Minutes of the inter-university meeting UGent/VUB Master of Science in Biomedical Engineering – Oct 21th 2015

Location: Campus Etterbeek, VUB

Present: Patrick Segers, Johan Stiens, Klaus Bacher, Mathias Polfliet, Carl Van Himbeeck, Pascal Verdonck, André Skirtach, Irène Raadschelders, Aldo Scafoglieri, Jef Vandemeulebroucke, Peter Dubruel, Carl Van Himbeeck, Dirk Verellen, Nico Buls


Agenda:

1. Formal approval of the minutes of the meeting of May 4th, 2015
2. Composition of programme board 2015-2016
3. Announcements/communications
4. Student affairs
5. Accreditation/visitation/permanent quality control
6. Preparatory courses
7. New specializations
8. Varia

1. Formal approval of the minutes of the meeting of May 4th, 2015

The study programme committee of the Master of Science in Biomedical Engineering (SPCmaBME) formally approves the minutes on the previous meeting of May 4th, 2015.

2. Composition of programme board 2015-2016

Members ZAP:

UGent: Patrick Segers (FEA, voorzitter), Stefaan Vandenberghe (FEA), Pascal Verdonck (FEA), Pieter Rombouts (FEA), Carlos De Wagter (FG), Peter Dubruel (WE), Klaus Bacher (FG), Roel Van Holen (FEA)

VUB: Johan Stiens (IR, vice-voorzitter), Aldo Scafoglieri (GF), Erik Catrysse (LK), Dirk Verellen (GF), Michel Sonck (IR), Jef Vandemeulebroecke (IR), Nico Buls (UZ/GF), Iris De Graeve (IR)

Members AAP/OAP: Amélie Chevalier* (UGent), Mathias Polfliet (VUB)

Students: Astrid De Cloet (UGent), Rohan Choudhari (UGent), Nick Lagast (UGent), Nuwan Liyanage (UGent), Marco Testaguizza (VUB), Eowyn Van Wittenberghe (VUB).
Advisory members: Irène Raadschelders (VUB) + all ZAP/AAP/OAP involved in MSc Biomedical Engineering

External advisory board: Maarten De Vleeschouwer (Materialise), Peter Dierickx (AZ Maria Middelares), Luc Fockey (St-Jude Medical), An Fremout (Federaal Agentschap voor Nucleaire Controle), Michel Guerchaft (Philips), Carl Van Himbeeck (Cochlear), Toon Van de Ven (Siemens Healthcare), Herbert De Breck (Luxilon Industries NV), Falk Berten (Sensotec), Dirk Debusscher (AGFA Healthcare), Filip Vanhavere (SCK*CEN)

* Charlotte Debaut was representing the OAP last year but she became 10% ZAP as of October 1st, 2015. The OAP delegation of UGent has proposed Amélie Chevalier to represent the OAP.

3. Announcements/communications

3.1. Student numbers

New students starting in 1st master or new in 2nd master in International MSc Biomed Eng

<table>
<thead>
<tr>
<th></th>
<th>MSc Biomed Eng</th>
<th>Intern. MSc</th>
<th>National</th>
<th>International</th>
<th>M/F</th>
</tr>
</thead>
<tbody>
<tr>
<td>UGent</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>9</td>
<td>6/6</td>
</tr>
<tr>
<td>VUB</td>
<td>4 (*)</td>
<td>N/A</td>
<td>0</td>
<td>4</td>
<td>2/2</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>6</td>
<td>3</td>
<td>13</td>
<td>8/8</td>
</tr>
</tbody>
</table>

(*) One student is following courses from a distance, while waiting for the VISA

There is a remarkable drop in the number of incoming students, and in particular of national students. After a record high inflow last year, we now face a record low inflow. This is disappointing, given our continued efforts to update and optimize the programme. Efforts will be taken to increase visibility and to counter-act any potential misperception with respect to the programme and the career chances of our graduates.

Note: To contact all students: masterbme@lists.ugent.be

3.2. Extramuros activities

- MEDICA: Wednesday, Nov 18th (Compulsory for 1st year students as part of Biomedical Product Development)

- National Day on Biomedical Engineering: Friday Nov 27. This is compulsory for the students in Master 2 as part of “Seminars”

- Biomedical Industry Day: Friday March 25th. The meeting will take place in het Pand, Ghent University, in “De Refter”. The room is big enough to split in a compartment for the oral lectures and the poster sessions.

