordinary exam will be assessed with the same criteria in the extraordinary exam.

Specifications for the resit/retake exam:

The same criteria will be followed as in the final exam, keeping in this call the grades obtained in the items Assessment of active participation, Oral Presentation assesment, Projects (continuous assessment), and Projects (non-continuous assessment) of the final exam.

In order to pass the course, students must obtain a minimum grade of 5 out of 10 in the overall grade.

Students who do not pass the course in this exam will have to take the whole course again.

Specifications for the second resit / retake exam:

The same criteria will be followed as for the assessment of the final exam in non-continuous assessment.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
Class Attendance (theory) [PRESENCIAL][Lectures]	14.5
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	12.5
Writing of reports or projects [AUTÓNOMA][Self-study]	42.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	25
Final test [PRESENCIAL][Assessment tests]	2.5
Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities]	12.5
Project or Topic Presentations [PRESENCIAL][Individual presentation of projects and reports]	3
Global activity	
Activities	hours
Class Attendance (theory) [PRESENCIAL][Lectures]	14.5
Final test [PRESENCIAL][Assessment tests]	2.5
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	12.5
Writing of reports or projects [AUTÓNOMA][Self-study]	42.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	25
Project or Topic Presentations [PRESENCIAL][Individual presentation of projects and reports]	3
Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities]	12.5
Total horas: 112.5	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Marina Lietti, Pedron Millán García	Manual Drones: Tecnología aplicada a campos de golf	IC editorial		978-84-17343-68-2	2018	
David Virués Ortega, José Antonio García-Cabañas Bueno	Piloto de dron (RPAS)	S.A. Ediciones Paraninfo		8428338736	2016	
Emilio Ortega Pérez	Sistemas de información geográfica : teoría y práctica /	Dextra,		978-84-16277-67-4	2016	
Arozarena Villar, Antonio.	Sistemas de captura de la información : fotogrametría y tele	Dextra,			2016	
Martínez Delgado, Sara	Introducción a Quantum GIS (QGIS) : aplicaciones en ingenier	Garceta,		978-84-1728-946-1	2019	
Tadeo Espinoza, Arturo	Aplicaciones de drones en ingeniería civil : topografía, ins	Marcombo,		978-84-267-3435-8	2022	