Study Information 2009–2010

Organization
Curricula
Regulations

Kladno, June 2009
CONTENTS

Introduction ........................................................................................................................................... 9
FBME history ........................................................................................................................................ 10
Czech Technical University in Prague ................................................................................................. 11
Faculty of Biomedical Engineering .................................................................................................... 12
Dean’s office ....................................................................................................................................... 15
Departments ......................................................................................................................................... 18
Academic Calendar 2009/2010 - FBME ............................................................................................. 22
List of accredited study programs and fields at FBME CTU in Prague ............................................ 23
Information on physical education at the Faculty of Biomedical Engineering .................................. 23
The bachelor study program of Biomedical and Clinical Technology, field of study Biomedical Technology .......................................................................................................................... 26
  - Organization and structure of study ............................................................................................ 26
  - Study plan .................................................................................................................................... 26
  - Language classes .......................................................................................................................... 27
  - Recognizing of examinations ......................................................................................................... 27
  - Practical training placement .......................................................................................................... 27
  - Objectives of the study field .......................................................................................................... 28
  - Total profile of the graduate .......................................................................................................... 28
  - Characteristics of jobs and institutions where a graduate can find employment ....................... 28
  - The study plan for the academic year 2009/10 for Bachelor study programme BMCT, field of study BMT (full-time study) ......................................................................................... 30
  - Annotation of courses for the bachelor study program BMCT paramedical field of study BMT (full-time study) ........................................................................................................... 34
Follow-up master degree program Biomedical and Clinical Technology study field
 Appliances and Methods for Biomedicine ........................................................................................ 46
  - Organization and Structure of the Study ...................................................................................... 46
  - Study plan .................................................................................................................................... 46
  - Objectives of the study field .......................................................................................................... 47
  - Total profile of the graduate .......................................................................................................... 47
  - Characteristics of jobs and institutions where a graduate can find employment ....................... 47
  - The study plan for the academic year 2009/10 for the follow-up master study programme BMCT, field of study Appliances and Methods for Biomedicine ......................................................... 48
  - Annotation of courses for the follow-up master study program BMCT, study
branch Appliances and Methods for Biomedicine

Doctoral study program Biomedical and Clinical Technology

- Organization and Clinical Technology
- Study plan
- Health and safety at work
- Objectives of the field of study
- Total profile of the graduate
- The study plan for doctoral study programme BMCT (full-time study and part-time study)

Optional courses

Choice of optional courses and rules for course selection and registration

- Annotations

Students of CTU FBME shall comply with CTU´s common internal regulations and FBME´s dean´s directives
INTRODUCTION

This booklet is an English translation of parts of the Czech study information booklet. It contains basic information about the Faculty and about the study fields taught in English. The list of all study programs and study fields at the FBME is on page 23. Out of them, three are accredited and taught in English language:

- bachelor study program Biomedical and Clinical Technology, field of study Biomedical Technology,
- master study program Biomedical and Clinical Technology, field of study Appliances and Methods for Biomedicine, and
- doctoral study program Biomedical and Clinical Technology.

This booklet contains information only about the fields of study accredited in English. If you are interested in the content of the other taught in Czech, please contact the Vice-Dean for pedagogical issues (hozman@fbmi.cvut.cz).

In the academic year 2009/2010, only individual courses within these study programs will be taught, mainly for incoming exchange students. FBME does not open any regular full study in English. Such a study in the above listed fields is planned since September 2010.

The list of individual courses offered in English can be found at https://www.erasmus.cvut.cz/prospectus/2009/FBME.html
FBME HISTORY

The Faculty of Biomedical Engineering (FBME) is the second youngest faculty of Czech Technical University in Prague. It was established in 2005 by a transformation of the Institute of Biomedical Engineering. Its history dates back to 1996 when the Centre of Biomedical Engineering (CBME) was founded at CTU. Its objective was to create a central coordination workplace of research and educational activities in biomedical engineering at CTU. The CBME CTU tasks were oriented above all towards research, and thanks to the suitable structure of its staff’s professional focus encompassing a large part of biomedical engineering, widely focused scientific research projects could be solved. In 2002, the CMBI prepared documentation to implement a 3-year bachelor program “Biomedical and Clinical Technology”, and was transformed into the Institute of Biomedical Engineering (IBME) of CTU.

In 2004, the bachelor program “Biomedical and Clinical Technology” was accredited, and the education began in the academic year 2003/04.

Based on the decision of the Academic Council of CTU as of 15 December 2004 and an affirmative opinion of the Accreditation Committee of the Ministry of Education, Youth and Sports of the Czech Republic (MEYS CR), the Faculty of Biomedical Engineering was established by registering the changed CTU Statute by the MEYS CR on 27 May 2005.

In the academic year 2005/2006, the first 48 students of the bachelor program graduated. Most of them decided to continue in the follow-up master program of the same name accredited in the beginning of 2006. This double-specialization study program has two study fields – “Appliances and Methods for Biomedicine” and “Systematic Integration of Processes in Health Service” in a full-time study form. The former is primarily intended for preparation of engineers for research and development activities as well as for implementation and maintenance of sophisticated technology in hospitals, while the latter offers preparation of engineers for managerial positions in the health system. The education is project-oriented and is held in modern-equipped laboratories. Based on a recommendation of the Accreditation Committee of the Ministry and approved by the Scientific Board of the Faculty, from September 2009 there are two different specializations within the study field Appliances and Methods for Biomedicine: New Technologies for Biomedicine, and Imaging Systems in Medicine.

In accordance with the “Long-Term Plan for Educational, Scientific, Research, Development, Artistic and Other Creative Activities of CTU”, a newly accredited doctoral study program “Biomedical and Clinical Technology” commenced in March 2007.

In 2007, an application for prolongation of the bachelor study field Biomedical and Clinical technology was accepted, and in line with the current legislation, the renamed paramedical study field Biomedical Technology was open in the full-time and combined study forms.

Since the academic year 2009/2010, two newly accredited bachelor study fields will be open: paramedical Optics and Optometry, and non-paramedical Biomedical Informatics, both in the full-time study form.

Simultaneously, a newly accredited study program Specialization in Health Service will be open with two paramedical study fields, Physiotherapy, and Radiological Assistant.

FBME is situated in the town of Kladno. Students have accommodation and catering services available here, and many free-time activities, including participation in projects solved at the FBME.
CZECH TECHNICAL UNIVERSITY IN PRAGUE

CTU – Rector’s Office
Zikova 4, 166 36 Praha 6, Czech Republic
phone: 224 351 111, fax: 224 310 783

Czech Technical University in Prague consists of the following faculties: Faculty of Civil Engineering, Faculty of Mechanical Engineering, Faculty of Electrical Engineering, Faculty of Nuclear Sciences and Physical Engineering, Faculty of Architecture, Faculty of Transportation Sciences, and Faculty of Biomedical Engineering, Faculty of Information Technologies, and other parts. Czech Technical University is headed by the Rector that coordinates pedagogical and scientific activities of CTU’s faculties and other parts. The Rector’s deputies for individual areas are Vice-Rectors, and the Rector’s permanent deputy for economical and administrative activities is the Bursar.

Rector
prof. Ing. Václav HAVLÍČEK, CSc.

Vice-Rectors
prof. Ing. Jiří BÍLA, DrSc. – for CTU’s progress
prof. Ing. Alena KOHOUTKOVÁ, CSc. – for study
Dr. Ing. Jaroslav KUBA, Ph.D. – for research and technology park and student affairs
prof. Ing. Ladislav MUSÍLEK, CSc. – for science and research
doc. Ing. Miloslav PAVLÍK, CSc. – for development and investments
prof. Ing. František VEJRAŽKA, CSc. – for public relations and marketing
prof. RNDr. Miroslav VLČEK, DrSc. – for international relations

Bursar
Ing. Petr PĚTIOKÝ, MBA

Chairman of CTU’s Academic Council
prof. Ing. Petr KONVALINKA, CSc.
FACULTY OF BIOMEDICAL ENGINEERING

The Faculty is headed by the Dean responsible for its activities. In particular areas, Vice-Deans and the Treasurer deputize the Dean.

The following bodies take part in management of the Faculty: the Academic Council representing the Faculty’s academic community, the Scientific Board, and the Dean’s Committee.

Dean
doc. MUDr. Jozef ROSINA, Ph.D.

Vice-Deans
prof. Ing. Peter KNEPPO, DrSc. – for development and public relations
doc. Ing. Jiří HOZMAN, Ph.D. – for pedagogical issues
doc. Vladimír ROGALEWICZ, CSc. – for science, research and international relations, the Dean’s statutory deputy

Treasurer
Ing. Jaroslav Pluhař, CSc.

FBME’s Academic Council
doc. Ing. Karel ROUBÍK, Ph.D. – chairman

academic workers:
Ing. Richard Grunes
Ing. Karel Hána, Ph.D.
Ing. Martin Rožánek, Ph.D.
Ing. Zoltán Szabó, Ph.D.
Mgr. Veronika Vymětalová

students:
Vít Janovský
Jakub Novák
FBME’s Scientific Board

**CTU members:**

prof. Ing. Juraj Borovský, Ph.D.
prof. Ing. Tomáš Čechák, CSc.
prof. Ing. Jan Čulík, DrSc.
prof. MUDr. Ivan Dylevský, DrSc.
prof. Ing. Svatava Konvičková, CSc.
prof. Ing. Peter Kneppo, DrSc.
prof. Ing. Vladimír Mařík, DrSc.
prof. MUDr. Leoš Navrátil, CSc.
Ing. Stanislav Pospíšil, DrSc.
doc. Vladimír Rogalewicz, CSc.
doc. Ing. Karel Roubík, Ph.D.
prof. Ing. František Vejražka, CSc.
prof. Ing. Miroslava Vrbová, CSc.

**Non-CTU members:**

doc. MUDr. Adámková, CSc. (IKEM Praha)
prof. MUDr. Anděl, DrSc. (3rd Medical Faculty, Charles University)
prof. MUDr. RNDr. Jiří Beneš, CSc. (1st Medical Faculty, Charles University)
Ing. Jaromír Cmíral, DrSc. (Ministry of Defence)
Ing. Zbyněk Frolík (LINET spol. s r.o.)
prof. Ing. Jiří Jan, CSc. (TU Brno)
doc. Ing. Milan Tyšler, CSc. (Institute of Measurement, Slovak Academy of Sciences)
prof. Ing. Jozef Živčák, Ph.D. (TU Košice)
FBME Dean´s Collegium

doc. Ing. Jiří HOZMAN, Ph.D.
prof. Ing. Peter KNEPPO, DrSc.
prof. MUDr. Leoš NAVRÁTIL, CSc.
Ing. Jaroslav PLUHAŘ, CSc.
Ing. Roman POTŮČEK

doc. Vladimír ROGALEWICZ, CSc.
doc. MUDr. Jozef ROSINA, Ph.D.
doc. Ing. Karel ROUBÍK, Ph.D.
prof. Ing. Miroslava VRBOVÁ, CSc.

FBME Dean´s Gremium

JUDr. Bohumil BREJŽEK
prof. MUDr. Ivan DYLEVSKÝ, DrSc.
Ing. Karel HÁNA, Ph.D.
doc. Ing. Jiří HOZMAN, Ph.D.
Ing. Jaroslav CHARFREITAG (students representative)
prof. Ing. Miroslav JELÍNEK, DrSc.
prof. Ing. Peter KNEPPO, DrSc.
prof. MUDr. Leoš NAVRÁTIL, CSc.
Ing. Jaroslav PLUHAŘ, CSc.
Ing. Roman POTŮČEK

doc. Vladimír ROGALEWICZ, CSc.
doc. MUDr. Jozef ROSINA, Ph.D.
doc. Ing. Karel ROUBÍK, Ph.D.
Ing. Ida SKOPALOVÁ
Ing. Zoltán SZABÓ, Ph.D.
prof. Ing. Miroslava VRBOVÁ, CSc.
DEAN’S OFFICE

Registered address: nám. Sítná 3105, 272 01 Kladno, Czech Republic
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Dean’s Office is the executive department of the Faculty to support its activities including economical-administrative operations and other business activities.

