Course unit title:	Image Processing		
Course unit code:	AEEE419		
Type of course unit:	Compulsory		
Level of course unit:	Bachelor (1st Cycle)		
Year of study:	4		
Semester when the unit is delivered:	8 (Spring)		
Number of ECTS credits allocated :	6		
Name of lecturer(s):	Prof. Michael Komodromos		
Learning outcomes of the course unit:	1. Discuss the historical development of image processing and identify the various areas of image processing. Explain the basics of light and describe simple visual phenomena. Define the basic components of a general-purpose image processing system and the fundamental steps in digital image processing. Explain the characteristics of the various types of image sensors. Relate image acquisition, sampling, quantization and encoding to the two-dimensional representation of a gray scale image. 2. Compare and contrast the various image enhancement techniques in the spatial domain. Use gray level transformation functions for contrast enhancement and stretching such as negative, logarithmic and power functions and their related applications. Generate histogram equalization and histogram matching and perform image subtraction. Appraise the resulting images. 3. Define mask filtering and identify the need for it. Apply mask filtering. Evaluate an image and determine the appropriate mask for a specific enhancement requirement. Describe the benefits of smoothing filters, Laplacian filters and high boost filters and discuss where they are used. Describe the use of order statistics filtering, median filtering, and max-min filtering. Define edge detection techniques and image interpolation. 4. Distinguish among the various image restoration techniques such as reduction of noise and Wiener filtering. Discuss reduction of signal dependent noise and frame averaging. Evaluate the results of the various image enhancement and image restoration techniques. 5. List the benefits of image coding and compression and differentiate between the various types of redundancy and describe the general compression system model. Calculate data redundancy and compression ratio.		
Mode of delivery:	Face-to-face		
Prerequisites:	Advisor Approval	Co-requisites:	
Recommended optional program components:	None		
Course contents:	**Introduction and Basics:** Light and visual phenomena. Fields using image processing based on the EM spectrum. Fundamental steps in image processing. Components of image processing (IP) systems. Applications of IP. **Signals and Processing Systems:** Image sensing and acquisition. Sampling, quantization, encoding and gray level resolution. Representation of digital images. Basic relationships between pixels. **Image Enhancement:** Gray scale modification, high pass and low pass filtering of image signals, homomorphic processing, noise reduction and smoothing. Edge detection techniques and image interpolation. **Image Restoration:** Reduction of noise, Wiener filtering and additive image processing. Reduction of image blurring, inverse filtering and blind deconvolution. Reduction of signal-dependent noise and frame averaging. **Image Coding and Compression:** Coding and coding redundancy. Source encoders and decoders. Channel encoder and decoder. Information measures.		

	Information channels. Fundamental coding theorems. Image compression.
Recommended and/or required reading:	
Textbooks:	R. Gonzales and R. Woods, *Digital Image Processing, Pearson- Prentice Hall, 3rd edition, 2008*.
References:	1. K. Castleman, *Digital Image Processing*, Prentice Hall, 1996. 2. R. Gonzales et al., *Digital Image Processing Using MATLAB*, Addison-Wesley Books 2002. 3. L. Shapiro, *Computer Vision*, Prentice Hall, 2001. 4. J. S. Lim, *Two Dimensional Signal and Image Processing*, Prentice Hall, 1990.
Planned learning activities and teaching methods:	The teaching of this course is based on lectures (3 hours per week) in a classroom, using a mixture of traditional teaching of writing notes on the white board as well as the use of a slide projector. The slide presentations are used for demonstrating images and image processing methods and their results using the MATLAB Image Processing ToolBox. Several exercises and examples are solved and presented in class. Students are encouraged to use the textbook assigned to the course through homework problems assigned from it as a turn in assignment or for homework practice. Also, students are advised to use the reference books for further reading and practice in solving related exercises. Tutorial problems are also submitted as homework and these are solved during lectures or privately during the lecturer's office hours. Students are assessed continuously and their knowledge is checked through tests assignments and the final exam.
Assessment methods and criteria:	• Assignments 10% • Tests: 30% • Final Exam 60%
Language of instruction:	English
Work placement(s):	No