- Company visits
- **Cochlear**: Carl Van Himbeeck confirms the company visit to cochlear in the context of artificial organs. The suggestion is raised to combine the visit with course content such that the guest lecturer from cochlear does not have to make the transportation and to avoid potential overlap between material that is given as part of the course and that is repeated during the visit.
  
  **Note**: the visit has been confirmed to take place on Dec 2nd. Practical arrangements will be taken care of by Patrick Segers.
- **Materialise**: To be worked out.
- **ORSI**: will be visited as part of Medical Equipment (to be coordinated with prof. De Looze).

- European Course on Laparoscopic Surgery

It is noted by Jef Vandemeulebroucke that Saint Pierre University Hospital organizes a European course on laparoscopic surgery (Nov 17-20) and that the fourth (and final) day is on emerging technologies. More information can be found on http://www.laparoscopic-surgery-brussels.com/#!annual-courses/c1zpg

3.3. Lecturer changes

Prof. Danny De Looze has replaced prof. De Cruyenaere as responsible teacher for “Medical Equipment”.

3.4. March 17, 2016: : UGent – university-wide day on education (sharing good practices, workshops and lectures)

### 4. Student affairs

#### 4.1. Individual student affairs

**4.1.1. Alexandra Stefanascova**

Alexandra was student in International MSc Biomedical Engineering (CEMACUBE) but failed too many courses to continue in the international programme. She will continue in the regular MSc programme

**4.1.2. Late graduations International MSc Biomedical Engineering**

Due to differences in length academic year and rules with respect to master theses (especially Aachen), two more students have formally graduated (Nikolai Chikovskii and Tan Su Ee) and three more can still graduate in July 2015.

#### 4.2. Erasmus

Students abroad in 2015-2016:

- Lieve Staessens, UGent, sem 3 at EPFL, Lausanne
- David Van Assche, VUB, sem 3 at Lund, Sweden
5. Accreditation – visitation – quality control


Preliminary schedule:

MSc in Biomedical Engineering is part of cluster 4 (electrical engineering)

At UGent, the faculty of engineering and architecture is working on the implementation of test and evaluation policy, with trials on the use of Plato applications to formalize and quantify the evaluation of competences.

5.2. Opleidingsportfolio (UGent)

Opleidingsportfolio (programme portfolio): web-based documentation system that will replace evaluation reports and that will be the instrument to monitor programmes, both internally and externally following “Plan-Do-Check-Act” approach.
Map 1: vision and results
- Uniqueness/Profile of the programme
- Competences
- Benchmark
- Communication
- Reflection on vision

Map 2: Programme
- Vision on and structure of programme
- Used teaching formats
- Master thesis
- Internships

Map 3: Examination
- Vision
- Examination policy
- Assessment of examination/level of graduates/master thesis
- Critical reflection/what to improve/policy

Map 4: Education based on excellent research
Map 5: Developing Talent
Map 6: Internationalization of students and staff
Map 7: Involvement of Stakeholders
Map 8: Permanent quality policy

This portfolio will have to be filled. Some sections are generic for and will be generated by the faculty, but some sections are specific and will have to be completed. The idea is to go back in time a couple of years and to update systematically.

Timing:
- By end 2015: completing faculty portfolio (FDO)
- Jan-Feb 2016: develop generic structure for programme portfolios + upload existing material (FDO)
- Feb – beginning of April: complete and finalize programme portfolio (OC)
5.3 Competence matrix

An important component of the self-evaluation report is how we ensure that all our competences are effectively acquired by our students via our curriculum. To assess this, lecturers have been invited to provide this information via Plato->Mijn opleidingsonderdelen->O XO tabel invullen.

