



DISCIPLINE ACADEMIC SHEET
ACADEMIC YEAR 2025 – 2026

1. PROGRAMME DATA

1.1. Higher Education Institution	UNIVERSITY OF CRAIOVA
1.2. Faculty	Automation, Computers and Electronics
1.3. Department	Computers and Information Technology
1.4. Field of Study	Computers and Information Technology
1.5. Study level	L(License / Undergraduate)
1.6. Organizational form	IF
1.7. Study Program (name/code) /Qualification	Computers / L2060101010

2. DISCIPLINE DATA

2.1 Discipline Name	Image Processing and Pattern Recognition						
2.2 Course Activities Holder	Prof. dr. ing. Dorian Cojocaru						
2.3. Practical Activities Holder	Conf. dr. ing. Florin Manta						
2.4. Study Year	4	2.5. Semester	1	2.6. Evaluation type	E	2.7. Discipline regime	DFA

3. ESTIMATED TOTAL TIME (hours per semester of teaching activities)

3.1. Number of hours per week	4	in which: 3.2 course	2	3.3. sem./lab./pr.	2
3.4. Total hours of curriculum	56	in which: 3.5 course	28	3.6. sem./lab./pr.	28
3.7. Time distribution - hours/week					hours
Study after manual, course support, bibliography and notes					-
Additional documentation in library, on specialized electronic platforms and field					8
Training seminars / labs, homework, portfolios and essays					14
Tutorial					-
Examinations					2
Other activities.....					-
Total hours per individual activities					19
3.8. Total hours per semester					75
3.9. Number of credits					3

4. PRECONDITIONS (where appropriate)

4.1. of curriculum	The student must possess specialized knowledge acquired in the following disciplines: Computer Programming and Programming Languages, Digital Electronics, Digital Computer Architecture, Fundamentals of Robotics, Numerical Methods, Sensors and Sensor Systems.
4.2. of competence	Not necessary.

5. CONDITIONS (where appropriate)

5.1. of the course	• For on-site teaching:
5.2. of seminar/ laboratory/project	•

6. COURSE OBJECTIVES – expected learning outcomes that are supported by completing and passing the course

Knowledge	The student/graduate describes, identifies and summarizes elementary concepts and methods regarding the modeling, analysis, design and testing of computing systems, with microcontrollers or processors, of operating systems, of graphic processing systems and of data acquisition systems.
Skills (Abilities)	The student/graduate elaborates models for different components of computing systems, hardware and software, and evaluates the functional and non-functional characteristics. The student/graduate uses specific methods and tools for the analysis, design and implementation of acquisition systems, graphic processing systems, data processing and display systems. The student/graduate designs and implements functional systems of small/medium complexity with microprocessors.
Responsibility and autonomy	The student/graduate shows a spirit of initiative and action for updating professional, economic and organizational culture knowledge.

7. CONTENT

7.1. Course	The method of implementation	Teaching methods	Allocated time (hours)
1. Introduction 2. Image acquisition 2.1 Introduction 2.2 The human vision system 2.3 Image sensors.		The course is taught using the video projector (on-site) or through Google Meet (online). 70% theoretical presentation, based on the course support (slides). 30% interactive activity (discussions with the students). The necessary materials will be made available to students in electronic format and in printed form.	2
2.3.1 Vidicon - historical reference 2.3.2 Photodiodes and phototransistors 2.3.3 CCD 2.3.4 CMOS 2.3.5 CCD - CMOS comparison.			2
2.3.6 Terminology 2.3.7 Integration time control (electronic shutter) 2.4 Characteristics of video cameras 2.4.1 Interpreting datasheet information 2.4.2 Intuitive interpretation of the performances of videoconference cameras 2.4.3 Lenses and cameras.			4
2.5 Image acquisition and processing boards 2.5.1			2

General considerations 2.5.2 The structure of an image acquisition and processing board.			
3. Digital image formation 3.1 The optical transformation 3.2 The geometric transformation 3.3 Camera calibration 3.4 Analog-to-digital conversion 3.4.1 Sampling.			4
3.4.2 The position of pixels in the image 4. Edge detection 4.1 Introduction 4.2 Image histograms and their processing 4.2.1 The general concept of histogram 4.2.2 Histogram modification techniques.			2
4.3 Digital image filtering 4.3.1 Frequency-domain filtering 4.3.2 Spatial-domain filtering 4.3.3 Using convolution masks 4.4 Contour tracking			4
5. Image segmentation 5.1 Contour processing 5.1.1 Contour closing 5.1.2 Contour thinning 5.2 Polygonal approximation of contours 5.3 The Hough transform 5.4 Region labeling 5.5 Dilation and erosion			2
6.2.4 Texture 6.3 Normalization processing 7. Shape classification 7.1 The concept of learning and classifiers 7.1.1 Linear classifiers			2
7.1.2 The least squares technique 7.2 Statistical classifications.			4

