

**1. General information****Course:** COMPUTER VISION**Type:** ELECTIVE**Degree:** 359 - UNDERGRAD. IN INDUSTRIAL ELECTRONICS AND AUTOMAT. ENGINEERING (CR)**Center:** 602 - E.T.S. INDUSTRIAL ENGINEERING OF C. REAL**Year:** 4**Main language:** Spanish**Use of additional languages:****Web site:****Code:** 56521**ECTS credits:** 6**Academic year:** 2023-24**Group(s):** 20**Duration:** C2**Second language:** English**English Friendly:** Y**Bilingual:** N**2. Pre-Requisites**

Basic knowledge using and programming computers

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

Computer Vision is a field widely used in industrial applications such as control quality, process control, navigation, medical imaging, etc. This subject provides knowledge and skills to design and develop a computer vision system. Software applications are the main element for these systems which are based on image analysis. The subject is closely related to other programming subjects, such as Computer Science, Industrial Computing and Advanced Computer Science.

The subject is also related to Biomedical Engineering and the Signal Processing subject, due to the image can be considered as a two-dimensional signal.

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

Code	Description
A02	To know how to apply knowledge to work or vocation in a professional manner and possess the competences that are usually demonstrated by the formulation and defence of arguments and the resolution of problems in the field of study.
A08	Appropriate level of oral and written communication.
A13	Ability to take the initiative to solve problems, take decisions, creativity, critical reasoning and ability to communicate and transmit knowledge, skills and abilities in Industrial Electronic Engineering and Automation.
E02	Knowledge of technologies that enable processes of automatization and complex systems to be dealt with.
E04	Ability to automatize manufacturing and production processes.
E06	Knowledge to develop automatic quality control systems.
E08	Knowledge of hardware and software necessary for the development of specialized computer systems used in automatized and robotic systems.

5. Objectives or Learning Outcomes**Course learning outcomes****Description**

Ability to design and implement discrete systems for processing signals on a computer

Know how to improve the benefits of circuits using the SPICE tool in combination algorithms

Anticipate and resolve communication problems in noisy surroundings

Know how to apply circuit simulation tools in the analysis of noise, analysis of circuits with analogue and digital devices and analysis of worst case scenario

Know how to apply the tool SPICE in iterative analyses of circuits with elements affected by tolerances

Knowledge and use of design flows and synthesis relating to programmable and configurable devices.

Ability to select and programme microcontrollers in the design of built-in control systems

Ability to analyze signals and discrete systems in the domain of frequencies

Additional outcomes**6. Units / Contents****Unit 1: Introduction****Unit 2: The digital image****Unit 3: Pre-processing****Unit 4: Contour detection****Unit 5: Segmentation****Unit 6: Descriptors****Unit 7: Recognition****Unit 8: Motion****ADDITIONAL COMMENTS, REMARKS**

Memoria verticada	Guía-e
Concepts and elements of a vision system	Unit 1
Geometric models of cameras	Unit 2
Visual information processing	Unit 2
Image operators	Units 3, 4
Image processing	Unit 3
Processing and feature extraction	Units 4, 5 y 6
Pattern representation and recognition	Unit 7
Applications	Units 1, 2, 3, 4, 5, 6 y 7

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	A02 A04 A05 A07 A08 A12 A13 A18 E01 E02 E03 E04 E05 E06 E08	1.2	30	N	-	
Laboratory practice or sessions [ON-SITE]	Combination of methods	A02 A04 A05 A07 A08 A12 A13 A18 E01 E02 E03 E04 E05 E06 E08	1.2	30	Y	N	
Study and Exam Preparation [OFF-SITE]	Self-study	A02 A04 A05 A07 A08 A12 A13 A18 E01 E02 E03 E04 E05 E06 E08	3.6	90	Y	N	
Total:			6	150			
Total credits of in-class work: 2.4			Total class time hours: 60				
Total credits of out of class work: 3.6			Total hours of out of class work: 90				

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
Assessment of problem solving and/or case studies	25.00%	25.00%	An extensive practical exercise
Projects	25.00%	25.00%	
Theoretical exam	50.00%	50.00%	
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:

The evaluation will consist of:

- Practical sessions exercises
- An extensive practical exercise focused on solving and developing a computer vision application
- Theoretical work (report and presentation) related to the subject
- Final test

To pass the subject in the ordinary call the student must reach the minimum score of 5/10.

Non-continuous evaluation:

Evaluation criteria not defined

Specifications for the resit/retake exam:

The evaluation conditions are the same. If the student has reached in a previous part a minimum score of 5 (except the written test), that score may be reused for this evaluation.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
Unit 1 (de 8): Introduction	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Laboratory practice or sessions [PRESENCIAL][Combination of methods]	2
Unit 2 (de 8): The digital image	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Laboratory practice or sessions [PRESENCIAL][Combination of methods]	4
Unit 3 (de 8): Pre-processing	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	4

Laboratory practice or sessions [PRESENCIAL][Combination of methods]	4
Unit 4 (de 8): Contour detection	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Laboratory practice or sessions [PRESENCIAL][Combination of methods]	4
Unit 5 (de 8): Segmentation	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Laboratory practice or sessions [PRESENCIAL][Combination of methods]	4
Unit 6 (de 8): Descriptors	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Laboratory practice or sessions [PRESENCIAL][Combination of methods]	4
Unit 7 (de 8): Recognition	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Laboratory practice or sessions [PRESENCIAL][Combination of methods]	4
Unit 8 (de 8): Motion	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Laboratory practice or sessions [PRESENCIAL][Combination of methods]	4
Global activity	
Activities	hours
Laboratory practice or sessions [PRESENCIAL][Combination of methods]	30
Class Attendance (theory) [PRESENCIAL][Lectures]	30
Total horas: 60	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Escalera Hueso, Arturo de la	Visión por computador : fundamentos y métodos	Prentice Hall		84-205-3098-0	2001	
Escalera Hueso, Arturo de la	Visión por computador : fundamentos y métodos	Prentice Hall		978-84-205-3098-7	2006	
Fuente López, Eusebio de la	Visión artificial industrial : procesamiento de imágenes par	Universidad de Valladolid, Secretariado de Publ		978-84-8448-730-2	2012	
Pajares Martinsanz, Gonzalo	Visión por computador : imágenes digitales y aplicaciones	Ra-Ma		84-7897-472-5	2001	
Pajares Martinsanz, Gonzalo	Visión por computador : imágenes digitales y aplicaciones	Ra-Ma		978-84-7897-831-1	2007	