The information is missing for the following courses:

- E074010  Kwantitatieve celbiologie  Andre.Skirtach@ugent.be
- E092660  Van genoom tot organisme  Filip.DeKeyser@UGent.be
- E092802  Biomedische productontwikkeling  Ewout.Vansteenkiste@UGent.be
- E063680  Biomechanica  Matthieu.DeBeule@UGent.be
- E092680  Geneeskundige apparatuur  Filip.DeLooze@UGent.be
- E063670  Biomaterialen  Peter.Dubruel@UGent.be
- E092730  Medische fysica  Klaas.Bacher@UGent.be
- E074120  Kunstatige organen: technologie en ontwerp  Guido.VanNooten@UGent.be
- E092000  Seminaries: innovaties in biomedische ingenieurstechnieken  Pascal.Verdonck@UGent.be
- E001570  Gezondheidszorg en informatica  Marc.Nyssen@vub.ac.be
- E027761  NMR (nucleaire magnetische resonantie) beeldvorming  Roel.VanHolen@UGent.be
- E027750  Nucleaire meettechniek  Freya.Blekman@vub.ac.be
- E025110  Kernfysica  msonck@etro.vub.ac.be
- E092880  Nucleaire reactoren en cyclotrons  Michel Sonck
- E027870  Medische dosimetrie  dverelle@vub.ac.be
- E025490  Radiologische technieken  Klaus Bacher
- E092841  Geavanceerde beeld- en signaalverwerking  Stefaan.Vandenbergh@UGent.be
- E092851  Contrastmiddelen en biomarkers voor beeldvorming en therapie  Christian.Vanhove@UGent.be
- E078220  Stralingsbescherming en wetgeving  Michel Sonck
- E025480  Radiobiologie en -pathologie  Marc.vanEijkeren@UGent.be

6. Preparatory courses

Background - We frequently get applications from engineering students who somewhat lack the broad background of our own students and lack, for instance, some background in fluid mechanics and transport processes, material science, chemistry or electrical engineering. To date, we have tried to remedy this problem by replacing elective courses by some compulsory courses in the curriculum of these students. The problem is, however, that while there are several courses in our bachelor programmes that could be used to fill in these voids in the background of the students, most are in
Dutch. To date, Patrick Segers and Johan Stiens tried to find ad-hoc solutions for individual cases (see table), but this should be standardized.

<table>
<thead>
<tr>
<th>Chemistry</th>
<th>Solution: Chemistry: Capita Selecta (UGent). Existing course; Marie-Françoise Reyniers. Self-study + contact moments.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid Mechanics/transport</td>
<td>Solution: For this AY, an ad-hoc solution has been suggested via “Modelling in medicine and biomedical engineering: case studies” at UGent but we will not need to make use of it. Another option is to introduce a new course (Biofluid mechanics and transport). Patrick Segers is willing to take initiative in this, preferably with one or more co-lecturer.</td>
</tr>
<tr>
<td>Materials science</td>
<td>Solution: students follow 3 credit partim of VUB-course Materiaalkunde (Iris De Graeve). Self-study + contact moments</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>@VUB: 9hr refreshment course (exercises) in electrical network theory 1 week prior to start AJ.</td>
</tr>
<tr>
<td>Programming skills (Matlab)</td>
<td>VUB organizes a Matlab “summer school” for new students. It could be relevant to broaden this initiative and make it accessible for all students</td>
</tr>
</tbody>
</table>

It is noted by some members of the SPCmaBME (Pascal Verdonck and Klaus Bacher) that the current system for preparatory courses is not optimal. Currently students with background gaps must take up courses to remedy this deficit as elective courses, which might lead to less specialised graduates and a dilution of the biomedical level of the master education. Rather than replacing elective courses, it is suggested that shortcomings should be resolved in other ways:

(i) Self-study as add-on to existing courses  
(ii) Organising summer schools  
(iii) Adding courses to the curriculum (~ preparatory programme) rather than replacing elective courses

This new policy will be adopted from the next academic year on. The proposal to organise a new course on *Biofluid mechanics and transport* is valuable, but will be reconsidered at a later moment.

### 7. New specialisations – elective course clusters

In follow-up of action points defined at previous meetings, Johan Stiens and Patrick Segers have explored opportunities to broaden the elective course options for our students and to provide new specialization tracks (or rather clusters of elective courses) (starting 2016-2017).

The preliminary results of this exercise is provided in Appendix 1 and is discussed during the meeting. The following comments were raised:

- the option to provide access to courses in the domain of Assistive Technologies and Rehabilitation at ULB opens new perspectives  
- in each specialisation it should be clear which courses provide basic knowledge of the knowledge of the topic, transitory knowledge and advanced knowledge.  
- biostatistics is an important course that deserves much more attention in the programme and should probably be a compulsory course rather than an elective
• the ecosystem of big data is not covered. It is noted that this is more the territory of bioinformatics and biostatistics, for which currently also a master exists.

