Politehnica University of Bucharest
Faculty of Electronics, Telecommunications and Information Technology

COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	Politehnica University of Bucharest
1.2 Faculty	Faculty of Electronics, Telecommunications and Information Technology
1.3 Department	Applied Electronics and Information Engineering
1.4 Domain of studies	Computers and Information Technology
1.5 Cycle of studies	Licence
1.6 Program of studies/Qualification	Information Engineering

2. Course identification information

2.1 Name of the course				**Image Processing (PI)**			
2.2 Lecturer				Lect. Dr. eng. Marta Maria Zamfir			
2.3 Instructor for practical activities				Lect. Dr. eng. Marta Maria Zamfir			
2.4 Year of studies	IV	2.5 Semester	I	2.6 Evaluation type	Exam	2.7 Course choice type	Mandatory

3. Total estimated time (hours per semester for academic activities)

3.1 Number of hours per week, out of which		3.2 course		3.3 practical activities	
3.4 Total hours in the curricula, out of which	42	3.5 course	28	3.6 practical activities	14

Distribution of time	hours
Study according to the manual, course support, bibliography and hand notes	35
Supplemental documentation (library, electronic access resources, in the field, etc)	14
Preparation for practical activities, homeworks, essays, portfolios, etc.	10
Tutoring	0
Examinations	3
Other activities	0

3.7 Total hours of individual study	62
3.9 Total hours per semester	104
3. 10 Number of ECTS credit points	4

4. Prerequisites (if applicable)

4.1 curricular	Decision and Estimation in Information Processing Algorithms and Data Structures
4.2 competence-based	General knowledge of signal processing, decision and estimation, as well as programming (Matlab proficiency)

5. Requisites (if applicable)

5.1 for running the course	Not applicable
5.2 for running of the applications	Presence at all lab sessions (as required by the UPB regulations for licence studies).

6. Specific competences

Professional competences	C3. Solving problems using the instruments of computer science and engineering C4 Use of programming technologies and computing environments
Transversal competences	CT1 Honorable, responsible and ethic behavior, as required by law, in order to insure the reputation of the profession.

7. Course objectives (as implied by the grid of specific competences)

7.1 General objective of the course	Theoretical understanding of general digital gray level image processing techniques. Developing in students the ability to implement the general digital gray level image processing techniques using Matlab.
4.2 Specific objectives	Developing in students the ability to identify and analyze the specific problems of the image processing systems and to propose solving approaches. Developing in students the ability to model and design software/hardware image processing systems for specific applications.

8. Content

8.1 Lectures	Teaching techniques	Remarks
Introduction. Image Fundamentals	Teaching is based on videoprojection of slides (as communication and demonstration function); the oral communication method is the frontal problematization. The course materials are: course notes, course slides, proposed exercises (theoretical and for computer-solving). All materials are available in electronic form	1h
Human Visual Sistem. Color Space		2h
Point operations (image enhancement, geometrical transforms)		4h
Linear and nonlinear filtering in spatial domain		6h
Image morphology		2h
Integral operation (unitary transform, filtering in frequency domain, image restoration)		7h
Image compression		4h
Applications		2h

	on the course website.	
Bibliography 1) C. Vertan, M. Ciuc: Tehnici Fundamentale de Prelucrarea şi Analiza Imaginilor, Ed. MatrixRom, Bucureşti, 2007. 2) M. Ciuc, C. Vertan: Prelucrarea statistică a semnalelor, Ed. MatrixROM, Bucureşti, 2005. 3) http://alpha.imag.pub.ro/cursuri/ 4) K. R. Castleman: Digital Image Processing, Prentice Hall, 2005 5) R. Gonzales, R. Woods: Digital Image Processing, Addison Wesley, 2006		
8.2 Practical applications	Teaching techniques	Remarks
Introduction in Matlab. Image representation in Matlab. Image processing functions in Matlab	Teaching is based on videoprojection of slides (as communication and demonstration function); the oral communication method is the frontal problematization. Students simulate, implement, test and evaluate in an independent manner the same problems by the continuous use of the computer with Matlab software. The teaching materials are available in the lab guide, printed and on-line.	2h
Matlab: Point operations for image enhancement. Geometric transforms		2h
Matlab: Linear and nonlinear filtering in spatial domain		2h
Matlab: Image morphology		2h
Matlab: Unitary transforms. Image filtering in frequency domain.		2h
Matlab: Image restoration. Image compression.		2h
Final laboratory test		2h
Bibliography 1) C. Vertan, M. Ciuc: Tehnici Fundamentale de Prelucrarea şi Analiza Imaginilor, Ed. MatrixRom, Bucureşti, 2007. 2) Constantin Vertan, Mihai Ciuc, Marta Zamfir: Prelucrarea şi Analiza Imaginilor: Îndrumar de laborator. Ed. Printech, Bucureşti, 2001. 3) M. Ciuc, C. Vertan: Prelucrarea statistică a semnalelor, Ed. MatrixROM, Bucureşti, 2005. 4) http://alpha.imag.pub.ro/cursuri/		

9. Bridging the course content with the expectations of the epistemic community representatives, professional associations and employers representatives for the domain of the program

Digital imaging has become a mature, fast-growing market. The consumer transition to digital imaging is complete, the industry closely following the trend. The industry has a growing demand for skilled, digital image savvy engineers, with a strong background in electronics, embedded systems and information technology in order to keep the momentum of producing new hardware and software applications.

This curricula is adapted to the current developments and evolutions from the european economy of services in the ICT domain. With the current progress of electronic technology, the target

applications are unlimited, spanning all areas from "consumer technologies" (digital cameras, tablets and smartphones), medical markets (medical image analysis and processing), military applications (remote sensing based applications), general security (surveillance and biometry), industrial automatization (quality control, product handling), robotics (man-machine interfaces) and many more.

The graduates will be empowered with the competences adapted to the requirements of the current qualifications as well as a modern, competitive scientific and technical training, that facilitate a fast employment after graduation. This approach is perfectly fitted to the general policies of the Politehnica University of Bucharest, from the points of view of content, structure, offered abilities and international opening.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight in the final mark
10.4 Lectures	- knowledge of the fundamental theoretical constructions of the domain; - knowledge of the application of the theory to specific practical situations; - differential analysis of theoretical methods and algorithms.	Written tests during the semester at announced dates; Exam The subjects cover the entire curricula, realizing a synthesis between the comparative theoretical knowledge and its application through exercises and practical problems.	30% 30%
10.5 Practical applications	- knowing the design templates for image processing algorithms used for solving a given problem; - knowledge of the coding [in Matlab] of a image processing algorithm; - proof of function of an image processing algorithm implemented by the student.	Final lab examination, with a theoretical part and a practical part. The theoretical part is checked by a questionnaire; the practical part requires the solving by the student (implementation, testing, functioning) of a solution to a practical problem.	

10.6 Minimal performance standard
- modeling a real-life simple image processing problem and specification of the processing chain needed for solving the problem; - design, implementation and proof of functionality of a simple solution of a enhancement/filtering/restoration/compression problem.

Date	Lecturer	Instructor for practical activities
20. 10. 2015	Lect. Dr. Eng. Marta M. Zamfir	Lect. Dr. Eng. Marta M. Zamfir

Date of department approval

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Director of Department,

Prof. Dr. Eng. S. Paşca