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

COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	University POLITEHNICA of Bucharest
1.2 Faculty	Electronics, Telecommunications and Information Technology
1.3 Department	Applied Electronics and Information Engineering
1.4 Domain of studies	Electronics, Telecommunications and Informational Technologies
1.5 Cycle of studies	First cycle (BSc degree in engineering)
1.6 Program of studies/Qualification	Applied Electronics

2. Course identification information

2.1 Name of the course				Medical Imaging			
2.2 Lecturer				Prof. Eng. Pașca Sever, PhD			
2.3 Instructor for practical activities				Lecturer Eng. Sultana Alina, PhD			
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	4	3.2 course	2	3.3 practical activities	2
3.4 Total hours in the curricula, out of which	56	3.5 course	28	3.6 practical activities	28

Distribution of time	hours
Study according to the manual, course support, bibliography and hand notes	32
Supplemental documentation (library, electronic access resources, in the field, etc)	6
Preparation for practical activities, homeworks, essays, portfolios, etc.	7
Tutoring	0
Examinations	3
Other activities	0

3.7 Total hours of individual study	48
3.9 Total hours per semester	104
3. 10 Number of ECTS credit points	4

4. Prerequisites (if applicable)

4.1 curricular	-
4.2 competence-based	General knowledge of physics, computer operation and programming (Matlab simulation environment and LabVIEW programming environment knowledge)

5. Requisites (if applicable)

5.1 for running the course	-
5.2 for running of the applications	Compulsory attendance at laboratories (under bachelor studies regulation in UPB)

6. Specific competences

Professional competences	C4 – Design and use hardware and software applications of low complexity, specific to

	applied electronics C5 - Applying the knowledge, the concepts and the basic methods regarding the power electronics, automatic systems, energy management, electromagnetic compatibility
Transversal competences	CT1 - The methodical analysis of the daily issues, identifying the problems for which well-known solutions are already available, thus accomplishing the professional tasks CT3 Adaptation to new technologies, professional and personal development by long-life learning using printed documentation, specialized software, and electronic resources both in Romanian and in an international language.

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

7.1 General objective of the course	Presenting the physics principles used in medical imaging techniques, the obtaining and reconstruction of medical images and the working principles of the main imaging systems. Presenting some of the processing and specific standards associated with digital medical imagining. The students will familiarize with some of the specialized visualization, processing and analysis software tools used for medical images. Mini-projects concerning small software applications will be made.
4.2 Specific objectives	Developing the ability to apply general knowledge on the basic physics principles and methods used in obtaining medical images on operating, maintenance and developing the medical imagining systems, as well as solving actual problems related to processing and manipulating the digital medical images.

8. Content

8.1 Lectures	Teaching techniques	Remarks
The physics foundation of medical imaging, Medical Imaging Methods, Image quality	The course presentation is based on multimedia facilities (interactive blackboard, PowerPoint presentations, and computer based examples) and includes open talks and interactive presentations. The materials for courses are available in electronic format	4 hours
Transmission Imaging (Radiography, Computer Tomography)		4 hours
Reflexion Imaging (Echography, Optical Coherence Tomography)		4 hours
Emission Imaging (Scintigraphy, Single Photon Emission Computed Tomography, Positron Emission Tomography, Thermography)		4 hours
Absorption-emission Imaging (NMR Tomography)		6 hours
Other Imaging Techniques (Optical Methods, Electrical Impedance Tomography)		2 hours
Image Reconstruction Algorithms in Projection Tomography		4 hours

Bibliography

- A. Macovski, „Medical Imaginc Systems”, Ed. Prentince-Hall, Englewood Cliffs, New Jersey.
- S. Webb, „The Phisics of Medical Imaging”, Ed. Adam Hilger, Bristol and Philadelphia.
- J. Ederle, S. Blanchard, J. Bronzino, „Introduction to Biomedical Engineering”, Ed. Academic Press, 2000.
- A. Kak, M. Stanlez, „Principles of Computerized Tomographic Imaging”, Ed. IEEE Press, 1988.
- M. Morega, „Introducere in imagistica medicală”, Ed. Matrix Rom, București, 2002.
- J.L. Prince, J.M.Links, “Medical Imaging Signals and Systems”, Ed. Prentice Hall, New Jersey 07458, 2006.
- P. Suetens, „Fundamentals of Medical Imaging”, Ed. Cambridge University Press, Second Edition, ISBN-13 978-0-511-59640-7, 2009.