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Library (part of CTU´s all-university library seated in the building of the National Technical Library in Prague-Dejvice located in Kladno)  
Stanislava Bořilová  
phone: 312 608 326, 224 358 455  
e-mail: borilova@fbmi.cvut.cz

The Study Office deals with all study affairs of bachelor and master students.

*Opening hours for students:*

- **Monday**  from 9 to 11  and  from 1 to 3
- **Tuesday**  from 1 to 3
- **Wednesday**  from 9 to 11  and  from 1 to 3
- **Thursday**  from 9 to 11

All study affairs of doctoral students are to be referred to Mrs. Helena Fujanová (contacts – see the Dean´s secretary).
International Office – managing issues of incoming and outgoing students.

Open for students:

**Monday** from 9.30 to 11

**Tuesday** from 13.30 to 15

**Wednesday** from 9.30 to 11

In accordance with the rental rules, rented books from the library can be used in the study room or outside of it. Textbooks (books) are rented for a period of one month, and lecture notes for a whole semester. Rental period can be extended up to three times unless the book has been ordered by someone else.

Opening hours of the library are:

**Monday** from 9 to 12 and from 1 to 3

**Tuesday** from 9 to 12 and from 1 to 3

**Wednesday** from 9 to 12 and from 1 to 3

The study room with a reference library and current-year issues of journals, as well as the computer study room with internet connection are available. All details can be found at the library’s web page http://www.fbmi.cvut.cz/studenti/knihovna.

Faculty Cash Desk – opening hours for students:

**Monday** from 8 to 11 and from 1 to 3

**Wednesday** from 8 to 11 and from 1 to 3
DEPARTMENTS

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MUDr. Stanislav Brádka
doc. MUDr. Alexander Čelko, CSc.
Mgr. Simona Hájková
doc. MUDr. Ladislav Horák, DrSc.
MUDr. David Kachlík, Ph.D.
Mgr. Ondřej Krahula
MUDr. Jiří Kubeš, Ph.D.
MUDr. Alice Kurzová
doc. MUDr. Jiří Málek, CSc.
doc. MUDr. Jan Mareš, CSc.
MUDr. Iveta Matějovská, CSc.
doc. Ing. František Podzimek, CSc.
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prof. MUDr. Jaroslav Racek, DrSc.
doc. MUDr. Jozef Rosina, Ph.D.
doc. Ing. Jozef Sabol, DrSc.
MUDr. Miroslav Starec, CSc.
MUDr. Jana Šeblová, Ph.D.
doc. MUDr. Jiří Šimek, CSc.
MUDr. Jiří Škopek, Ph.D.
MUDr. Josef Štorek, Ph.D.
doc. MVDr. Šimon Vaculín, Ph.D.
doc. RNDr. Friedo Zöelzer, Ph.D.

External teachers:
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RNDr. Dagmar Brechlerová, Ph.D.
doc. RNDr. Ing. Marcel Jiřina, Ph.D.
Mgr. Radim Krupička
doc. Ing. Jan Münz, CSc.

K 17220  Joint Department of Biomedical Engineering of FBME and 1st Medical Faculty

Detached laboratory: Studničkova 7, Praha 2 - Albertov

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Secretary: Helena Uhrová
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Members: Ing. Jiří Brada
Ing. Tomáš Funda
doc. MUDr. Jaroslav Jeřábek, CSc.
Ing. Jan Kašpar
Ing. Jan Mužík
MUDr. Tomáš Nedělka
Ing. Jiří Potůček, CSc.
Examination period: 4. 1. 2010–12. 2. 2010 6 weeks
Imatriculation 8. 10. 2009
Registration for summer semester 8. 2. 2010–12. 2. 2010

Summer Semester: 15. 2. 2010–14. 5. 2010 13 weeks
Consultation days: 17. 5. 2010–19. 5. 2010
Examination period: 20. 5. 2010–30. 6. 2010 6 weeks
Summer holidays: 1. 7. 2010–27. 8. 2010

Final State Examination:
Deadline for applications: 12. 2. 2010
Delivery of Bachelor/Diploma Thesis: 4. 6. 2010
Presenting Student’s Record Books to close the study: 14. 6. 2010
Delivery of Bachelor/Diploma Thesis: 20. 8. 2010
Presenting Student’s Record Books to close the study: 30. 8. 2010
Graduation ceremony: 8. 10. 2010 and 9. 10. 2010

Deadline for applications for entrance exams 2010/2011: 31. 3. 2010
Open Door Day: 27. 11. 2009 and 5. 2. 2010
Accommodation in dormitories: from 14. 9. 2009
Leaving dormitories: before 2. 7. 2010
Rector’s Day (Summer Semester): We 12. 5. 2010
Rector’s Day (Winter Semester): We 7. 10. 2009 (from 2pm)
Courses are cancelled on 28. 9. 2009 (Mo)
28. 10. 2009 (We) and 17. 11. 2009 (Tu)
5. 4. 2010 (Mo)
Dean’s Day: 29. 10. 2009 (Th) and 2. 4. 2010 (Fr)
List of accredited study programs and fields at Faculty of Biomedical Engineering
Czech Technical University in Prague

<table>
<thead>
<tr>
<th>Study program code (STUDPROG)</th>
<th>Name of study program</th>
<th>Study field code (KKOV)</th>
<th>Name of study field</th>
<th>Bc</th>
<th>Ing</th>
<th>PhD</th>
<th>Form</th>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>B3921</td>
<td>Biomedical and Clinical Technology</td>
<td>3901R039</td>
<td>Biomedical Technology</td>
<td>3</td>
<td>P, K</td>
<td>Czech English</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B3921</td>
<td>Biomedical and Clinical Technology</td>
<td>5345R030</td>
<td>Optics and Optometry</td>
<td>3</td>
<td>P</td>
<td>Czech</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B3921</td>
<td>Biomedical and Clinical Technology</td>
<td>1802R002</td>
<td>Biomedical Informatics</td>
<td>3</td>
<td>P</td>
<td>Czech</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B5345</td>
<td>Specialization in Health Service</td>
<td>5342R004</td>
<td>Physiotherapy</td>
<td>3</td>
<td>P</td>
<td>Czech</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B5345</td>
<td>Specialization in Health Service</td>
<td>5345R010</td>
<td>Radiological Assistant</td>
<td>3</td>
<td>P</td>
<td>Czech</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N3921</td>
<td>Biomedical and Clinical Technology</td>
<td>3901T035</td>
<td>Appliances and Methods for Biomedicine</td>
<td>2</td>
<td>P</td>
<td>Czech English</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N3921</td>
<td>Biomedical and Clinical Technology</td>
<td>3901T036</td>
<td>Systematic Integration of Processes in Health Service</td>
<td>2</td>
<td>P</td>
<td>Czech</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3921</td>
<td>Biomedical and Clinical Technology</td>
<td>3901V031</td>
<td>Biomedical and Clinical Technology</td>
<td>3</td>
<td>P, K</td>
<td>Czech English</td>
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Explanation: Form: P – full-time (daily), K – part-time (combination of full-time and distance)

Information on physical education at the Faculty of Biomedical Engineering (applicable for all study programs and all fields of study)

Physical education and sports at the Faculty of Biomedical Engineering are provided by CTU’s Institute of Physical Education and Sports (hereinafter by ÚTVS) based in CTU’s Sport Centre at the address Prague 6, Pod Juliskou 4.

Head of the ÚTVS: doc. PaedDr. Jiří Drnek, CSc.

Secretary of the ÚTVS: Mlušě Čermáková, Irena Brůnová
phone: 224 351 881, 2 (door No. 204)  
phone/fax: 233 337 353

Contact person: Mgr. Martin Vosyka
phone: 224 351 896, 7  
e-mail: vosyka@utvs.cvut.cz

The physical education at the FBME is incorporated in the study program as an optional course for which a credit is given. Students of all years of study can enroll in two sports and one training camp per semester (see the optional courses for the list) according to their interests and time options. Information about
physical education and sport activities within CTU, together with the application form for optional physical education, can be found on the ÚTVS web pages.

**Registration instructions for optional physical education courses**

On the ÚTVS web pages, you can see an offer of the individual exercises, in case of interest you can register as follows:

1) Register for PE in your study office; enter PE into the KOS IS, and have a record in your student’s record book.
2) Register for the particular PE course on the ÚTVS web pages (http://www.utvs.cvut.cz).

- **a successful registration is only possible the following day after entering PE into KOS** (since September 2009 in the beginning of an academic year)

**Sports summary:**
- aerobics (various types) - bodybuilding
- basketball - indoor rock-climbing
- beach volleyball - archery
- bowling - swimming
- BUDO (Judo, Karate) - table tennis
- football + futsal (indoor football) - squash
- Frisbee - softball
- floorball - tennis
- golf - hiking
- ice-hockey - volleyball
- canoeing (only for swimmers) - remedial physical education
- karate

**Winter and summer training camps:**
Downhill and cross-country skiing, snowboarding.
Outdoor sports (hiking, cycling, canoe sport, mountaining), windsurfing, ball games, floorball, aerobic, general athletics. Information about the content, venue and financial conditions of individual camps, together with the application form for training camps, can be found on the ÚTVS web pages (http://www.utvs.cvut.cz).

**The CTU’s sport life is complemented by university sport clubs:**
VŠTJ Stavební fakulta Praha (University Sport Club Faculty of Civil Engineering Prague),
VŠTJ Technika Praha strojní (University Sport Club Engineering Prague Mechanical),
VSK Elektro ČVUT Praha (University Sport Club Electro CTU Prague).

In the sport clubs, you can find teams and individuals that participate in regular sport competitions and other activities held by sport associations belonging to the Czech Sport Association. Their performance level spreads out through the full spectrum from recreational up to professional ones.

**Health and safety at work**

While registering for the first semester of the study, each student of the bachelor study programs and follow-up study programs of all fields of study and forms (full-time, combined) has to pass basic health and safety training according to the given curriculum. The basic health and safety training records are archived. Even if a student already studied at FBME, he has to attend the basic health and safety training each time he enrolls in the study. This training is carried out simultaneously with trainings related to professional capability in electrotechnology and to the work in all types of laboratories at FBME. If students attend courses in facilities of another university as well, they have to pass a special health and safety training in the particular facility. Successful passing of both trainings and related exams will be
marked in the student’s record book. This training does not constitute any right to the electrotechnical qualification according to the current legislation outside CTU.

For students in the Biomechanical Technology field, this training is simultaneously a part of the compulsory course called Health and Safety at Work and Electrotechnology Standards in the extent of 1+0, finished by a credit in the winter semester of the 1st year. That means that students have to register for the above-mentioned course at the beginning of their study. The classes of this course will take place at time of registration, and also in the form of blocks in the beginning of the 1st semester. Finishing of the course is through passing a credit test. Summary of this course is given below in the next chapters. Successful passing of this course will be marked in the student’s record book.
The bachelor study program of Biomedical and Clinical Technology, field of study Biomedical Technology

Organization and structure of study

The study is a three-year program finished by a completion of a bachelor thesis, its defence, and passing the final state examination. It is a part of so-called structured university study. The classes are given in full-time and combined types of study.

Except for lectures, seminars, practices, exercises in computer laboratories and laboratory work, a mandatory 3-week professional training is a part of the study plan. Within the subject exercises there are incorporated seminars with representatives of suitable institutions, businesses, companies and firms of the field as well as educational excursions to health establishments and institutions, businesses, companies and firms dealing with issues of biomedical engineering. Our continuous effort is that as many exercises as possible would take place in a form of laboratory classes.

In the 3-year bachelor study program of BMT, a student has to pass a mandatory one semester English language course including professional terminology, and meet the requirements of a classified credit. However, the entry prerequisites of this course are fixed. This way, a student has an option to present a document proving he had passed some of the examinations stated below, or to attend an optional English language course according to results of the entry English language assessment at the registration time for the first study semester. These courses are designed in such a way that after finishing a course, a student is ready to take the mandatory professional English course. Taking entry examinations for the mandatory course is a part of optional courses. However, a student also has a chance to prepare himself for the mandatory course outside of FBME, and then only to take the entrance test for the mandatory course.

To a large degree, the study is situated in the educational complex in the town of Kladno.

