Recommended template: "Course Description, Syllabus, Course Requirements"

COURSE SYLLABUS AND COURSE REQUIREMENTS
ACADEMIC YEAR ... SEMESTER ...

Course title	***Medical image processing***
Course Code	*MSM613ANEG*
Hours/Week: le/pr/lab	*2 lectures, 2 practices*
Credits	**4**
Degree Programme	**Biomedical Engineering Master**
Study Mode	***Full Time***
Requirements	**Mid-term test, final exam**
Teaching Period	**Feb 3 – May 11.**
Prerequisites	**mathematics**
Department(s)	***Dr. Szilvia Anett Nagy***
Course Director	
Teaching Staff	***Dr. Szilvia Anett Nagy, senior lecturer***
	Dr. Gergely ORSI, research associate
	Dr. Gábor PERLAKI, research associate
	Dr Szukits Sándor, radiologist

törölt: *8*

COURSE DESCRIPTION

A short description of the course (max. 10 sentences).
Neptun: Instruction/Subjects/Subject Details/Basic data/Subject description

Medical image processing encompasses the use and exploration of 3D image datasets of the human body and in experimental animals, obtained most commonly from a Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET), Single Photon Emission Computed Tomography (SPECT) scanner to diagnose pathologies or guide medical interventions such as surgical planning, or for research purposes. Medical image processing is carried out by radiologists, engineers, and clinicians. Students learn the building blocks of medical imaging and learn about the basic physics of different imaging modalities. Students then learn the principles of image formation and the standard way to handle, store, print and transmit information in medical imaging using DICOM format and PACS medical imaging technology. The principles of image formation, sampling, coding and visualization will be also discussed.

SYLLABUS

Neptun: Instruction/Subjects/Subject Details/Syllabus

1. GOALS AND OBJECTIVES

Goals, student learning outcome.
Neptun: Instruction/Subjects/Subject Details/Syllabus/Goal of Instruction

To get a deeper knowledge of advanced medical image processing, students learn about image intensity transformations, spatial filtering, segmentation algorithms and image (co)registration methods in theory and practice. Finally, students learn about advanced methods used in medical imaging, clinical research, image-guided and radiation therapy. The presentations give an introduction about medical image processing algorithms and applications, while the practical course give a hint about the real evaluation of medical imaging data.

2. COURSE CONTENT

Neptun: Instruction/Subjects/Subject Details/Syllabus/Subject content

		TOPICS
LECTURE	*1*	*Introduction, Image representation, file formats, and simple operations*
	2	*Operations in intensity space*
	3	*Filters and image transforms*
	4	*Medical image segmentation*

	5	*Linear and non-linear image registration algorithms*
	6	*Hybrid imaging and neuronavigation*
	7	*CT and MR perfusion*
	8	*Diffusion MRI*
	9	*Functional MRI*
	10	*MR Spectroscopy*
	11	*Artificial intelligence basics*
	12	*Small Animal MRI*
PRACTICE	1	*Introduction, Image representation, file formats, and simple operations*
	2	*Operations in intensity space*
	3	*Filters and image transforms*
	4	*Medical image segmentation*
	5	*Linear and non-linear image registration algorithms*
	6	*Hybrid imaging and neuronavigation*
	7	*CT and MR perfusion*
	8	*Diffusion MRI*
	9	*Functional MRI*
	10	*MR Spectroscopy*
	11	*Artificial intelligence basics*
LABORATORY PRACTICE	12	*Small Animal MRI*

DETAILED SYLLABUS AND COURSE SCHEDULE

ACADEMIC HOLIDAYS INCLUDED

LECTURE

week	**Topic**	**Compulsory reading; page number (from … to …)**	**Required tasks (assignments, tests, etc.)**	**Completion date, due date**
1.	Introduction, Image representation, file formats, and simple operations	Wolfgang Birkfellner - Applied Medical Image Processing 1-90	-	Febr. 06, 2025
2.	Operations in intensity space	Wolfgang Birkfellner - Applied Medical Image Processing 91-114	-	Febr. 13, 2025
3.	Filters and image transforms	Wolfgang Birkfellner - Applied Medical Image Processing 115-176	-	Febr. 20, 2025
4.	Medical image segmentation	Wolfgang Birkfellner - Applied Medical Image Processing 177-214	-	Febr. 27, 2025
5.	Linear and non-linear image registration algorithms	Wolfgang Birkfellner - Applied Medical Image Processing 215-250; 297-338	-	March 6, 2025
6.	Hybrid imaging and neuronavigation	Corresponding lecture	-	March 13, 2025
7.	CT and MR perfusion	https://www.mriquestions.com/index.html, corresponding lecture	-	March 20, 2025
8.	Diffusion MRI	https://www.mriquestions.com/index.html, corresponding lecture	-	March. 27, 2025

