



**ESOGU ELECTRICAL-ELECTRONICS ENGINEERING DEPARTMENT  
COURSE INFORMATION FORM**

Course Title	Course Code
Introduction to Image Processing	151227522

Semester in Program	Number of Course Hours per Week		ECTS Credit
	Theory	Practice	
7	3	0	5

Course ECTS Credit Distribution				
Basic Sciences	Engineering Sciences	Design	General Education	Social
1	4			

Language of Instruction	Course Level	Course Type
English	Undergraduate	Elective

<b>Prerequisite</b>	Signals and Systems
<b>Objectives of the Course</b>	To learn basic principles of two-dimensional digital signal processing and the application of these principles to images. To learn the mathematical aspects of image processing. To learn implementation methods that address common problems in image processing. To formulate real life image processing applications and devise solutions.
<b>Brief Course Content</b>	Components of an image processing system and its applications, Introduction to the human visual system, Low level image processing, Image histograms and gray level transformation, Spatial filters, Color Spaces, Image enhancement, Image morphology, Edge detection, Segmentation, Introduction to computer vision

Learning Outcomes of the Course	Contributed POs	Teaching Methods *	Assessment Methods **
1 Students will be able to understand basic principles and mathematical aspects of digital image processing.	1a, 1c	1, 11	A
2 Students will be able to understand basics of the human visual system.	1b	1, 11	A
3 Students will be able to perform basic image manipulation techniques through low-level programming.	1c	1, 3, 10, 11	D
4 Students will be able to use advanced image processing tools for common applications in the field.	1c, 1d	1, 3, 10, 11	D
5 Students will be able to formulate complex real-life image processing applications and search for and apply advanced techniques and tools towards solutions.	1d, 2, 3	3, 12, 14	D, J

\***Teaching Methods** 1:Lecture, 2:Discussion, 3:Experiment, 4:Simulation, 5:Question-Answer, 6:Tutorial, 7:Observation, 8:Case Study, 9:Technical Visit, 10:Problem Solving, 11:Individual Work, 12:Team/Group Work, 13:Brain Storm, 14:Project Design / Management, 15:Report Preparation and/or Presentation

\*\***Assessment Methods** A:Exam, B:Quiz, C:Oral Exam, D:Homework, E:Report, F:Article Examination, G:Presentation, I:Experimental Skill, J:Project Observation, K:Class Attendance; L:Jury Exam

<b>Main Textbook</b>	Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Fourth Ed., Pearson, 2018.
<b>Supplementary Resources</b>	Richard Szeliski, "Computer Vision: Algorithms and Applications (Texts in Computer Science)", 2nd ed. 2022 Edition, Springer, 2022.
<b>Necessary Course Material</b>	

Course Weekly Schedule	
1	Introduction, basic concepts, image processing applications
2	Representation formats of images, scaling, translation and rotation of images, sums and differences
3	The human visual system
4	Contrast and grey levels, histograms, intensity transforms, equalization
5	Spatial filtering, convolution, simple filters, Gaussian filter, non-linear filters, image enhancement
6	Filtering in the frequency domain, power spectral density, FFT, noise removal
7	Color basics, color spaces
8	Mid-Term Exams
9	Image morphology, morphological operations, dilation, erosion, opening, closing
10	Image morphology, extraction of connected components, convex hull, contour extraction
11	Thresholding, clustering, segmentation, edge detection
12	Region based segmentation, region growing
13	Introduction to computer vision, shape analysis, extraction of shape-based features
14	Introduction to computer vision, texture analysis, extraction of texture-based features
15	Introduction to deep learning for image processing
16,17	Final Exams

Calculation of Course Workload			
Activities	Count	Time (Hour)	Total Workload (Hour)
Weekly classroom time	14	3	42
Weekly study time (review, reinforcing, preparation)	14	3	42
Homework	6	4	24
Taking a quiz			
Studying for a quiz			
Oral exam			
Studying for an oral exam			
Report writing (Preparation and presentation time included)			
Project (Preparation and presentation time included)	1	20	20
Presentation (Preparation time included)			
Mid-Term Exam	1	1	1
Studying for Mid-Term Exam	1	10	10
Final Exam	1	1	1
Studying for Final Exam	1	10	10
	<b>Total workload</b>		<b>150</b>
	<b>Total workload / 30</b>		<b>5</b>
	<b>Course ECTS Credit</b>		<b>5</b>

Assessment	
Activity Type	%
Mid-term	20
Homework	40
Project Observation	20
<b>Final Exam</b>	20
<b>Total</b>	100

**COURSE CONTRIBUTION TO THE PROGRAM OUTCOMES**

(5: Very high, 4: High, 3: Middle, 2: Low, 1: Very low)

NO	PROGRAM OUTCOMES	Contribution
1	a. Sufficient knowledge of mathematics	4
	b. Sufficient knowledge of basic sciences	3
	c. Sufficient basic engineering and Electrical-Electronics engineering knowledge	5
	d. Skill of applying all these knowledge and experience to complicated Electrical-Electronics engineering problems	4
2	Skill of defining, identifying, formulating and solving the complicated problems in Electrical-Electronics engineering and related areas by applying appropriate analysis and modelling methods.	3
3	Skill of designing a complicated process, system, equipment or product by applying modern design methods under realistic constraints and conditions.	3
4	To analyze and solve the complicated engineering problems:	
	a. skill of developing, selecting and applying the required techniques and devices	
	b. skill of using information technologies effectively	
5	To study the complicated on the complicated Electrical-Electronics engineering problems and research subjects:	
	a. skill of experimental design	
	b. skill of performing the experiments, collecting the data and analyzing and interpreting the results	
6	a. Skill of performing individual studies	
	b. Skill of performing intra and interdisciplinary and multidisciplinary teamwork and studies	
7	a. Skill of effective oral and written communication in Turkish and English	
	b. Skill of improving and using foreign language knowledge	
	c. Skill of effective reporting, understanding the reports and preparing the design and production reports	
	d. Skill of effective presentation and giving and getting clear and understandable instructions.	
8	Awareness of the necessity of life-long learning and skill of accessing to information and following the improvements in contemporary science and technology	
9	a. Awareness of necessity of behaving in accordance with the ethical principles and awareness of the importance of having professional ethical responsibilities	
	b. Knowledge about legal regulations and standards of engineering	
10	a. Knowledge about project management, risk management and change management	
	b. Awareness of the significance of entrepreneurship and innovation	
	c. Knowledge about sustainable development	
11	Knowledge about the effects of engineering applications and practices on the global and social health, ecology and safety, knowledge about the current problems in relation to the working areas of Electrical-Electronics engineering; and awareness of the legal issues resulting from engineering solutions	
12	Knowledge about modern problems in local and universal scale	

**INSTRUCTORS**

Prepared by	Helin Dutağacı			
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Date:20.07.2024