• Carl Van Himbeek, representing industry, expressed the need for courses on the process validation of a product. The remark is made that some of our courses would be very valuable for members of industry. It should be possible to follow some of our individual courses via credit contract.

• it is suggested by Pascal Verdonck to start from a clean sheet and orient the specialisations towards the subdivision in the markets: medical devices, pharma, medical aids and hospital and home care. As part of such an exercise, it might be worthwhile to also reconsider the compulsory part of the programme and make the specialisation tracks visible earlier in the programme

• the list of courses listed in Appendix 1 actually covers most of the topics we want to address. The “packaging” and labelling, however, could be more appealing.

Following the vivid discussion, the following is decided:

- With appendix 1 as basis, a new proposal will be worked out that is easily implemented and that will be the subject of programme changes in 2016 – 2017 (deadline November 1st). This proposal is given in Appendix 2

More profound changes will be worked out by Spring 2016 by working groups that will be composed.

8. Varia

- A discussion on FANC regarding Interuniversity Master in Medical Radiation Physics (mail Karen Haest) leads to the conclusion that they probably want to raise the internship to two years. Some members of the SPCmaBME will be present on the meeting on this topic to represent our interests.

- Screening international students remains cumbersome. It also appears that, at least in Gent, students are not allowed until their final curriculum has been approved by the curriculum committee. That introduces substantial delays. To be discussed with administration.

- A meeting with the steering group is held on Nov 10th, 4pm.

- Some of our international students have asked for the possibility to work as research assistant. If you have relevant research projects for which you seek assistance, please do not hesitate to advertise via masterbme@lists.ugent.be Students can be hired on the basis of student contracts.

- It is decided that some of the meetings of the SPCmaBME will be held via teleconferencing.
Appendix 1

The tables below provide a global overview, including existing clusters.

