Course Specifications
Valid as from the academic year 2020-2021

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

Course size
(nominal values; actual values may depend on programme)

<table>
<thead>
<tr>
<th>Credits</th>
<th>Study time</th>
<th>Contact hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.0</td>
<td>180 h</td>
<td>50.0 h</td>
</tr>
</tbody>
</table>

Course offerings and teaching methods in academic year 2020-2021

A (semester 1) English Gent
lecture 35.0 h
seminar: practical PC room classes 15.0 h

B (semester 1) Dutch

Lecturers in academic year 2020-2021

Vandenberghe, Stefaan TW06 lecturer-in-charge
Vandemeulebroucke, Jef VUB co-lecturer

Offered in the following programmes in 2020-2021

<table>
<thead>
<tr>
<th>Programmes</th>
<th>Credits</th>
<th>Offering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master of Science in Electrical Engineering (main subject Communication and Information Technology)</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Electromechanical Engineering (main subject Control Engineering and Automation)</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Electromechanical Engineering (main subject Electrical Power Engineering)</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Electromechanical Engineering (main subject Maritime Engineering)</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Electromechanical Engineering (main subject Mechanical Construction)</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering)</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Biomedical Engineering</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>International Master of Science in Biomedical Engineering</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Biomedical Engineering</td>
<td>6</td>
<td>B</td>
</tr>
<tr>
<td>Master of Science in Chemical Engineering</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Computer Science Engineering</td>
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<td>A</td>
</tr>
<tr>
<td>Master of Science in Computer Science Engineering</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>European Master of Science in Photonics</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Chemical Engineering</td>
<td>6</td>
<td>A</td>
</tr>
</tbody>
</table>

Teaching languages
Dutch, English

Keywords
MRI, CT, SPECT, PET, Ultrasound, image processing

Position of the course
The goal of this course is to make the students familiar with medical imaging and image processing techniques. An overview will be given of the working mechanisms of the most important medical imaging techniques, their advantages and disadvantages, their applications and recent technical developments. In addition, an introduction is given to the most commonly used techniques in medical image processing and analysis.

Contents

(Approved)
1. Introduction to images and image processing: sampling, filters, convolution theorem
2. X-rays radiography and principle of computed tomography and analytical reconstruction
3. SPECT imaging: collimation, detection and image degrading effects
4. PET imaging: principle, image degrading effects and iterative reconstruction
5. Ultrasonic imaging
6. MRI: basic principles of magnetic resonance and image formation
7. Image enhancement and filtering: histogram-based methods, linear and nonlinear filters for noise reduction, edge enhancement and detection.
8. Image registration and visualization
9. Segmentation: thresholding, region growing, level sets, classification, mathematical morphology

Initial competences
Basic knowledge of physics and signal processing

Final competences
1. Understand physical principles of different medical imaging techniques
2. Be capable of defining components of medical imaging systems
3. Have insight in advantages and disadvantages of existing image reconstruction techniques
4. Be able to judge the advantages and disadvantages of different medical imaging techniques.
5. Be able to explain the basic principles of the most important techniques in image enhancement, image segmentation and image registration.
6. Understand relationship between different image processing techniques

Conditions for credit contract
Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract
This course unit cannot be taken via an exam contract

Teaching methods
Lecture, seminar: practical PC room classes

Learning materials and price

References

Course content-related study coaching

Evaluation methods
end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period
Oral examination

Examination methods in case of periodic evaluation during the second examination period
Oral examination

Examination methods in case of permanent evaluation
Report

Possibilities of retake in case of permanent evaluation
not applicable

Calculation of the examination mark
Periodical evaluation (75%) + non-periodical evaluation (25%)
Second exam: only periodical evaluation

(Approved)