8.2 Practical applications	Teaching techniques	Remarks

Introductory elements in medical image analysis applied on ImageJ platform	The presentation is based on multimedia facilities (interactive blackboard, PowerPoint presentations, and computer based examples) and includes open talks and interactive presentations. The practical activities require both individual and team work and include small projects and homework. The materials for applications are available in electronic format.	4 hours
Medical image processing using Matlab		4 hours
Implementing mammography image processing algorithms		4 hours
Medical image analysis and processing using LabVIEW		4 hours
DICOM standard, specifications and applications		4 hours
DICOM Viewers		4 hours
Using specialized software for 3D medical images reconstruction using Slicer3D		4 hours
Bibliography - E. Berry, „A practical Approach to Medical Image Processing", Taylor & Francis, 2007. - J.L. Prince, J.M.Links, "Medical Imaging Signals and Systems", Ed. Prentice Hall, New Jersey 07458, 2006. - A. Sultana, S. Pasca, „Imagistica medicala: Indrumar de laborator", Editura POLITEHNICA PRESS, Bucureşti, 2013, ISBN 978-606-515-478-0.		

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

Medical imaging has become a mature market with high growth. The medicine has included medical imaging techniques in basic medical investigations packets, the industry closely following this trend. The industry has a strong demand for qualified engineers with specializations related to medical imaging, with a solid foundation in electronics and information technology systems, such that it can be able to keep the pace of development of new hardware and software.
The course curricula answer these developments and evolution trends, subscribed to the general framework of a European economy of services in the area of Electronics, Telecommunications and Informational Technologies.
The current technological advance of electronic devices enables unlimited application opportunities, ranging from medical electronics (medical diagnostic and therapy based or aided on imaging investigation, product and technologies for acquisition, analyse, and processing medical images, new method for medical imaging investigation), military (products and technologies for non-destructive product quality test), security (surveiance systems), industrial (non-destructive products investigation systems), and many others.
This provides graduates with the appropriate skills and training needs of current qualifications, and a modern and competitive scientific and technical instruction, enabling them a quick employment after graduation, being perfectly framed within the Bucharest Polytechnic University policy, both in terms of content and structure, and in terms of skills and international openness offered to students.

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 notions; - knowledge of the solving of specific problems; - differential analysis of the theoretical methods.	One written exam during the session; the subjects cover the entire course material, being a synthesis between the comparative theoretical knowledge and application of theoretical methods and techniques to solving practical problems.	50%
10.5 Practical applications	- knowledge of the general	The final lab exam	50%

	design of an image analysis algorithm for a simple, given problem; - theoretical comprehension and finding anticipation solution for a practical implementation of a given problem; - Image analysis algorithm Matlab coding; - proving the operation of a given image analysis algorithm.	consists of a practical examination, during which the student must solve (implement, test, proof of functioning) a practical image analysis problem.	
10.6 Minimal performance standard			
- modeling a simple real image analysis problem and designing the processing flow used to solve the problem; - basic theoretical information comprehension and their application for solving practical problems; - design, implementation, and proving of the operation of a simple solution to a given medical image analysis problem and the region of interest object description.			

Date	Lecturer	Instructor for practical activities
01.10.2013	Prof. Dr. Ing. Sever Pașca	Ș.l. Dr. Ing. Alina Sultana

Date of department approval

Director of Department,

07.10.2013

Prof. Dr. Ing. Sever Pașca