Study plan

The courses are divided into 3 groups according to their obligatory or facultative character: P – compulsory, PV – compulsory optional, V – optional. The compulsory courses are to be registered for study according to the designed study plan, and accordingly also passed with a proper completion. The compulsory optional courses are recommended to be studied in the 2nd to the 6th semester. At least one such course in each of these semesters is to be chosen according to the study plan either from the offer below or from all CTU courses related to the bachelor thesis topic. The way of registration is described in the Directive of the Dean for Bachelor and Master Study Programs. Each of them is evaluated by 2 credits. The optional courses are integrated in each semester’s curricula, and are considered as additional study either from the view of repeating high-school material, or from the view of supplementary study over the compulsory and compulsory optional courses. A student can choose them from the offer of optional courses for all fields of study at FBME; he/she can also register as an optional course any course taught at FBME or at the whole CTU. It is not obligatory for the student to choose any optional course during his/her study.

An integral part of the study plan is also a template (table) that reflects the structure of the study plan of courses in the BMT study, taking into account time and logical course interrelations, and a complex schedule of the study plan broken down to individual semesters stating names of teachers of individual courses and guaranteeing departments.

Students have to obtain minimum 180 credits for successfully passed courses during the whole course of study in prescribed composition (172 credits from compulsory and compulsory optional courses of the study field, and other 8 credits for bachelor thesis completion). Students have to fulfil the mandatory professional training during their study. After a successful defence of their bachelor thesis and passing the final state examination, they will obtain the academic title of bachelor (abbreviated Bc.) in the study field of Biomedical Technology.
Language classes

In the 3-year bachelor study program BMT of the structured study, a student has to pass a compulsory one-semester language course of English including professional terminology, and meet the conditions of a classified credit.

Recognizing of examinations

The examination of a foreign language can be relieved if the student meets and proves at least one of the following conditions:
- he passed the Czech state general language examination,
- he passed an equivalent examination of the appropriate language at a different university with excellent or laudable marks,
- he passed one of the internationally recognized examinations,
- he studied full-time at least for one semester at a university abroad,
- he passed a grammar school with a double-language education,
- he is studying at CTU in English, and for courses passed in English he achieved minimum 60 credits.

Other cases can be assessed by the course guarantor. The relief from the examination is considered for a successfully passed entrance test for the compulsory course, and that is because of a necessity to pass a professional conversation, terminology and written language exam, unless a student proves that he had passed these professional parts otherwise. All cases are exclusively assessed by the course guarantor.

Practical training placement

The objective of our practical training placement is that all future graduates gain proper habits for their future employment in health services after graduating from the 3-year study program according to the valid accreditation granted by the Ministry of Education, Youth and Sports of the Czech Republic. And that is not only from the teamwork point of view, but also from the point of view of language preparation and economic-managerial skills. The professional improvement aspect in the field of biomedical technology is also very important. Within the practical training, attention is paid especially to the activities stated in the Act No. 96/2004 Coll. and in related provisions. Suitable workplaces are recommended to the students. All details will be shown at www stránce http://www.fbmixvut.cz/studenti/odborna-praxe/bsp-bmkt/bso-bmt .

Practical training in the total length of 3 weeks (that is 120 hours) consists of:
“Individual practical training” that is arranged by a student himself (in the extent of 100 hours broken down into 50 hours of diagnostic technology, 30 hours of therapeutic technology, and 20 hours of laboratory technology). The practical training guarantor approves suitability and professional level of the chosen workplace that is selected by the student himself/herself to perform his/her practical training placement. All the necessities and related activities are arranged by students individually.

“Practical training organized by the Faculty” that is arranged by the guarantor (in the extent of 20 hours). All related activities are arranged by the guarantor of the practical training placement.

Each student is led towards arranging for a part of his/her practical training placement by himself/herself as an “Individual practical training placement” (with an expected extend of 100 hours). The second part of his/her practical training, the so called “Practical training placement organized by the Faculty”, is arranged by the Faculty. If a student does not succeed in arranging his/her “Individual practical placement”, the guarantor provides him/her with assistance.
Objectives of the study field

Bachelor study field Biomedical Technology prepares above all practically-oriented graduates, but also future students of master degree fields within the FBME, CTU as well as other universities. A student is supposed to obtain theoretical knowledge of mathematics, physics, chemistry, basic biology, anatomy and human physiology that are necessary for understanding basic biological processes in human organism, but also for communication with other physicians and health-care personnel. He/she is introduced to the principles of work and the rules of medical technology application including the ability to communicate with this technology via appropriate programs. He/she also acquires information from the field of law and technical standards that he will be able apply appropriately in practice. He/she obtains knowledge of economics and management of the fields. The emphasis is also laid on his/her language preparation that is, from the point of view of professional terminology, focused on coping with basic situations that a biomedical Technology shall meet on a daily basis.

Total profile of the graduate

Practically focused graduate of the bachelor study program with technical knowledge in the field of biomedical technology, with language professional training, with emphasis on organizational and communicative skills, and all that with the accent on teamwork, and furthermore with knowledge and skills allowing to continue in developing and deepening his/her professional education in accordance with state-of-the-art knowledge in the biomedical technology field.

Students will apply obtained knowledge in practical operations at individual workplaces. In line with the valid legal provisions, graduates will be able, within a medical environment, to work with medical equipment including assisting with examinations using imaging methods, but also with other examinations requiring technical assistance, to control and maintain equipment, keep log books, and ensure secure activities related to the operation of medical equipment and hospital information system, to participate in evaluation of medical equipment failure cases and in arranging for preventive measures, to administer software for diagnostic support, to take part in medical equipment acquisition including selection procedures, in planning medical technology complexes, and in technical training of workers in the field of medical equipment operation and safety at work.

Having abilities and skills to participate in scientific and research work, especially work of an experimental character, they will be able to find employment also in institutes of the Academy of Sciences of the Czech Republic, but also in businesses, firms and companies dealing with development, manufacturing, sale and service of medical equipment or software products.

The graduate will possess good knowledge of mathematics, physics, chemistry, but also of biology, anatomy and human physiology. He/she will be familiar with state-of-the-art methods of medical technology and with all issues of their operation. He/she will know and be able to apply international and national standards in the field of medical technology.

Graduate’s knowledge and abilities are basically focused on practical operation in a medical workplace, and/or in manufacturing, service or business companies. However, the common basis enables also further study in a subsequent master degree field at FBME, CTU, or any other university.

Characteristics of jobs and institutions where a graduate can find employment

The graduate can find employment in all jobs related to developing, manufacturing, operating and maintaining medical equipment including both work with computer technology and software (installations, innovations, settings). His/her prime employment should be connected with medical technology that is in hospitals, health centres etc. He/she is also able to perform activities in sale and service organizations focused on medical equipment, but also on rehabilitation and prosthetic products.

According to the April 2004 Paramedical Professions Act No. 96/2004 Coll., graduates from the bachelor study field of BMT gain the qualification “Biomedical Technology”. This qualification is recognized by the Ministry of Health of the Czech Republic through the National Centre of Nursing Care and Paramedical Health Fields (the so-called registration). Graduates of this bachelor study field are comprehensively
prepared for performing the biomedical Technology profession, and that both from the point of view of the so-called medical minimum and from the point of view of the electrotechnical qualification. The completed study complies with the following legal documents and provisions of the central authorities of the Czech Republic:

- the Paramedical Professions Act No. 96/2004 Coll. as of 4 February 2004,
- the Decree No. 39/2005 Coll. as of 11 January 2005 that determines minimum requirements for study programs to obtain professional qualification to perform paramedical professions,
- the Decree No. 424/2004 Coll. as of 30 June 2004 that determines activities of medical workers and other professional workers,
- the standards of the Accreditation Committee of the Ministry of Education, Youth and Sports of the Czech Republic regarding accreditation application assessments,
- other specific criteria to assess applications for re/accreditation and accreditation extension in paramedical fields approved by the Accreditation Committee of the Ministry of Education, Youth and Sports of the Czech Republic in 2006,
- the minimum requirements for the technical part of education in the field of study of biomedical technology corresponding to the Decree No. 39/2005 Coll. (part of the common methodology of the Ministry of Health of the Czech Republic and the Accreditation Committee of the Ministry of Education, Youth and Sports of the Czech Republic for approving applications for accreditation in the paramedical field of study Biomedical Technology).

Based on a fulfillment of the requirements mentioned above, the study field Biomedical Technology at CTU FBME was granted an affirmative stance of the Ministry of Health of the Czech Republic proving that graduates of the field will be able to perform the paramedical profession of Biomedical Technology as of 15 January 2007 Ref. No. MZDR 44609/2006, and it was also accredited by the Accreditation Committee of the Ministry of Education, Youth and Sports of the Czech Republic during their meeting on 19 and 20 June 2006. The graduates of this field will gain the so-called professional qualification in accordance with the Paramedical Professions Act No. 96/2004 Coll.

Except for jobs in health service, the graduates can also work in positions with experimental and scientific orientation, e.g. in research institutes of the Academy of Sciences of the Czech Republic. Other possible employments are in metrological and testing institutes, in standardization institutes, the State Institute for Drug Control etc. Due to their language skills, they can find employment also abroad.
The study plan for the academic year 2009/2010 for Bachelor study programme BMCT, field of study BMT (full-time study)

Guaranteeing department: Department of Biomedical Technology - KBT 17110
Guarantor of the field of study: doc. Ing. Jiří Hozman, Ph.D.

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>Type</th>
<th>Obligation</th>
<th>Load</th>
<th>Credits</th>
<th>Conclusion</th>
<th>Lecturer</th>
<th>Guaranteeing dept.</th>
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</tr>
<tr>
<td>17BBMAM</td>
<td>Management and Administration in Health</td>
<td>EKM</td>
<td>P</td>
<td>2+0</td>
<td>2</td>
<td>kl. z</td>
<td>doc. Ing. Jiří Hozman, Ph.D.</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td></td>
<td>Care</td>
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<tr>
<td>17BBEB</td>
<td>Ethics in Biomedical Engineering</td>
<td>HUM</td>
<td>P</td>
<td>2+0</td>
<td>2</td>
<td>kl. z</td>
<td>doc. MUDr. Jiří Šimek, CSc.</td>
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<tr>
<td>17BB???</td>
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<td>PV</td>
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<td>2</td>
<td></td>
<td></td>
<td>see the list below</td>
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</tr>
</tbody>
</table>

