Image Processing

1. GENERAL

SCHOOL	ENGINEERING		
DEPARTMENT	INFORMATICS AND COMPUTER ENGINEERING		
LEVEL OF EDUCATION	UNDERGRADUATE		
COURSE CODE		**SEMESTER OF STUDIES**	**7ο**
COURSE TITLE	Image Processing		
INDEPENDENT TEACHING ACTIVITIES *in case the credits are awarded in separate parts of the course e.g. Lectures, Laboratory Exercises, etc. If the credits are awarded uniformly for the whole course, indicate the weekly teaching hours and the total number of credits.*		**WEEKLY HOURS OF TEACHING**	**ECTS CREDITS**
	Lectures	3	
	Practice -Exercises	1	
Add rows if needed. The teaching organization and teaching - methods used are described in detail in 4.		**4**	**5**
COURSE TYPE *Background, General Knowledge, Scientific Area, Skills Development*	Scientific Area, Skill Development		
PREREQUISITE COURSES:			
LANGUAGE OF TEACHING AND EXAMS :	Greek		
ERASMUS STUDENTS	Yes (in English)		
ONLINE COURSE (URL) (if available)			

2. LEARNING OUTCOMES

Learning outcomes

The learning outcomes of the course are described, the specific knowledge, skills and abilities of an appropriate level that students will acquire after the successful completion of the course.

Refer to Appendix A.

- *Description of the Level of Learning Outcomes for each course according to the Qualifications Framework of the European Higher Education Area*
- *Descriptive Indicators Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Annex B*
- *Summary Guide for writing Learning Outcomes*

Upon successful completion of the course the student will be able to:

- knows the types of images, the ways of their representation and the basic ones concepts in image processing and analysis.
- mathematically describes basic image transformations.
- mathematically describes filtering mechanisms in the spatial domain and frequency.
- understands the techniques of morphological processing of binary images.
- knows edge, line and contour detection techniques.
- knows the basic image coding and compression methods.
- analyze, compare and implement image processing algorithms, as well as to critically combine their knowledge to solve processing problems and image analysis
- analyze an image processing problem and propose, design and implements coping methods regarding improvement, restoration, image compression and edge detection
- applies the above in computing environments (e.g. MATLAB) for the digital image processing.

General Abilities

Taking into account the general skills that the graduate must have acquired (as they are listed in the Diploma Supplement and are listed below), which of them is intended for the course ?.

Search, analysis and synthesis of data and information, using the necessary technologies *Adaptation to new situations* *Decision making* *Autonomous work* *Teamwork* *Working in an international environment* *Work in an interdisciplinary environment* *Production of new research ideas*	*Project design and management* *Respect for diversity and multiculturalism* *Respect for the natural environment* *Demonstration of social, professional and moral responsibility and sensitivity in gender issues* *Exercise criticism and self-criticism* *Promoting free, creative and inductive thinking*

- Search, analysis and synthesis of data and information, using the necessary technologies
- Decision making
- Team work
- Promoting free, creative and inductive thinking

3. COURSE CONTENT

Introduction, representation and types of images, image digitization.

Fundamentals of digital images: human visual perception, principles of optics, sampling, quantization, pixel neighborhoods, defining coherents areas, distance metrics.

Arithmetic and logical operations on digital images, point transformations, histogram, histogram equalization, spatial filtering, convolution, smoothing and image enhancement with spatial filters.

Processing in the frequency domain, image transformations (the basic ones transformations with example applications, e.g. Fourier, DFT, DCT), design of filters in the frequency domain

Color, color models, color perception

Morphological processing of images (erosion, dilation, opening, closing)

Thresholding

Edge, line, contour and region detection, Hough transform, Hough line & Hough circle.

Image coding, coding types (lossy and lossless), algorithms coding (Huffman coding, numerical coding), image compression (with emphasis on the JPEG standard).

Image editing applications.

The laboratory part of the course includes training in the environment and the MATLAB Image Manipulation toolbox for use practical computing tools for the practical implementation of the above.

4. TEACHING AND LEARNING METHODS - EVALUATION

METHOD OF DELIVERY *Face to face, Distance education etc.*	In class face to face
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES *Use of ICT in Teaching, in Laboratory Education, in Communication with students*	Post course material (notes, lecture slides, exercises, topics tasks, etc.) on the platform electronic learning (e-class). Use of e-mail and announcements on the electronic platform learning, to communicate with students

TEACHING ORGANIZATION

The way and methods of teaching are described in detail.
Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliography study & analysis, Tutoring, Internship (Placement), Clinical Exercise, Art Workshop, Interactive teaching , Study visits, Study work, artwork, creation. λπ.

The student study hours for each learning activity are indicated as well as the non-guided study hours so that the total workload at the semester level corresponds to the ECTS standards .

Activity	***Semester Workload***
Lectures	39
Laboratory exercises	13
Assignments	21
Independent Study	52
Total Course Load (25 hours per credit)	**125**

STUDENT EVALUATION

Description of the evaluation process

Assessment Language, Assessment Methods, Formative or Concluding, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Report / Report, Oral Examination, Public Presentation, Public Presentation, Others

Explicitly defined assessment criteria are stated and if and where they are accessible to students.

I. Written final exam (70%) including:
- Short answer questions
- Problem solving

II. Preparation of laboratory exercises and final lab exam (30%)

The subject matter and the evaluation process they are announced to the students in the room lectures, in the workshop and on the platform e-learning of the department.

5. RECOMMENDED-BIBLIOGRAPHY

- Suggested Bibliography:

1. R.C. Gonzalez and, R.E. Woods, Ψηφιακή Επεξεργασία Εικόνας, Εκδ. Τζιόλα, 2011.
2. I.N. Έλληνας, Ψηφιακή Επεξεργασία Εικόνας & Βίντεο: Από τη Θεωρία στην Πράξη, Εκδ. Λύχνος, 2010.
3. Ν. Παπαμάρκος, Ψηφιακή Επεξεργασία & Ανάλυση Εικόνας, Εκδ. Γκιούρδας, 2005.

- - Additional Bibliography

- M. Sonka, V. HlavacandR. Boyle, Image Processing, Analysis and Machine Vision, Chapman & Hall, 1993.
- K.R. Castleman, Digital Image Processing, Prentice Hall, 1996.
- W.K. Pratt, Digital Image Processing, 2nd ed., John Wiley & Sons, 1991.
- A.K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, 1989.
- D.H. Ballard and C.M. Brown, Computer Vision, Prentice Hall, 1982.

- Related scientific journals:

- IEEE Transactions on Image Processing
- Image and Vision Computing, Elsevier
- Signal Processing: Image Communication, Elsevier
- Proceedings of the IEEE International Conference on Image Processing (ICIP)