Bibliography:

- Computer Imaging: Digital Image Analysis and Processing, Scott E Umbaugh, 2005.
- Machine Vision: Theory, Algorithms, Practicalities, E. R. Davies, 2012
- Achizitia, prelucrarea si recunoasterea imaginilor, Cojocaru, D, Editura Universitaria, 2003. - Fuzzy Techniques in Computer Vision, Tănasie, R. T., Cojocaru, D., Editura Universitaria, 2006.
- Introduction to Visual Computing - Core Concepts in Computer Vision, Graphics, and Image Processing, Aditi Majumder, M. Gopi, Taylor & Francis Group, 2018.
- Machine Vision and Mechatronics in Practice, John Billingsley, Peter Brett, Springer-Verlag Berlin Heidelberg, 2015
- [http://robotics.ucv.ro/index.php/Achizitia%2C Prelucrarea si Recunoasterea Imaginilor](http://robotics.ucv.ro/index.php/Achizitia%2C%20Prelucrarea%20si%20Recunoasterea%20Imaginilor)

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7.2. Seminar/laboratory/project	The method of implementation	Teaching methods	Allocated time (hours)
1. Description of the parameters of a digital image acquisition system			2
2. Presentation of the Omron image acquisition and processing system. Its integration into the SMC flexible manufacturing station.			2
3. Visual inspection of product quality using the Omron machine vision system			2
4. Presentation of the ADEPT machine vision system for a SCARA-type robot.			2
5. Programming the ADEPT machine vision system for a SCARA-type robot.			2
6. Presentation of the Cognex machine vision system for a Mitsubishi robot, PUMA configuration.			2
7. Programming the Cognex machine vision system for a Mitsubishi robot, PUMA configuration. Project hours			2
8. Analysis of the parameters of a digital image acquisition system			2
9. Product quality visual inspection applications using the Omron machine vision system			2
10. Part recognition, localization and management applications using the ADEPT machine vision system for a SCARA-type robot.			4
11. Part recognition and sorting applications using the Cognex machine vision system for a Mitsubishi robot, PUMA configuration.			2
12. Applications using the Fastec Imaging high-speed acquisition camera			4
Bibliography:			
1.			
2.			

8. Correlating the content of the discipline with the expectations of representatives from the epistemic community, professional associations and representative employers in the field related to the program

The content of the Robotics curriculum was discussed periodically with the representatives of companies in the region. In this context, the content of this course was also taken into account (for example S.C. Q-Fort SRL, Ford Romania, SC IPA SA Craiova).

9. EVALUATION

Activity Type	9.1. Evaluation criteria	9.2. Evaluation methods	9.3. Final mark weight
9.4. Course	- Understanding the theoretical fundamentals of image acquisition, processing and recognition - The ability to make connections between the taught notions. - The capacity for analysis and synthesis in a concrete application.	Multiple choice + theoretical synthesis subject	60%
9.5. Seminar/laboratory/project	L+P: - Understanding and applying the fundamental notions of configuring and programming machine vision systems, - Interpretation of the results; - The solutions of the applications are presented and discussed within the group	Ongoing assessment and reports	40%
9.6. Minimum standard of performance			
- All three grades of the intermediate tests (course theory multiple choice, synthesis subject and laboratory activity) must be above the passing grade (5). - A bonus is granted for course attendance only if the final grade is above the passing grade (5). - The examination is carried out using the functionalities of the Google Classroom platform.			

Date of Completion	Signature of the Course Activities Holder,	Signature of the Practical Activities Holder,
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23.08.2025	Prof. dr. ing. Dorian Cojocaru	Conf. dr. ing. Florin Manta
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Date of Approval in the Department	Signature of the Department Director,
25.08.2025	Ș.l.dr.ing. Nicolae ENESCU

Date of Approval in the Faculty	Signature of the Dean,
	Prof.dr.ing. Dorin ȘENDRESCU