**Glossary:**
- **TEP** theoretical course
- **OBR** technical course
- **PV** compulsory optional course
- **z** assessment
- **EKM** economical-managerials course
- **V** optional course
- **kl. z** graded assessment
- **HUM** humanity course
- **zk** examination
<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>Type</th>
<th>Obligation</th>
<th>Load</th>
<th>Credits</th>
<th>Conclusion</th>
<th>Lecturer</th>
<th>Guaranteeing dept.</th>
</tr>
</thead>
<tbody>
<tr>
<td>17BBBB</td>
<td>Biomechanics and Biomaterials</td>
<td>OBR</td>
<td>P</td>
<td>2+2</td>
<td>4</td>
<td>z, zk</td>
<td>Ing. Patrik Kutílek, Ph.D.</td>
<td>FBMI KPO</td>
</tr>
<tr>
<td>17BBEM</td>
<td>Electrical Measurements</td>
<td>OBR</td>
<td>P</td>
<td>2+2</td>
<td>4</td>
<td>z, zk</td>
<td>prof. Ing. Peter Kneppo, DrSc.</td>
<td>FBMI KBT</td>
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<tr>
<td>17BBEO</td>
<td>Electronic Circuits</td>
<td>OBR</td>
<td>P</td>
<td>2+2</td>
<td>4</td>
<td>z, zk</td>
<td>prof. Ing. Jan Uhlíř, CSc.</td>
<td>FBMI KBT</td>
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<tr>
<td>17BBLPZ</td>
<td>Medical Devices &amp; Equipment</td>
<td>OBR</td>
<td>P</td>
<td>2+2</td>
<td>5</td>
<td>z, zk</td>
<td>prof. Ing. Jiří Hozman, Ph.D.</td>
<td>FBMI KBT</td>
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<tr>
<td>17BBZS</td>
<td>Imaging Systems</td>
<td>OBR</td>
<td>P</td>
<td>2+2</td>
<td>4</td>
<td>z, zk</td>
<td>doc. Ing. Jiří Hozman, Ph.D.</td>
<td>FBMI KBT</td>
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<tr>
<td>17BBZLN</td>
<td>Legislation in Health Care and Technical Standards</td>
<td>OBR</td>
<td>P</td>
<td>1+1</td>
<td>2</td>
<td>kl. z</td>
<td>prof. Ing. Peter Kneppo, DrSc.</td>
<td>FBMI KBT</td>
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<tr>
<td>17BBPNK</td>
<td>Design and Construction of Medical Devices / Practical Exercises</td>
<td>OBR</td>
<td>P</td>
<td>0+2</td>
<td>2</td>
<td>kl. z</td>
<td>doc. Ing. Jiří Hozman, Ph.D.</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td>17BBTPR</td>
<td>Team Project</td>
<td>TEP</td>
<td>P</td>
<td>0+2</td>
<td>3</td>
<td>kl. z</td>
<td>doc. Ing. Jiří Hozman, Ph.D.</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td>17BB???</td>
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<td>see the list below</td>
<td>FBMI</td>
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<td>17BBBP</td>
<td>Bachelor Thesis</td>
<td>P</td>
<td>0+8</td>
<td>8</td>
<td>z</td>
<td></td>
<td>doc. Ing. Jiří Hozman, Ph.D.</td>
<td>FBMI KBT</td>
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<tr>
<td>17BBLT</td>
<td>Clinical Laboratory Instrumentation</td>
<td>OBR</td>
<td>P</td>
<td>1+1</td>
<td>4</td>
<td>z, zk</td>
<td>Ing. Jiří Kukačka, Ph.D.</td>
<td>FBMI KBT</td>
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<tr>
<td>17BBMZT</td>
<td>Management of Health Care Technology</td>
<td>EKM</td>
<td>P</td>
<td>1+1</td>
<td>2</td>
<td>kl. z</td>
<td>Ing. Antonín Grošpic, CSc.</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td>17BBMAT</td>
<td>Marketing of Medical Technology</td>
<td>EKM</td>
<td>P</td>
<td>1+1</td>
<td>2</td>
<td>kl. z</td>
<td>Ing. Tomáš Kolář</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td>17BBSEL</td>
<td>Heavy-current electrical engineering</td>
<td>OBR</td>
<td>P</td>
<td>2+2</td>
<td>4</td>
<td>z, zk</td>
<td>doc. Ing. Jiří Hozman, Ph.D.</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td>17BBOIZ</td>
<td>Protection against Ionizing Radiation</td>
<td>OBR</td>
<td>P</td>
<td>2+0</td>
<td>2</td>
<td>z, zk</td>
<td>prof. Ing. Tomáš Čechák, CSc.</td>
<td>FBMI KPO</td>
</tr>
<tr>
<td>17BBSPT</td>
<td>Equipment for Anaesthesiology and Resuscitation</td>
<td>OBR</td>
<td>P</td>
<td>1+1</td>
<td>4</td>
<td>z, zk</td>
<td>doc. Ing. Karel Roubík, Ph.D.</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td>17BB???</td>
<td>Compulsory optional course see the list below</td>
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<td></td>
<td></td>
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<td>see the list below</td>
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<tr>
<td>17BB???</td>
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</table>

3rd year 5th semester

3rd year 6th semester
### List of offered compulsory optional courses in 2nd semester (the course will be taught if taken by at least 10 students)

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>Type</th>
<th>Obligation</th>
<th>Load</th>
<th>Credits</th>
<th>Conclusion</th>
<th>Lecturer</th>
<th>Guaranteeing dept.</th>
</tr>
</thead>
<tbody>
<tr>
<td>17BBPPZ</td>
<td>Programming Tools (beginners)</td>
<td>TEP</td>
<td>PV</td>
<td>0+2</td>
<td>2</td>
<td>kl. z</td>
<td>Ing. Pavel Smrčka, Ph.D.</td>
<td>FBMI KBI</td>
</tr>
<tr>
<td>17BBPPP</td>
<td>Programming Tools (advanced)</td>
<td>TEP</td>
<td>PV</td>
<td>0+2</td>
<td>2</td>
<td>kl. z</td>
<td>Ing. Pavel Smrčka, Ph.D.</td>
<td>FBMI KBI</td>
</tr>
<tr>
<td>17BBPPM</td>
<td>Programming in Matlab</td>
<td>TEP</td>
<td>PV</td>
<td>0+2</td>
<td>2</td>
<td>kl. z</td>
<td>Ing. Zoltán Szabó, Ph.D.</td>
<td>FBMI KBI</td>
</tr>
<tr>
<td>17BBBUI</td>
<td>Biological Effects of Ionizing Radiation</td>
<td>OBR</td>
<td>PV</td>
<td>2+0</td>
<td>2</td>
<td></td>
<td>doc. RNDr. Friedo Zoelzer, Ph.D.</td>
<td>FBMI KLIHO</td>
</tr>
<tr>
<td>17BBFVP</td>
<td>Multivariable Calculus</td>
<td>TEP</td>
<td>PV</td>
<td>1+1</td>
<td>2</td>
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<td>Helena Řihová, CSc.</td>
<td>FBMI KPO</td>
</tr>
<tr>
<td>17BBMVP</td>
<td>Research Methodology</td>
<td>TEP</td>
<td>PV</td>
<td>1+1</td>
<td>2</td>
<td></td>
<td>doc. Ing. Karel Roubík, Ph.D.</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td>17BBBCH</td>
<td>Biochemistry</td>
<td>OBR</td>
<td>PV</td>
<td>1+1</td>
<td>2</td>
<td>kl. z</td>
<td>RNDr. Jana Šerá</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td>17BBBFT</td>
<td>Biophotonics</td>
<td>OBR</td>
<td>PV</td>
<td>2+0</td>
<td>2</td>
<td></td>
<td>doc. Ing. Miroslav Jelínek, DrSc.</td>
<td>FBMI KPO</td>
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</tbody>
</table>

### List of offered compulsory optional courses in 3rd semester (the course will be taught if taken by at least 10 students)

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>Type</th>
<th>Obligation</th>
<th>Load</th>
<th>Credits</th>
<th>Conclusion</th>
<th>Lecturer</th>
<th>Guaranteeing dept.</th>
</tr>
</thead>
<tbody>
<tr>
<td>17BBFSR</td>
<td>Term Project</td>
<td>PV</td>
<td>0+2</td>
<td>2</td>
<td></td>
<td></td>
<td>doc. Ing. Jiří Hozman, Ph.D.</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td>17BBVKS</td>
<td>Selected Topics in Statistics</td>
<td>OBR</td>
<td>PV</td>
<td>1+1</td>
<td>2</td>
<td></td>
<td>doc. Vladimír Rogalewicz, CSc.</td>
<td>FBMI KPO</td>
</tr>
<tr>
<td>17BBFY3</td>
<td>Physics III</td>
<td>TPR</td>
<td>PV</td>
<td>1+1</td>
<td>2</td>
<td></td>
<td>doc. Ing. Jiří Novák, Ph.D.</td>
<td>FBMI KPO</td>
</tr>
<tr>
<td>17BBDIZ</td>
<td>Detectors of Ionizing Radiation</td>
<td>OBR</td>
<td>PV</td>
<td>2+0</td>
<td>2</td>
<td></td>
<td>doc. Ing. Ladislav Pína, DrSc.</td>
<td>FBMI KPO</td>
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</tbody>
</table>

### List of offered compulsory optional courses in 4th semester (the course will be taught if taken by at least 10 students)

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>Type</th>
<th>Obligation</th>
<th>Load</th>
<th>Credits</th>
<th>Conclusion</th>
<th>Lecturer</th>
<th>Guaranteeing dept.</th>
</tr>
</thead>
<tbody>
<tr>
<td>17BBMTB</td>
<td>Microprocessors in Medicine</td>
<td>OBR</td>
<td>PV</td>
<td>1+1</td>
<td>2</td>
<td>kl. z</td>
<td>Ing. Pavel Smrčka, Ph.D.</td>
<td>FBMI SPA</td>
</tr>
<tr>
<td>17BBZOD</td>
<td>Image Data Processing</td>
<td>OBR</td>
<td>PV</td>
<td>1+1</td>
<td>2</td>
<td></td>
<td>Ing. Zoltán Szabó, Ph.D.</td>
<td>FBMI KBI</td>
</tr>
</tbody>
</table>

### List of offered compulsory optional courses in 5th semester (the course will be taught if taken by at least 10 students)

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>Type</th>
<th>Obligation</th>
<th>Load</th>
<th>Credits</th>
<th>Conclusion</th>
<th>Lecturer</th>
<th>Guaranteeing dept.</th>
</tr>
</thead>
<tbody>
<tr>
<td>17BBEMP</td>
<td>Electromagnetic Fields of Living Organisms</td>
<td>OBR</td>
<td>PV</td>
<td>1+1</td>
<td>2</td>
<td>kl. z</td>
<td>prof. Ing. Peter Knepp, DrSc.</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td>17BBRBL</td>
<td>Robotics in Medicine</td>
<td>OBR</td>
<td>PV</td>
<td>1+1</td>
<td>2</td>
<td>kl. z</td>
<td>Ing. Jan Kauler, Ph.D.</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td>17BBRI</td>
<td>Rehabilitation Engineering</td>
<td>OBR</td>
<td>PV</td>
<td>1+1</td>
<td>2</td>
<td>kl. z</td>
<td>prof. Ing. Jozef Živčáč, CSc.</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td>17BBECP</td>
<td>Economics of Health Services</td>
<td>EKM</td>
<td>PV</td>
<td>1+1</td>
<td>2</td>
<td>kl. z</td>
<td>Ing. Jiří Petráček</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td>17BBAZC</td>
<td>Algorithms for Biosignal Processing in the C Language</td>
<td>OBR</td>
<td>PV</td>
<td>1+1</td>
<td>2</td>
<td></td>
<td>Ing. Pavel Smrčka, Ph.D.</td>
<td>FBMI SPA</td>
</tr>
</tbody>
</table>
Annotation of courses for the bachelor study program
Biomedical and Clinical Technology
paramedical field of study Biomedical Technology
(full-time study)

Guaranteeing department: Department of Biomedical Technology – KBT 17110
Guarantor of the field of study: doc. Ing. Jiří Hozman, Ph.D.

Annotations show only approximate contents of courses. Specific contents are given by curricula that will be provided to students in the beginning of each particular course.

List of abbreviations:  P – compulsory, PV – compulsory optional, V – optional
Load (hours/weekly):  P – lecture, C – tutorial, L – laboratory exercise, S – seminar
Conclusion:  z – assessment, kl. z. – graded assessment, zk – examination
1 Credit = 1 ECTS

Algorithmic and Programming Theory (17BBALP)  P
Weekly load (hours): 2 P+2 C  5 credits  Conclusion: kl. z
Lecturer: Ing. Pavel Smrčka, Ph.D.
Algorithm, data structures. Identifiers, data types. Assignment statement, conditional statement, cycles. Arithmetical and logical operations. Digital representation of numbers, number systems. Introduction to structured programming in the C language – creation and structure of simple programs, creating of user functions, user input and output, file management, memory management. Practical overview of programming techniques and basic algorithms in the C language. Recursive and iterative methods, measuring algorithm quality. Abstract data types, data sorting and searching, implementation of basic numerical algorithms. Introduction to biomedical data processing – a programmer’s view. Introduction to software engineering.

Anatomy and Physiology I (17BBAF1)  P
Weekly load (hours): 2 P+2 L  5 credits  Conclusion: z, zk
Lecturer: prof. MUDr. Ivan Dylevský, DrSc.
This combined course of anatomy and physiology is the introductory course of medical subjects for non-medical fields of study.

Anatomy and Physiology II (17BBAF2)  P
Weekly load (hours): 2 P+2 L  5 credits  Conclusion: z, zk
Lecturer: prof. MUDr. Ivan Dylevský, DrSc.
This combined course of anatomy and physiology is the introductory course of medical subjects for non-medical fields of study.