9.	Functional MRI	https://www.mriquestions.com/index.html, corresponding lecture	-	Apr. 10, 2025
10.	MR Spectroscopy	https://www.mriquestions.com/index.html, corresponding lecture	-	Apr. 24, 2025
11.	Artificial intelligence basics	corresponding lecture	-	Maj 8, 2025

PRACTICE, LABORATORY PRACTICE

week	**Topic**	**Compulsory reading; page number (from … to …)**	**Required tasks (assignments, tests, etc.)**	**Completion date, due date**
1.	Small Animal MRI	-	-	under discuss

3. ASSESSMENT AND EVALUATION

(Neptun: Instruction/Subjects/Subject Details/Syllabus/Examination and Evaluation System)

ATTENDANCE

In accordance with the Code of Studies and Examinations of the University of Pécs, Article 45 (2) and Annex 9. (Article 3) a student may be refused a grade or qualification in the given full-time course if the number of class absences exceeds 30% of the contact hours stipulated in the course description.

Attending is required all classes, and will impact the grade (max. 10%). Unexcused absences will adversely affect the grade, and in case of absence from more than 30% of the total number of lesson will be grounds for failing the class. To be in class at the beginning time and stay until the scheduled end of the lesson is required, tardiness of more than 20 minutes will be counted as an absence. In the case of an illness or family emergency, the student must present a valid excuse, such as a doctor's note.

Method for monitoring attendance *(e.g.: attendance sheet / online test/ register, etc.)*

attendance sheet

ASSESSMENT

Cells of the appropriate type of requirement is to be filled out (course-units resulting in mid-term grade or examination). Cells of the other type can be deleted.

Course-unit with final examination

Mid-term assessments, performance evaluation and their weighting as a pre-requisite for taking the final exam

(The samples in the table to be deleted.)

Type	**Assessment**	***Weighting as a proportion of the pre-requisite for taking the exam***
1. ***Test***	*max 20 points*	*100 %*

Requirements for the end-of-semester signature

(Eg.: mid-term assessment of 40%)

mid-term assessment of 40%

Re-takes for the end-of-semester signature (PTE TVSz 50§(2))

The specific regulations for grade betterment and re-take must be read and applied according to the general Code of Studies and Examinations. E.g.: all the tests and the records to be submitted can be repeated/improved each at least once every semester, and the tests and home assignments can be repeated/improved at least once in the first two weeks of the examination period.

the tests and the records to be submitted can be repeated/improved once every semester

Type of examination *(written, oral): oral*

The exam is successful if the result is minimum 40%. *(The minimum cannot exceed 40%.)*

Calculation of the grade *(TVSz 47§ (3))*

The mid-term performance accounts for ***10***%, the performance at the final oral exam accounts for 90 %in the calculation of the final grade.

Calculation of the final grade based on aggregate performance in percentage.

Course grade	Performance in %
excellent (5)	85 % …
good (4)	70 % ... 85 %
satisfactory (3)	55 % ... 70 %
pass (2)	40 % ... 55 %
fail (1)	below 40 %

The lower limit given at each grade belongs to that grade.

4. SPECIFIED LITERATURE

In order of relevance. (In Neptun ES: Instruction/Subject/Subject details/Syllabus/Literature)

COMPULSORY READING AND AVAILABILITY

- Wolfgang Birkfellner - Applied Medical Image Processing, Second Edition: A Basic Course, Publisher: CRC Press, Year: 2013, ISBN: 9781466555594,1466555599
- https://www.mriquestions.com/index.html

RECOMMENDED LITERATURE AND AVAILABILITY

- JERROLD T. BUSHBERG - The Essential Physics of Medical Imaging third edition, Publisher: LWW, Year 2012, ISBN 978-0-7817-8057-5

- Geoff Dougherty - Digital image processing for medical applications, Publisher: Cambridge University Press, Year 2009, ISBN: 0521860857,9780521860857