COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
DEPARTMENT	Electrical and Computer Engineering		
LEVEL OF STUDY	Undergraduate		
COURSE UNIT CODE	7.010	**SEMESTER**	7th
COURSE TITLE	Digital Image Processing		

COURSEWORK BREAKDOWN	**TEACHING WEEKLY HOURS**	**ECTS Credits**
Theory (Lectures)	4	3
Tutorial/Exercises		
Laboratory Work/Exercises	2	2
TOTAL	**6**	**5**

COURSE UNIT TYPE	Specialized general knowledge/Skills development
PREREQUISITES	Digital Signal Processing
LANGUAGE OF INSTRUCTION/EXAMS	Greek
COURSE DELIVERED TO ERASMUS STUDENTS	No
WEB PAGE (URL)	https://eclass.hmu.gr/courses/ECE152/

(2) LEARNING OUTCOMES

Learning Objectives

The course focuses on understanding the basic concepts of image processing and familiarizing students with computer applications of the theory. Upon successful completion of the course the student will be able to:

- Understand the application of basic image processing techniques in the spatial and frequency domain.
- To apply and implement image processing algorithms autonomously in the context of laboratory exercises.
- Understand the basic theoretical background that governs modern image processing applications.
- Analyze specific problems and propose appropriate solutions through a combination of theoretical knowledge and programming techniques.
- Employ theoretical knowledge and algorithms as the course progresses to solve more complex problems (e.g. for image restoration).
- To develop skills of evaluating the results in the context of individual laboratory exercises as well as extracting / justifying the results.

General Skills

- Search, analysis and synthesis of data and information, using the necessary technologies
- Autonomous work
- Teamwork
- Work in an interdisciplinary environment
- Production of new research ideas
- Promoting free, creative and inductive thinking

(3) SYLLABUS

Lecture Units

- Introduction to Digital Image Processing, point hole camera, perspective model, aperture, depth of field, field of view, lenses, filters, color formation, color spaces.
- Digital Image Processing in the spatial domain: Neighborhood, Connectivity, Areas, and Boundaries.
- Spatial filtering techniques: Spatial filters: convolution, mean value filter, gauss filter, median filter, min / max filters, max-median filter.
- Image optimization with point processing in the spatial domain: Brightness transformations, exponential transformation, logarithmic transformation, power transformation.
- Image histogram and histogram processing: histogram equalization and matching, histogram transformations, contrast.
- Image Sharpening: Image sharpening techniques in the spatial and frequency domain.
- Edge detection: edge detection, gradient, noise, Sobel filters, Prewitt filters, Roberts filters, smoothing, Laplacian of Gaussian, Canny edge detector.
- Fourier Transform: 2-d Distinct Fourier Transform (DFT). 2-d Fast Fourier Transform (FFT). FFT Convolution. Improving image quality with noise removal techniques with bandwidth filters in the frequency domain - image restoration.
- Morphological image processing.
- Image compression: lossless compression, lossless compression, cosine transform, Jpeg standard, compression indicators.

Laboratory Exercises

- Familiarization with python / Octave for image editing.
- Examples of implementation of all topics presented in theory with the participation of students.
- Emphasis on the implementation of filters in the spatial and frequency field

(4) TEACHING METHODS - ASSESSMENT

MODE OF DELIVERY	In-Class Face-to-Face
USE OF INFORMATION AND COMMUNICATION TECHNOLOGY	▪ Use of ICTs in lecturing ▪ Use of ICTs for the communication with students via the e-class platform
TEACHING ORGANIZATION	

Method description / Activity	Semester Workload
Lectures	40
Laboratory	30
Non-guided personal study	40

	Individual Project	20
	Weekly exercises	20
	Total Contact Hours	**150**
ASSESSMENT METHODS	Language of Evaluation: Greek Evaluation methods: 1. Written final exam (50%) • by solving problems • Short Answer Questions • with multiple choice questions 3. Individual laboratory work (report and oral examination) (30%) 4. Weekly exercises for home (20%) The evaluation criteria are announced to the students at the beginning of the semester and are posted on the course website in eClass.	

(5) RECOMMENDED BIBLIOGRAPHY

Recommended Bibliography*:*

1. *Digital Image Processing (in Greek only), Ν. Παπαμάρκος 2013*
2. *Gonzalez and Woods, Digital Image Processing, 4th Edition*

Relevant Scientific Journals:

1. *IEEE Transactions on Image Processing*