Bachelor Thesis (17BBBP)  P
Weekly load (hours): 0 P+8 L  8 credits  Conclusion: z
Lecturer: doc. Ing. Jiří Hozman, Ph.D. (guarantor of the field of study)
Individual student projects at the end of bachelor studies. Students choose topics from a list during the 5th semester. Bachelor thesis defence is a part of the state exam. Bachelor thesis can be written and defended either in Czech or English. Students are supervised by a tutor during the above mentioned process.
Biochemistry (17BBBCH)  
Weekly load (hours): 1 P+1 L 2 credits  Conclusion: kl. z  
Lecturer: RNDr. Jana Šerá  

Biological Effects of Ionizing Radiation (17BBBUl)  
Weekly load (hours): 2 P+0 2 credits  Conclusion: z  
Lecturer: doc. RNDr. Friedo Zoelzer, Ph.D.  
The presented lectures are aimed at basic principles of radiation biology. Students are introduced to biological effects of ionizing radiation; to physical and chemical processes of radiation damage in biological materials; mechanisms of radiation damage to DNA and other cell components; types of damage and repair; subcellular and cellular sensitivity and response to irradiation; physical, biological and chemical modifiers of cell response to radiation. Theories and models for cell survival and radiation biology of normal and neoplastic tissue systems.

Biological signals (17BBBLS)  
Weekly load (hours): 2 P+2 L 4 credits  Conclusion: z, zk  
Lecturer: doc. Ing. Vladimír Krajča, CSc.  
The course deals with origins and description of the most important electrical and non-electrical biological signals. The principles of generation, recording and basic properties are studied in all the signals. The studied signals involve natural and evoked biosignals, including biological signals of the heart, brain, muscles, nervous system, auditory and visual systems, signals from the gastro-intestinal system etc.

Biomechanics and Biomaterials (17BBBB)  
Weekly load (hours): 2 P+2 C 4 credits  Conclusion: z, zk  
Lecturer: Ing. Patrik Kutílek, Ph.D.  

Biology (17BBBLG)  
Weekly load (hours): 2 P+2 L 5 credits  Conclusion: z, zk  
Lecturer: Mgr. Veronika Vymětalová  

**Biophotonics (17BBBFT)** | PV
---|---
Weekly load (hours): 2 P+0 | 2 credits
Lecturer: doc. Ing. Miroslav Jelínek, DrSc.

Overview of principles and applications in the interdisciplinary area connecting physics, optics and biology. Interaction of laser radiation with matter, interaction of radiation with tissue, biology basics, photobiology, bioimaging, basics of lasers, laser safety, optical biosensors, photodynamic therapy, optical manipulation with cells, nanotechnology for biophotonics, biomaterials for photonics.

**Chemistry (17BBCHM)** | P
---|---
Weekly load (hours): 2 P+2 L | 5 credits
Lecturer: RNDr. Jana Šerá

Introduction to chemistry, categorization and properties of substances, chemical bonds, chemical reactions, elements in periodic table, organic chemistry fundamentals, natural substances, polymers, analytical methods - instrumental analysis, chemical calculations, chemical equations.

**Clinical Laboratory Instrumentation (17BBLT)** | P
---|---
Weekly load (hours): 1 P+1 L | 4 credits
Lecturer: Ing. Jiří Kukačka, Ph.D.


**Design and Construction of Medical Devices/Practical Exercises (17BBPNK)** | P
---|---
Weekly load (hours): 0 P+2 L | 2 credits
Lecturer: doc. Ing. Jiří Hozman, Ph.D.

The following exercises will be practised: properties and possibilities of operational amplifier utilization, different ways to suppress common signals, different ways to perform the galvanic separation, design and development of ECG and EEG preamplifiers, connections of specialized sensors and transducers. The course is meant especially for students who will use medical electronic equipment in practice.

**Detectors of Ionizing Radiation (17BBDIZ)** | PV
---|---
Weekly load (hours): 2 P+0 | 2 credits
Lecturer: doc. Ing. Ladislav Pína, DrSc.

Types of gas filled detectors, DC mode of IC, pulse mode of IC, proportional counters, pulse shape of proportional counter, neutron detection and spectrometry by means of nuclear reactions, principle of Geiger-Mueller counters, corona counter, scintillation detectors, exploitation of organic (solid and/or liquid) scintillators, Cerenkov detector, semiconductor detectors, Li compensated Ge detectors and HPGe detectors as photon detectors.
Economics of Health Services (17BBEZP) 
Weekly load (hours): 1 P+1 S  
2 credits  
Conclusion: kl. z  
Lecturer: Ing. Jiří Petráček

Basic categories of health care facility economics (hospitals, public and/or private health care facilities) as: facility efficiency, costs and income, financial management in health care, health care marketing etc. Specifics of health care facilities. Integral view on functioning of health care companies. Development of knowledge and skills in the field of financial management tools.

Electrical Measurements (17BBEM)  
Weekly load (hours): 2 P+2 L  
4 credits  
Conclusion: z, zk  
Lecturer: prof. Ing. Peter Kneppo, DrSc.


Electromagnetic Fields of Living Organisms (17BBEMP)  
Weekly load (hours): 1 P+1 C  
2 credits  
Conclusion: kl. z  
Lecturer: prof. Ing. Peter Kneppo, DrSc.


Electronic Circuits (17BBEO)  
Weekly load (hours): 2 P+2 L  
4 credits  
Conclusion: z, zk  
Lecturer: prof. Ing. Jan Uhlíř, CSc.


Electronic Elements and Sensors in Medicine (17BBESL)  
Weekly load (hours): 2 P+2 L  
5 credits  
Conclusion: z, zk  
Lecturer: prof. Ing. Miroslav Husák, CSc.

This course provides information on basic electronic devices and sensors, describes their operational principles, basic circuit configurations, and application in biomedicine. The stress is put mainly on clarifying basic principles and their practical utilization. Students are introduced to basic passive electronic devices (resistors, capacitors, inductors), their design and manufacturing, and to equivalent circuits and models. The next topic is engaged in basic effects in semiconductors and PN junction operation principle, diodes and their application (rectifiers, stabilizers), bipolar and unipolar transistors (amplifiers, switchers, temperature characteristics), multilayer semiconductor devices for high-power applications, technologies for integrated circuit fabrication and vacuum devices. Integral part of this course is basic information about sensors of non-electric quantities and their read-out circuits eg. strain related sensors (force, pressure, torque, vibration, displacement, acceleration etc.), magnetic field sensors, temperature sensors, chemical sensors, optical sensors, and biosensors. The stress is aid on miniaturization, integration and application in biomedicine.
Electrophysiology (17BBELF)

Weekly load (hours): 2 P+0 C 5 credits Conclusion: z, zk
Lecturer: doc. MVDr. Šimon Vaculín, Ph.D.

The study subject links to Anatomy and Physiology II and is dedicated to excitable tissues (muscles and the neural system) in the terms of signal generation, measuring possibilities and exploitation of changes in electrical parameters. Signal generation is explained at cellular and molecular levels, different software simulations are employed. From the methodological point of view, measurements of electrical parameters are described at all levels - cell, tissue, organ. Exploitation of electrical parameters of cells, tissues and organs is treated from both clinical and experimental points. Methods to use electrical field or stimulation for medical purposes are described. Next to lectures, practical classes focused on independent study of students are incorporated into the syllabus.

English Language III (17BBJA3)

Weekly load (hours): 0 P + 4 C 4 credits Conclusion: kl. z
Lecturer: PhDr. Stanislava Pattonová

English for Biomedical Professionals. Vocabulary and communication in Medicine, Medical Equipments, Health Care System, Biological Signals, Medical Imaging Systems, Giving Presentations, Economy in Health Care, Management in Medicine and Medical Institutions, Life Functions, etc.

Equipment for Anaesthesiology and Resuscitation (17BBSPT)

Weekly load (hours): 1 P + 1 L 4 credits Conclusion: z, zk
Lecturer: doc. Ing. Karel Roubík, Ph.D.


Ethics in Biomedical Engineering (17BBEBI)

Weekly load (hours): 2 P+0 2 credits Conclusion: kl. z
Lecturer: doc. MUDr. Jiří Šimek, CSc.

In the subject Medical Ethics students gain basic knowledge in contemporary ethics, both in general and health care ethics. Students also learn some necessary skills in ethical discourse. General ethics is an inevitable basis for explanations of health care issues. Contemporary ethics, general and applied, is no more a set of given norms, but a ground for discussions about good and evil. It is necessary first to identify and name the problem, than to ascribe both, the problem and various possible solutions, and finally to show and assess arguments for and against all possible solutions. From these reasons it is necessary to give students basic knowledge and some skills that will help them to be well informed in the area of ethics.

First Aid (17BBPP)

Weekly load (hours): 1 P+1 C 2 credits Conclusion: z, zk
Lecturer: doc. MUDr. Jiří Málek, CSc.

Performing the first aid at the site of injury at the level of educated laymen. Basic principles of diagnose and treatment of emergency situations resulting in acute threat to life of victims. Practical education in life-saving and health-saving methods is practiced improvisely using commonly accessible aids and tools.

Fundamentals of Pathophysiology and Diagnostic Methods (17BBZPD)

Weekly load (hours): 2 P+0 5 credits Conclusion: z, zk
Lecturers: prof. MUDr. Štěpán Svačina, DrSc., MBA, prof. MUDr. Tomáš Zima, DrSc.

Fundamentals of Pathology and Diagnostic Methods classify inborn and acquired pathologies and relate them to individual findings by various diagnostic methods.
Heavy-current electrical engineering (17BBSEL)  P
Weekly load (hours): 2 P+2 L  4 credits  Conclusion: z, zk
Lecturer: doc. Ing. Jiří Hozman, Ph.D.

Foundations of power electronics, power supply units including electrochemical supplies, rectifiers, stabilizers, common types of motors, elements of electricity distribution, electric system types and connecting electric appliances specified for medical purposes. Knowledge will be checked by means of practical examples during work in a laboratory.

Hygiene and Epidemiology (17BBHE)  P
Weekly load (hours): 2 P+0  2 credits  Conclusion: kl. z
Lecturer: doc. MUDr. Martin Čelko, CSc.


Image Data Processing (17BBZOD)  PV
Weekly load (hours): 1 P+1 L  2 credits  Conclusion: z
Lecturer: Ing. Zoltán Szabó, Ph.D.

Continuous image representation, linear 2D systems, 2D spectrum. Digital representation of images. Basic image characteristics: brightness, contrast, resolution, noise, look up tables, histogram. Discrete Fourier transform, discrete cosine transform, image enhancement, geometric operations, image filtering, morphological operations, image restoration, image segmentation, basic principles of image compression.

Imaging Systems (17BBZS)  P
Weekly load (hours): 2 P+2 L  4 credits  Conclusion: z, zk
Lecturer: doc. Ing. Jiří Hozman, Ph.D.

Electromagnetic radiation and its relationship to the medical imaging systems. Imaging theory fundamentals. 2D Fourier transform and related applications. Transfer properties of imaging systems. Optical imaging systems. Television (TV) imaging systems (including videoendoscopy and capsule imaging). Fundamentals of image processing. Imaging systems using infrared radiation (thermovision systems). X-ray imaging systems. X-ray TV medical imaging systems. Nuclear medical imaging systems. Ultrasound medical imaging systems. Doppler systems. Computed tomography (basic idea, schematic system arrangement, basic physical principle, development generation, basic principles of reconstruction). Magnetic resonance imaging. Positron emission tomography (PET) and single photon emission computed tomography (SPECT). Specialized medical imaging systems. Lectures and laboratory exercises offer to students a view on medical image data formation, on sensing and scanning principles, on data digitization and processing, on functional principles, as well as on image sensing devices.
Information Systems in Health Care (17BBISZ)  P
Weekly load (hours): 2 P+2 L  4 credits  Conclusion: z, zk
Lecturer: Ing. Zoltán Szabó, Ph.D.

Lectures are oriented on the definition of medical informatics, and on basic characteristic of its different specialized areas. The relations between IS and health care structure, financing and controlling are analyzed as well. Some basic information technology, HW and SW tools are described in relation to an IS design. A special attention is paid to medical data coding and interpretation, data and communication standards. Different types and features of clinical and hospital IS, decision support systems and regional health care IS are analyzed and discussed. Methodology of IS development, implementation and support is presented as well.

Information Technology and Telemedicine (17BBITT)  P
Weekly load (hours): 2 P+0  2 credits  Conclusion: z, zk
Lecturer: Ing. Karel Hána, Ph.D.


Integral Calculus (17BBITP)  P
Weekly load (hours): 2 P+2 C  5 credits  Conclusion: z, zk
Lecturer: doc. RNDr. Ing. Marcel Jiřina, Ph.D.