<table>
<thead>
<tr>
<th>Radiation Physics</th>
<th>Credits</th>
<th>Sem</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement Techniques in Nuclear Science</td>
<td>3</td>
<td>2</td>
<td>VUB</td>
</tr>
<tr>
<td>Nuclear Physics</td>
<td>3</td>
<td>2</td>
<td>VUB</td>
</tr>
<tr>
<td>Nuclear Reactors and Cyclotrons</td>
<td>3</td>
<td>1</td>
<td>VUB</td>
</tr>
<tr>
<td>Technology of radiotherapy</td>
<td>3</td>
<td>1</td>
<td>UGent</td>
</tr>
<tr>
<td>Medical dosimetry</td>
<td>3</td>
<td>1</td>
<td>VUB</td>
</tr>
<tr>
<td>Radiologic Techniques</td>
<td>3</td>
<td>1</td>
<td>UGent</td>
</tr>
<tr>
<td>Radioprotection and Regulations</td>
<td>3</td>
<td>2</td>
<td>VUB</td>
</tr>
<tr>
<td>Radiochemistry</td>
<td>3</td>
<td>2</td>
<td>UGent</td>
</tr>
<tr>
<td>Radiobiology and Radiopathology</td>
<td>3</td>
<td>2</td>
<td>UGent</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Medical Imaging and Signals</th>
<th>Credits</th>
<th>Sem</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced image and signal processing</td>
<td>3</td>
<td>1</td>
<td>UGent</td>
</tr>
<tr>
<td>NMR Imaging Technology</td>
<td>3</td>
<td>1</td>
<td>UGent</td>
</tr>
<tr>
<td>Contrast Agents and Biomarkers for Imaging and Therapy</td>
<td>4</td>
<td>1</td>
<td>UGent</td>
</tr>
<tr>
<td>Bio-electromagnetism</td>
<td>3</td>
<td>2</td>
<td>UGent/VUB</td>
</tr>
<tr>
<td>Biomedical Acoustics</td>
<td>6</td>
<td>2</td>
<td>UGent</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Biofluids, Tissues and Medical Devices [NEW NAME]</th>
<th>Credits</th>
<th>Sem</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Computational Fluid Dynamics</td>
<td>3</td>
<td>1</td>
<td>UGent</td>
</tr>
<tr>
<td>Computational Biomechanics</td>
<td>3</td>
<td>1</td>
<td>UGent</td>
</tr>
<tr>
<td>Fluid-Structure Interaction</td>
<td>3</td>
<td>1</td>
<td>UGent</td>
</tr>
<tr>
<td>From Medical Image to Computer Model (project)</td>
<td>6</td>
<td>1</td>
<td>UGent</td>
</tr>
<tr>
<td>Modelling in Medicine and Biomedical Eng.: Case Studies</td>
<td>4</td>
<td>2</td>
<td>UGent</td>
</tr>
<tr>
<td>Biofluid mechanics and transport [NEW]</td>
<td>3</td>
<td>2</td>
<td>UGent</td>
</tr>
<tr>
<td>Microfluidics and bioreactors</td>
<td>?</td>
<td>1,2</td>
<td>Nothing concrete</td>
</tr>
<tr>
<td>Medical device technonology: active vs passive</td>
<td>?</td>
<td>1,2</td>
<td>Nothing concrete</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Biosensors and Microsystems [NEW]</th>
<th>Credits</th>
<th>Sem</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Design of microsystems</td>
<td>6</td>
<td>1</td>
<td>UGent/VUB</td>
</tr>
<tr>
<td>Microphotonics</td>
<td>6</td>
<td>1</td>
<td>UGent+VUB</td>
</tr>
<tr>
<td>Biophotonics</td>
<td>4</td>
<td>1</td>
<td>UGent+VU</td>
</tr>
<tr>
<td>Micro-Nano biotechnology [NEW ON LIST]</td>
<td>3</td>
<td>2</td>
<td>Gert Desmet (VUB)</td>
</tr>
<tr>
<td>Biosensors [NEW in 17-18]</td>
<td>?</td>
<td>1,2</td>
<td>VUB/ULB/UG – 2017-2018</td>
</tr>
<tr>
<td>Technology of integrated circuits and Microsystems [NEW ON LIST]</td>
<td>6</td>
<td>1</td>
<td>UGent</td>
</tr>
<tr>
<td>Technological processes for Photonics and Electronics [NEW TITLE/ NEW ON LIST]</td>
<td>4</td>
<td></td>
<td>VUB</td>
</tr>
<tr>
<td>Embedded bioelectronics systems</td>
<td>5</td>
<td></td>
<td>VUB via ULB</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Assistive Technologies and rehabilitation [?]</th>
<th>Credits</th>
<th>Sem</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomedical robotics [NEW]</td>
<td>5</td>
<td>2</td>
<td>via ULB</td>
</tr>
<tr>
<td>Course</td>
<td>Credits</td>
<td>Sem</td>
<td>Institution/Instructor</td>
</tr>
<tr>
<td>----------------------------------------------------------------</td>
<td>---------</td>
<td>-----</td>
<td>------------------------------------------------------------</td>
</tr>
<tr>
<td>Virtual Reality [NEW]</td>
<td>5</td>
<td>1</td>
<td>via ULB (Gauthier LA FRUIT)</td>
</tr>
<tr>
<td>Computer Assisted Surgery [NEW]</td>
<td>5</td>
<td>2</td>
<td>via ULB</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>???</td>
<td>1,2</td>
<td>Nothing concrete</td>
</tr>
<tr>
<td>Brain-computer interface</td>
<td>???</td>
<td>1,2</td>
<td>Nothing concrete</td>
</tr>
<tr>
<td>Problems of the Locomotor System (incl. GAIT analysis)</td>
<td>???</td>
<td>1,2</td>
<td>Nothing concrete</td>
</tr>
<tr>
<td>Orthopedics Biomechanics</td>
<td>5</td>
<td>3</td>
<td>Nothing concrete</td>
</tr>
<tr>
<td><strong>Biomaterials and nanotechnology [?]</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics and Chemistry of Nanostructured Materials</td>
<td>6</td>
<td>1</td>
<td>UGent</td>
</tr>
<tr>
<td>Tissue Engineering (in Dutch)</td>
<td>?</td>
<td>1,2</td>
<td>Nothing concrete</td>
</tr>
<tr>
<td>Polymers for bio-related applications (aimed at chemistry</td>
<td>3</td>
<td>1,2</td>
<td>Nothing concrete</td>
</tr>
<tr>
<td>students)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Additive manufacturing</td>
<td>?</td>
<td>1,2</td>
<td>Nothing concrete</td>
</tr>
<tr>
<td>Surface treatment and functionalization of biomaterials</td>
<td>?</td>
<td>1,2</td>
<td>Nothing concrete</td>
</tr>
<tr>
<td>Biopolymers (includes elements from additive manufacturing</td>
<td>6</td>
<td>2</td>
<td>Peter Dubruel</td>
</tr>
<tr>
<td>and surface treatment and functionalization of biomaterials)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Neuro-engineering [?]</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artificial Intelligence in Biomedical Engineering [NEW – based</td>
<td>6</td>
<td>1</td>
<td>4 credits partim of existing course (Aleksandra Pizurica) +</td>
</tr>
<tr>
<td>on existing course]</td>
<td></td>
<td></td>
<td>2 credits VUB (Bart Jansen)</td>
</tr>
<tr>
<td>Neuro-physiological signal processing [NEW]</td>
<td>4</td>
<td>1</td>
<td>VUB (Guy Nagels)</td>
</tr>
<tr>
<td>Brain-computer interface</td>
<td>?</td>
<td>1,2</td>
<td>Nothing concrete</td>
</tr>
<tr>
<td>Implantable systems</td>
<td>?</td>
<td>1,2</td>
<td>Nothing concrete</td>
</tr>
<tr>
<td>fMRI</td>
<td>?</td>
<td>1,2</td>
<td>Nothing concrete</td>
</tr>
<tr>
<td>Speech and hearing</td>
<td>?</td>
<td>1,2</td>
<td>Nothing concrete</td>
</tr>
<tr>
<td>Pattern Recognition</td>
<td>?</td>
<td>1,2</td>
<td>Nothing concrete</td>
</tr>
</tbody>
</table>
## Appendix 2