Definite and indefinite integral, methods of solutions, applications of definite integral for area/volume under a curve, volumes and areas of rotational bodies, static moments and centres of gravity. Differential and difference equations, and methods of their solution. Integral transform, Laplace transform. Fourier series and Fourier transform.

Introduction to Systems and Signals (17BBUSS)  P
Weekly load (hours): 2 P+2 C  5 credits  Conclusion: z, zk
Lecturer: doc. RNDr. Ing. Marcel Jiřina, Ph.D.

The main purpose of this course is to introduce students to basics of the theory of signals and systems. To explain main principles of applications from the areas of biology and medicine. To become acquainted with basic mutual relations (exercises in computer laboratories using MATLAB).

Legislation in Health Care and Technical Standards (17BBZLN)  P
Weekly load (hours): 1 P+1 S  2 credits  Conclusion: kl. z
Lecturer: prof. Ing. Peter Kneppo, DrSc.


Linear Algebra and Differential Calculus (17BBLAD)  P
Weekly load (hours): 2 P+2 S  5 credits  Conclusion: z, zk
Lecturer: prof. RNDr. Marie Demlová, CSc.

The course is an introduction into linear algebra and calculus of one variable. The linear algebra part consists of systems of linear equations and their solutions, Gauss elimination, matrices, rank of a matrix, operations with matrices, inverse matrix, determinant and its calculation, eigenvalues and eigenvectors of matrices. The differential calculus consists of sequences and their limits, functions of one real variable,
their limits, continuousness, derivatives. Local and absolute extremes of a function of one variable, investigation of functions. Taylor polynomial.

Management and Administration in Health Care (17BBMAZ)  
Weekly load (hours): 2 P+0  
2 credits  
Conclusion: kl. z  
Lecturer: doc. Ing. Jiří Hozman, Ph.D.

Structure and models of financing of health care services. Description of a typical workplace and typical jobs. Interdisciplinary approach as an essential premise of contemporary health care services. Architecture of health care service buildings and its historical development. Structure, duties and activities of hospitals from the point of view of a patient and that of health care service staff.

Management of Health Care Technology (17BBMZT)  
Weekly load (hours): 1 P+1 L  
2 credits  
Conclusion: kl. z  
Lecturer: Ing. Antonín Grošpic, CSc.


Marketing of Health Care Technology (17BBMAT)  
Weekly load (hours): 1 P+1 S  
2 credits  
Conclusion: kl. z  
Lecturer: Ing. Tomáš Kolář


Medical Devices and Equipment (17BBLPZ)  
Weekly load (hours): 2 P+2 L  
5 credits  
Conclusion: z, zk  
Lecturer: doc. Ing. Karel Roubík, Ph.D.


Medical Terminology (block course in the beginning of semester) (17BBLTR)  
Weekly load (hours): 1 P+0  
1 credits  
Conclusion: z  
Lecturer: MUDr. David Kachlík, Ph.D.

Students are made acquainted with particular terms originating in Latin but also in Greek languages. Students are continuously informed about terms concerning a whole diagnostic and therapeutical procedure. Lectures are combined with continuous check-ups using tests.

Mechanics (17BBMEC)  
Weekly load (hours): 2 P+2 C  
5 credits  
Conclusion: z, zk  
Lecturer: Ing. Patrik Kutilek, Ph.D.

Cross-section characteristics, body stress state (Cauchy, geometry, compatibility and physical equations), linear elasticity theory, non-linear theories, reaction, beam bending, normal and tangential stress, deformation, torsion influence. Framework vibration.
Microprocessors in Medicine (17BBMTB) PV
Weekly load (hours): 1 P+1 L 2 credits Conclusion: kl. z
Lecturer: Ing. Pavel Smrčka, Ph.D.
Introduction to embedded microprocessor systems in medicine, principles and structure of microcontrollers, logical circuits. Interconnection with common peripheral devices: AD/DA converters, serial communication, WiFi, Bluetooth and GPRS communication. Examples of embedded systems on architectures 8051, AVR, PIC, and ARM. Introduction to multiplatform software development for embedded systems.

Modeling and Simulation (17BBMS) P
Weekly load (hours): 2 P+2 C 5 credits Conclusion: z, zk
Lecturer: doc. RNDr. Ing. Marcel Jiřina, Ph.D.

Multivariable Calculus (17BBFVP) PV
Weekly load (hours): 1 P+1 C 2 credits Conclusion: z
Lecturer: Helena Říhová, CSc.

Physics I (17BBFY1) P
Weekly load (hours): 2 P+2 L 5 credits Conclusion: z, zk
Lecturer: doc. RNDr. Zdeněk Klíber, CSc., Ph.D.
Consists of mechanics, thermodynamics and solid state physics. Stress is put at theoretical knowledge, but problem solution and quantity measurement are also important. Limits of classical physics are presented. Seminar project. Students choose topics of seminar projects not later than on 3rd lecture. Students present their results on the last lecture.

Physics II (17BBFY2) P
Weekly load (hours): 2 P+2 L 5 credits Conclusion: z, zk
Lecturer: Ing. Ladislav Sieger, CSc.
Electromagnetic interaction, electricity and magnetism, Maxwell's equations, geometrical optics, apparatus for optics, wave optics, atoms, reactors. Special relativity theory.

Physics III (17BBFY3) PV
Weekly load (hours): 1 P+1 L 2 credits Conclusion: z
Lecturer: doc. Ing. Jiří Novák, Ph.D.
The course extends the previous courses Physics I. and Physics II. In this set of courses the main emphasis is placed on understanding to principles and on the ability to solve standard physical examples. In Physics III course we study waves, optics and lasers. We concentrate on practical examples and experiments.
Physical Chemistry (17BBFCH)  
Weekly load (hours): 2 P+2 C  
5 credits  
Conclusion: z, zk  
Lecturer: doc. Ing. Karel Roubík, Ph.D.  

Probability and Mathematical Statistics (17BBPMS)  
Weekly load (hours): 1 P+1 C  
2 credits  
Conclusion: z, zk  
Lecturer: doc. Vladimír Rogalewicz, CSc.  

Programming in Matlab (17BBPPM)  
Weekly load (hours): 0 P+2 C  
2 credits  
Conclusion: z  
Lecturer: Ing. Zoltán Szabó, Ph.D.  

Programming in Matlab (advanced) (17BBPPP)  
Weekly load (hours): 0 P+2 C  
2 credits  
Conclusion: kl. z  
Lecturer: Ing. Pavel Smrčka, Ph.D.  
Introduction to software tools on the MS Windows and GNU/Linux platforms. Problem of data file transfer, standardized exchange formats - HTML, XML, PDF, ODF, PNG etc. Introduction to administration and configuration of MS Windows and GNU/Linux, programming of scripts, connectivity and compatibility of major operating systems. Multiplatform applications - WWW browsers, e-mail clients, Office toolboxes, Graphical and CAD programs.

Programming Tools (advanced) (17BBPPZ)  
Weekly load (hours): 0 P+2 C  
2 credits  
Conclusion: kl. z  
Lecturer: Ing. Pavel Smrčka, Ph.D.  
Introduction to modern software resources in MS Windows and GNU/Linux environments - office applications, basic visualisation of experimental data, graphical presentation, Internet communication. Data formats, compatibility. Selected parts of the course are compatible with the ECDL (European Computer Driving Licence) knowledge syllabus.

Project Proposal and Management (17BBNMP)  
Weekly load (hours): 1 P+1 C  
2 credits  
Conclusion: kl. z  
Lecturers: Ing. Pavel Beránek, Ing. Vladimír Jurka  
Protection against Ionizing Radiation (17BBOIZ)  
Weekly load (hours): 2 P+0 C  
2 credits  
Conclusion: z, zk  
Lecturer: prof. Ing. Tomáš Čechák, CSc.

General properties of radiation, radiation sources, interaction of gamma rays with matter, interaction of charged particles with matter, photon and electron beams passing through an absorber, quantities and units used in dosimetry and radiation protection, operational quantities for staff, working and environmental monitoring, dose measurement, cavity chamber theory, determination of activity and source strength, internal radiation exposure, photon sources shielding, a Monte-Carlo method, absorbed dose estimation in photon and electron clinical beams.

Psychology (17BBPSL)  
Weekly load (hours): 1 P+1 S  
2 credits  
Conclusion: kl. z  
Lecturer: Mgr. Jana Uhrová


Rehabilitation Engineering (17BBRI)  
Weekly load (hours): 1 P+1 L  
2 credits  
Conclusion: kl. z  
Lecturer: prof. Ing. Josef Živčák, Ph.D.

Physiotherapy, especially physical therapy, orthotics and prosthetics, selected parts from biomechanics and ergonomy. Physical therapeutic methods, technology in therapy (ultrasound apparatus and radiotherapy technology). Replacement by sensors and possibilities of communication with a computer. Artificial organs and relevant circulatory confirmatory devices. Implantable medical devices – pacemakers, defibrillators, cardioverters.

Research Methodology (17BBMVP)  
Weekly load (hours): 1 P+1 S  
2 credits  
Conclusion: z  
Lecturer: doc. Ing. Karel Roubík, Ph.D.

Methodical starting points of research. Methods and technology of research. Logic of scientific research. Theoretical starting points of research. Scientific information as a fool for everyday work. Structure of scientific information, possibility for its acquisition, methods of its processing and application in practice. Description of principles for searching for scientific information. Description of specific systems, namely from health service. Final report.

Robotics in Medicine (17BBRBL)  
Weekly load (hours): 1 P+1 C  
2 credits  
Conclusion: kl. z  
Lecturer: Ing. Jan Kauler, Ph.D.

Principles of robotics in medicine and laboratory technology – what kind of task can be solved, synthesis of kinematics according to the task processed by a robot - operating (operating theatre), handling (laboratory), kinematics a dynamics of the robot arm – computing methodology, verification of obtained models in the Matlab environment, sensors and drivers used by robots applicable in medicine, possible robot control paradigms – according human (operator) tasks.

Safety Regulations and Standards in Electrical Engineering (17BBBOZP)  
Weekly load (hours): 1 P+0 C  
0 credits  
Conclusion: z  
Lecturer: doc. Ing. Jiří Hozman, Ph.D.
The course is outlined as a series of lectures with the content as follows: basic training in safety and health protection, training and testing in Section 5, Decree No. 50/1978 Coll., and instruction concerning conditions of laboratory work with electrical equipment and devices. Factors determining the danger of electrical accidents, symbols and marking in electrical engineering – meaning of safety colours, safety meaning of geometrical shapes, examples of safety labels, graphic signs on electrical objects, marking conductors with letters. Nominal alternating voltage according to the Czech Technical Standards (ČSN), allowed current maximum values, electrical circuit protection against short-circuit and overload, safety of electrical and electronic objects – protection classes, regular checks and inspections of electrical appliances and electrical hand-operated tools, important standards, first aid in case of electrical accidents. Links of legal and electrical regulations. Risks and causes of accidents in electrical engineering. Special qualification in electrical engineering – Decree No. 50/1978 Coll. Personal competence according to electrical qualification level, order B. Inspections and checks of electrical installation and appliances. A part of the training is also safety of work with lasers. Hence, the course consists of both the basic training and training and testing of Section 4, Decree No. 50/1978 Coll. This means that passing the test is a necessary condition for entry into laboratories. At the end of the semester, there will be another testing, this time of Section 5.

Selected Topics in Statistics (17BBVKS)  
Weekly load (hours): 1 P+1 C  
2 credits  
Conclusion: z  
Lecturer: doc. Vladimír Rogalewicz, CSc.


Semester Project (17BBSPR)  
Weekly load (hours): 0 P+2 S  
2 credits  
Conclusion: z  
Lecturer: doc. Ing. Jiří Hozman, Ph.D. (guarantor of the field of study)

Basic communication and presentation skills. Team work, team and project management. Creation of presentations and written texts. Typography rules. Types, purpose and requirements of technical presentations and technical texts. Writing reviews and/or quotations.

Team Project (17BBTPR)  
Weekly load (hours): 0 P+2 S  
3 credits  
Conclusion: kl. z  
Lecturer: doc. Ing. Jiří Hozman, Ph.D. (guarantor of the field of study)

Basic communication and presentation skills. Team work, team and project management. Creation of presentations and written texts. Typography rules. Types, purpose and requirements of technical presentations and technical texts. Writing reviews and/or quotations.

Theory of Electrical Engineering (17BBTEL)  
Weekly load (hours): 2 P+2 L  
5 credits  
Conclusion: z, zk  
Lecturer: prof. Ing. Jan Uhlíř, CSc.

Follow-up master degree program
Biomedical and Clinical Technology
study field Appliances and Methods for Biomedicine

Organization and Structure of the Study

The master study field Appliances and Methods for Biomedicine is a 2-year, 4-semestral follow-up program, finished by presenting a thesis, its defence as a part of the final state examination, and passing the final state examination. Thus, this study is a part of the so-called structured university study.

Courses are project-oriented. The study plan was developed to emphasise students’ independent creativity. At the start of the two-year programme, each student selects a project topic from a list proposed by the Faculty’s academic staff and experts of collaborating institutions. Each student works under the supervision of the teacher or expert who proposed the project and who shall also recommend the choice of compulsory optional and optional courses. Compulsory courses represent approximately one third of the study load during the two years. Compulsory option and optional courses make up another third and independent project work represents the remaining third. The number of contact classes gradually decreases during the two years, which ensures that students have enough time for own creative work. The thesis is the final stage of project work.

To a large degree, the study is situated in the educational complex in the town of Kladno.

Study plan

There are three types of courses based on how obligatory they are: P – compulsory, PV – compulsory optional, V – optional. As part of their compulsory optional courses, students may, in justified cases, choose courses at the CTU (for details see Study Guideline and Optional Courses Rules). Such compulsory optional courses will be credited in accordance with the study plan. Optional courses are recommended for the fall and/or spring semester (for details see Optional Courses).

As of September 2009, two specialisations are available under the study field Appliances and Methods for Biomedicine: New Technology for Biomedicine (NTB) and Medical Imaging Systems (ZSL). Each specialisation has a different structure of recommended compulsory optional courses. However, students may choose courses regardless of their specialisation. The key criteria for course choice should always be the topic of the student’s project and his or her specialisation. Since students still remain under the master study field of Appliances and Methods for Biomedicine, the following principles and rules apply:

1. Compulsory courses are the same for both specialisations, i.e. students of the two specialisations share lectures.
2. In some cases, exercises in compulsory courses may be different for different specialisations.
3. Development of student projects is a compulsory part of the study plan. Each student chooses his/her project topic at the beginning of the 1st semester of the master course from a list of proposed projects for NTB and ZSL available at the web site. Students are then divided into specialisations (NTB or ZSL) according to the chosen project topic.
4. The master course (field of study) has a guarantor and each specialisation has a guarantor. If students have any questions or need an explanation, they must talk to the specialisation guarantor or the course guarantor.
5. The new structure applies to students who begin the course in the 2009/2010 academic year. Students who started earlier shall continue with their original study plan (as defined in the respective study plan).

Students have to obtain minimum 120 credits including their theses for successful passing the courses of the whole study. After a successful thesis defence and passing the final state examination, they will obtain the academic title Magister (Mgr.) of the study field Appliances and Methods for Biomedicine (equivalent to Master of Science).
Objectives of the study field

The study field Appliances and Methods for Biomedicine is a follow-up master study field, and it prepares graduates with both good theoretical and practical knowledge in the fields that create the basis of applications of modern technology in biology and medicine. Graduates of bachelor programs of technical, medical and/or natural scientific fields of universities are particularly accepted for the study in this field. The student shall deepen his/her knowledge, widen his/her skills and abilities that he had obtained in the bachelor study program, and specialize in a detailed way in solving chosen professional issues. The graduate is a highly specialized expert, who will find employment in research and development of unique instrumental equipments and methods for biology and medicine, while implementing and maintaining technologically challenging techniques in clinical medicine and other fields.

Total profile of the graduate

The graduate of the practically specialized master study program Appliances and Methods for Biomedicine will have a very good technological and practical overview in the field of biomedical and clinical technology with an emphasis given on organizational and communicative skills, and all that with a special attention given to teamwork. He can further develop and deepen his professional knowledge and skills in accordance with the cognition development in the field of biomedical and clinical technology within a doctoral study. Masters of Science will find jobs above all in development departments, in research institutes of the Academy of Sciences of the Czech Republic, and in health facilities; they will take part in research and development of challenging instrumental equipment, and further in work with this medical technology. They will also be able to inspect and maintain technological equipment, and carry out activities related to health technology operation.

Given the ability to take part in scientific and research work, especially work of an experimental character, they will find jobs not only in the above stated places, but also in specialized university departments, in businesses, firms and companies, dealing with development, manufacturing, sale and service of challenging instrumental equipment for clinical medicine and other operations. Graduates of this field of study do not obtain the so-called professional qualification according to the Paramedical Professions Act No. 96/2004 Coll. as of 4 February 2004.

Characteristics of jobs and institutions where a graduate can find employment

The graduate of the master study program Appliances and Methods for Biomedicine possesses unique specialized skills, theoretical knowledge of a high quality, and during his/her studies, he/she has been trained for research teamwork. His/her prime place of employment should be in research and development departments and institutes of the Academy of Sciences of the Czech Republic, R&D departments of medical technology manufacturers, and also in research health institutions. Due to their language skills, they can find employment also abroad. Moreover, they are well prepared for a doctoral study program at CTU, at other universities of technical, medical and/or natural scientific fields in the Czech Republic and abroad.
The study plan for the academic year 2009/2010 for the follow-up master study programme BMCT, field of study Appliances and Methods for Biomedicine (full-time study)

Guaranteeing department: Department of Natural Sciences - KPO 17101

Guarantor of the field of study: prof. Ing. Miroslava Vrbová, CSc.


Guarantor of the specialization Medical Imaging Systems (ZSL): prof. Ing. Peter Kneppo, DrSc. (/ZSL - valid for specialization ZSL)

<table>
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<tr>
<th>Code</th>
<th>Course</th>
<th>Type</th>
<th>Obligation</th>
<th>Load</th>
<th>Credits</th>
<th>Conclusion</th>
<th>Lecturer</th>
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<td>17MPZMB</td>
<td>Fundamentals of Molecular Biology</td>
<td>OBR</td>
<td>P</td>
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<td>Mgr. Veronika Vymětalová</td>
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<td>Fundamentals of Nuclear and Molecular Physics</td>
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<td>Selected Chapters in Physics</td>
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<td>P</td>
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<td>z, zk</td>
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1st year 2nd semester

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<td>Electrotechnology</td>
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<td>Microscopy in Medicine</td>
<td>OBR</td>
<td>P</td>
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<td>kl. z</td>
<td>prof. Ing. Miroslav Jelínek, DrSc.</td>
<td>FBMI KPO</td>
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<td>Project II – Seminar</td>
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<td>P</td>
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<td>17MPAEM</td>
<td>Electromagnetic Field in Medicine</td>
<td>OBR</td>
<td>P</td>
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<td>prof. Ing. Jan Vrba, CSc.</td>
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<td>17MPAOL</td>
<td>Applied Optoelectronics in Medicine</td>
<td>OBR</td>
<td>P</td>
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<td>17MPBFT</td>
<td>Biophotonics</td>
<td>OBR</td>
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<td>z, zk</td>
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<td>17MPDSPI</td>
<td>Diploma Thesis I – Seminar</td>
<td>OBR</td>
<td>P</td>
<td>0+1</td>
<td>2</td>
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<td>17MPRTD</td>
<td>Radiation Therapy &amp; Dosimetry</td>
<td>OBR</td>
<td>P</td>
<td>2+0</td>
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<td>kl. z</td>
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<tr>
<td>17MPDSPI</td>
<td>Diploma Thesis II - Seminar</td>
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<td>P</td>
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**2nd year 3rd semester**

**2nd year 4th semester**
### List of offered compulsory optional courses in 1st semester

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<th>Credits</th>
<th>Conclusion</th>
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<th>Guaranteeing dept.</th>
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<tr>
<td>17MPMTM</td>
<td>Novel Technologies and Characterisation Methods in Biomedicine</td>
<td>OBR</td>
<td>PV</td>
<td>2+0</td>
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<td>kl. z</td>
<td>doc. Ing. Miroslav Jelínek, DrSc.</td>
<td>FBMI KPO</td>
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<tr>
<td>17MPPGS</td>
<td>Computer Algebra Systems (it is possible to register instead of 2 compulsory optional courses)</td>
<td>TEP</td>
<td>PV</td>
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<td>RNDr. Eva Feuerstein, Ph.D.</td>
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<td>17MPMFS</td>
<td>Modelling Physiological Systems</td>
<td>OBR</td>
<td>PV</td>
<td>1+1</td>
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<td>Ing. Jiří Potůček, CSc.</td>
<td>FBMI KBI</td>
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<tr>
<td>17MPOS</td>
<td>Image Sensors, Displays, Cathode Ray Tubes and Projection Systems</td>
<td>OBR</td>
<td>PV</td>
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<td>prof. Ing. Miloš Klíma, CSc.</td>
<td>FBMI KBI</td>
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<tr>
<td>17MPTPP</td>
<td>Technical and Program Tools for Telemedicine, Multimedia and Virtual Reality</td>
<td>OBR</td>
<td>PV</td>
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<td>FBMI SPA</td>
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<tr>
<td>17MPZNS</td>
<td>Fundamentals of Neural Networks and Fuzzy Logic</td>
<td>TEP</td>
<td>PV</td>
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<td>kl. z</td>
<td>doc. RNDr. Ing. Marcel Jiřina, Ph.D.</td>
<td>FBMI KBI</td>
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<tr>
<td>17MPBS</td>
<td>Biostatistics</td>
<td>OBR</td>
<td>PV</td>
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<td>kl. z</td>
<td>Mgr. Tereza Štěpánová</td>
<td>FBMI KPO</td>
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<tr>
<td>17MPOP</td>
<td>Optics in Biology and Medicine</td>
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### List of offered compulsory optional courses in 2nd semester

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<th>Lecturer</th>
<th>Guaranteeing dept.</th>
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<td>17MPNM</td>
<td>Numerical Methods (it is possible to register instead of 2 compulsory optional courses)</td>
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<td>FBMI KPO</td>
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<td>17MPSBL</td>
<td>Spectroscopy in Biology &amp; Medicine</td>
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<td>kl. z</td>
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<td>17MPZAO</td>
<td>Image Processing and Analysis</td>
<td>OBR</td>
<td>PV</td>
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<td>prof. Ing. Václav Hlaváč, CSc.</td>
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<tr>
<td>17MPMPZ</td>
<td>Methods nad Devices (HW+SW) for Processing, Compression and Recording of Image Signal</td>
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<td>kl. z</td>
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<td>17MPLT</td>
<td>Laser technology</td>
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<td>17MPOCH</td>
<td>Organic Chemistry</td>
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<td>17MPPIZ</td>
<td>Work with Information Sources and Research Methodology</td>
<td>OBR</td>
<td>PV</td>
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### List of offered compulsory optional courses in 3rd semester

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<th>Guaranteeing dept.</th>
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<td>17MPAZD</td>
<td>Data Analysis &amp; Processing</td>
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<td>PV</td>
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<td>doc. RNDr. Ing. Marcel Jiřina, Ph.D.</td>
<td>FBMI KBI</td>
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<tr>
<td>17MPZMI</td>
<td>Ionizing Radiation Imaging</td>
<td>OBR</td>
<td>PV</td>
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<td>Ing. Stanislav Pospíšil, DrSc.</td>
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<td>17MPZSN</td>
<td>Nuclear Medicine Imaging Systems</td>
<td>OBR</td>
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<td>prof. MUDr. Martin Šámal, DrSc.</td>
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<td>17MPUDS</td>
<td>Ultrasound and Doppler Imaging Systems</td>
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<td>17MPHEK</td>
<td>Hemocompability</td>
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<td>17MPPLB</td>
<td>Solid Substances in Biology and Medicine</td>
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<td>17MPTVP</td>
<td>Technology of the Vacuum and Work with Gases</td>
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<td>PV</td>
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<td>17MPVOB</td>
<td>Fiber Optics for Biomedicine</td>
<td>OBR</td>
<td>PV</td>
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<td>Ing. Marie Pospíšilová, CSc.</td>
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### List of offered compulsory optional courses in 4th semester