<table>
<thead>
<tr>
<th>Compulsory courses</th>
<th>Basic Life Science</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Biomedical Engineering</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Medical Devices</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>General Course</td>
<td>12</td>
</tr>
<tr>
<td>Elective courses</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Master thesis</td>
<td>24</td>
<td></td>
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<tr>
<td>Total</td>
<td>120</td>
<td></td>
</tr>
</tbody>
</table>

### Basic Life Science
- Biomedical Engineering
- Medical Devices
- General Course

### Biomedical Engineering
- Quantitative cell biology
- From genome to organisms
- Modelling of Physiological Systems
- Biomedical Imaging
- Bio-electronics
- Biomechanics
- Biomaterials
- Medical Physics
- Biomedical Product Development
- Technology and Design of Artificial Organs
- Human and environment, Safety and Regulations
- Health Care and Informatics
- Seminars
- Neuromodulation and Imaging

### Medical Devices
- Biostatistics
- Modelling in Medicine and Biomedical Eng.: Case Studies
- Multidisciplinary Biomedical Project
- International Internship

### Medical Devices Tracks

#### Advanced Design Methods in Biomedical Engineering
- Computational Fluid Dynamics
- Computational Biomechanics
- Fluid Structure Interaction
- From Medical Image to Computer Model (project)

#### Assistive Technologies
- Biomedical robotics (NIRW)
- 3D Assistive Technologies (NIRW)
- Computer Assisted Surgery (NIRW)
- From Medical Image to Computer Model (project)

#### Micro- and Nano Devices
- Design of microsystems
- Microphotronics
- Bioelectrodes
- Nano-biotechnology (NIRW)
- Technology of integrated circuits and microsystems (NIRW)
- Technology of sensor for Biomedical Devices (NIRW)
- Embedded bioelectronics systems

### Health Care
- Personalized Medicine
- Physics and Chemistry of Nanostructured Materials
- Polymers for bio-related applications
- Contrast agents and Biomarkers for Imaging and Therapy
- Neuro-engineering
- Advanced Image and signal processing
- NMR Imaging Technology
- Contrast agents and Biomarkers for Imaging and Therapy
- Biomedical Acoustics
- Neuro-physiological signal processing and network analysis
- Artificial Intelligence in Biomedical Engineering

### Health Care Tracks
- Engineering (Physical) in Oncology
  - Measurement Techniques in Nuclear Science
  - Nuclear Physics
  - Nuclear Reactors and Cyclotrons
  - Technology of radiotherapy
  - Medical dosimetry
  - Radiologic Techniques
  - Radioprotection and Regulations
  - Radiopharmacy
  - Radiobiology and Radiopathology
  - Contrast agents and Biomarkers for Imaging and Therapy