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<th>Conclusion</th>
<th>Lecturer</th>
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<tr>
<td>17MPBKM</td>
<td>Biocompatible Materials</td>
<td>OBR</td>
<td>PV</td>
<td>2+0</td>
<td>2</td>
<td>kl. z</td>
<td>doc. Ing. Miroslav Jelínek, DrSc.</td>
<td>FBMI KPO</td>
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<tr>
<td>17MPCC</td>
<td>Cytology &amp; Cytogenetics</td>
<td>OBR</td>
<td>PV</td>
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<td>kl. z</td>
<td>Mgr. Veronika Vymětalová</td>
<td>FBMI KPO</td>
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<tr>
<td>17MPNT</td>
<td>Nanotechnology</td>
<td>OBR</td>
<td>PV</td>
<td>2+0</td>
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<td>kl. z</td>
<td>doc. Ing. Miroslav Jelínek, DrSc.</td>
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<td>17MPALB</td>
<td>Laser Applications in Biomedicine</td>
<td>OBR</td>
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<td>kl. z</td>
<td>prof. Ing. Helena Jelínková, DrSc.</td>
<td>FBMI KPO</td>
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<td>17MPTTE</td>
<td>Television, Thermovision and Endoscopic Imaging Systems</td>
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<td>prof. Ing. Miloš Klíma, CSc.</td>
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<td>17MPZMR</td>
<td>Magnetic Resonance Imaging and Impedance Tomography</td>
<td>OBR</td>
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<td>2+0</td>
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<tr>
<td>17MPSMI</td>
<td>Simulation in Biomedical Engineering</td>
<td>OBR</td>
<td>PV</td>
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<td>2</td>
<td>kl. z</td>
<td>Ing. Patrik Kutílek, Ph.D.</td>
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<tr>
<td>17MSZF</td>
<td>Fundamentals of Pharmacology</td>
<td>OBR</td>
<td>PV</td>
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<td>z, zk</td>
<td>MUDr. Miroslav Starec, CSc.</td>
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<tr>
<td>17MPPVA</td>
<td>Presenting One’s Results in English</td>
<td>OBR</td>
<td>PV</td>
<td>0+2</td>
<td>2</td>
<td>kl. z</td>
<td>doc. Vladimír Rogalewicz, CSc.</td>
<td>FBMI KPO</td>
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</table>

### List of abbreviations:

- **TEP**: theoretical course
- **OBR**: technical course
- **EKM**: economical-managerial course
- **HUM**: humanity course
- **P**: compulsory course
- **PV**: compulsory optional course
- **V**: optional course
- **z**: assessment
- **kl. z**: graded assessment
- **zk**: examination
Annotations show only approximate contents of courses. Specific contents are given by curricula that will be provided to students in the beginning of each particular course.

List of abbreviations: P – compulsory, PV – compulsory optional, V – optional
Load (hours/weekly): P – lecture, C – tutorial, L – laboratory exercise, S – seminar
Conclusion: z – assessment, kl. z. – graded assessment, zk – examination
1 Credit = 1 ECTS

Applied Optoelectronics in Medicine (17MPAOL)  P
Weekly load (hours): 2 P+2 C  4 credits  Conclusion: kl. z
Lecturer: prof. Dr. Ing. Dr.h.c. Vladimír Blažek

Biocompatible Materials (17MPBKM)  PV
Weekly load (hours): 2 P+0 C  2 credits  Conclusion: kl. z
Lecturer: doc. Ing. Miroslav Jelínek, DrSc.
Contemporary theoretical, experimental and clinical knowledge concerning functions, shapes, structures and qualities of artificial replacements in human and veterinary medicine. Structures and qualities of some selected tissues. Artificial replacements of parts of diaphysis, replacement of flat bones, bones of the facial skeleton, cartilages, vertebrae (incl. discs), and some vessels.

Biophotonics (17MPBFT)  P
Weekly load (hours): 2 P+1 C  4 credits  Conclusion: z, zk
Lecturer: doc. Ing. Miroslav Jelínek, DrSc.
Overview of principles and applications in the interdisciplinary field connecting disciplines of physics, optics and biology. Interaction of optical radiation with matter, with tissue, basics of biology, photobiology, bioimaging, microscopy, basics of lasers, laser safety, optical biosensors, nanotechnology for biophotonics.
Biophysics (17MPBF2)  
Weekly load (hours): 2 P+2 C  
5 credits  
Lecturer: RNDr. Josef Pražák, CSc.  

Physics of biological micro- and macro-world; geometrical aspects of biophysics, physical interactions significant for living matter construction, quantum description of microworld, biophysics and nanotechnologies, actions on membranes, thermodynamics and statistical physics of cell actions; biological sources and forms of motion, muscle cell; physical principles of sense organs and signal transmission in organism; continuum mechanics of living matter – bioengineering and body liquids circulation; interaction of a living organism and effects of external physical forces – radiation, heat, mechanical contact.

Biostatistics (17MPBS)  
Weekly load (hours): 2 P+0 C  
2 credits  
Lecturer: doc. Vladimír Rogalewicz, CSc.

Introductory course of statistics in the extent appropriate for an engineering, non-mathematical degree program at a technical university. The course mainly aims at explaining concepts and methods, which should give the students the ability to a) solve simple problems by themselves, and b) cooperate with expert statisticians in solving problems of greater complexity. The exercises aim at acquiring practical skills in data mining from SQL databases, and their subsequent statistical treatment.

Computer Algebra Systems (17MPPGS)  
Weekly load (hours): 2 P+2 C  
4 credits  
Lecturer: RNDr. Eva Feuerstein, Ph.D.

Introduction to computer algebra systems (DERIVE, MAPLE, MATHEMATICA, MATLAB), history, general properties, comparison. Students are introduced into symbolic and numerical operations, programming and debugging, libraries and data structures, solving problems, matrix operations, logical operations and graphics in each of the four systems.

Cytology and Cytogenetics (17MPCC)  
Weekly load (hours): 2 P+0 C  
2 credits  
Lecturer: Mgr. Veronika Vymětalová


Data Analysis and Processing (17MPAZD)  
Weekly load (hours): 2 P+0 C  
2 credits  
Lecturer: doc. RNDr. Ing. Marcel Jiřina, Ph.D.

Diploma Thesis I (17MPDP1)
Weekly load (hours): 0 P+8 C 9 credits Conclusion: z
Lecturer: individual

Diploma theme is suggested by the department and given by the Faculty. Preparation of the thesis is divided into two semesters, and it is a usually a continuation of the project from the previous year. In the winter semester, the focus of the work is on resolution of the introduction to the Thesis. The student takes part in regular seminars in a working group. In the end of the semester, a department seminar will be held with obligatory presentation of the student’s results.

Diploma Thesis I – Seminar (17MPSDP1)
Weekly load (hours): 0 P+1 C 2 credits Conclusion: z
Lecturer: NTB prof. Ing. Miroslava Vrbová, CSc., ZSL prof. Ing. Peter Kneppo, DrSc.

Diploma theme is suggested by the department and given by the Faculty. Preparation of the thesis is divided into two semesters, and it is a usually a continuation of the project from the previous year. In the winter semester, the focus of the work is on resolution of the introduction to the Thesis. The student takes part in regular seminars in a working group. In the end of the semester, a department seminar will be held with obligatory presentation of the student’s results.

Diploma Thesis II (17MPDP2)
Weekly load (hours): 0 P+12 C 12 credits Conclusion: z
Lecturer: individual

The topic of the thesis is suggested by the department and given by the Faculty. Preparation of the thesis is divided into two semesters, and it is a usually a continuation of the project from the previous year. In the last semester, students approach an independent solution. They take part in regular seminars of the working group. Students discuss their results with their thesis supervisors. Credits are provided for delivering the thesis before the prescribed deadline.

Diploma Thesis II - Seminar (17MPSDP2)
Weekly load (hours): 0 P+1 C 2 credits Conclusion: z
Lecturer: NTB prof. Ing. Miroslava Vrbová, CSc., ZSL prof. Ing. Peter Kneppo, DrSc.

The topic of the thesis is suggested by the department and given by the Faculty. Preparation of the thesis is divided into two semesters, and it is a usually a continuation of the project from the previous year. In the last semester, students approach an independent solution. They take part in regular seminars of the working group. Students discuss their results with their thesis supervisors. Credits are provided for delivering the thesis before the prescribed deadline.

Electrical Measurements (17MPEM)
Weekly load (hours): 2 P+2 C 5 credits Conclusion: z, zk
Lecturer: prof. Ing. Peter Kneppo, DrSc.

Electrotechnology (17MPEL)
Weekly load (hours): 2 P+2 C 5 credits Conclusion: z, zk
Lecturer: doc. Ing. Jiří Hozman, Ph.D.

Basic electrical laws, circuit equations, basic theorems, amplifiers. Source of electrical voltage and current, electrical power sources and distribution, safety at work with electrical equipment, autonomous power distribution for medical centres, harmonic and non-harmonic signals, electrical machines: transformers, DC/AC engines, step motors, ways of electrical motor controls, basic notions in logical circuits.

Electromagnetic Field in Medicine (17MPAEM)
Weekly load (hours): 2 P+2 C 5 credits Conclusion: z, zk

The major aim of these lectures is to explain to students the present and probable future possibilities of microwave medical applications. Biological thermal and non-thermal effects of electromagnetic field as well as safety limits are discussed. Microwave thermotherapy applied to cancer and other diseases is described. Details of microwave thermotherapy apparatus are given, especially from the point of view of applicators for local, intracavitary and regional treatment.

Fibre Optics in Biology and Medicine (17MPVOB)
Weekly load (hours): 2 P+0 C 2 credits Conclusion: kl. z
Lecturer: Ing. Marie Pospíšilová, CSc.


Fundamentals of Molecular Biology (17MPZMB)
Weekly load (hours): 2 P+2 C 5 credits Conclusion: z, zk
Lecturer: Mgr. Veronika Vymětalová


Fundamentals of Neural Network and Fuzzy Logic (17MPZNS)
Weekly load (hours): 1 P+1 C 2 credits Conclusion: kl. z
Lecturer: doc. RNDr. Ing. Marcel Jiřina, Ph.D.

Fundamentals of Nuclear and Molecular Physics (17MPZAF)  P
Weekly load (hours): 2 P+2 C  5 credits  Conclusion: z, zk
Lecturer: doc. Dr. Ing. Milan Šiňor


Fundamentals of Pharmacology (17MPZF)  PV
Weekly load (hours): 2 P+2 C  5 credits  Conclusion: z, zk
Lecturer: MUDr. Miroslav Starec, CSc.

Origin and sources of pharmaceutical substances, drug (pharmacon), dispensatory, drugs terminology, pharmaceutical substances of vegetable origin, kinds of pharmacotherapy. Pharmacokinetics based on models, related examples, kinetics of pharmaceutical substances in organism. Detailed description of basic pharmaceutical groups and their effect mechanism in separate systems. Information technology in pharmacology.

Hemocompatibility (17MPHEK)  PV
Weekly load (hours): 2 P+0 C  2 credits  Conclusion: kl. z
Lecturer: prof. Ing. Jan E. Dyr, DrSc.


Image Processing and Analysis (17MPZAO)  PV
Weekly load (hours): 1 P+1 C  2 credits  Conclusion: kl. z
Lecturer: prof. Ing. Václav Hlaváč, CSc.


Image Sensors, Displays, Cathode Ray Tubes and Projection Systems (17MPOS D)  PV
Weekly load (hours): 1 P+1 C  2 credits  Conclusion: kl. z
Lecturer: prof. Ing. Miloš Klíma, CSc.

The aim of the course is to provide students with an overview of the principles and application of image sensors, displays, monitors and project systems in medicine, focusing primarily on specific and image sensors for different spectral fields (physical principles, properties, parameters, possibilities, application – vacuum scanning tubes, photomultipliers and semiconductor detectors, APD, CCD, CID, CMOS, CIS scanners, etc.). Overview of different types of imaging monitors. LCD TFT, plasma displays, special LCD monitors for medical application and diagnostic imaging, grey calibration options, quality of geometric imaging, grey scales, etc. Principles of electron optics. Basic structure of BW and colour screens. External screen equipment. Geometric distortion and correction options. Convergence circuit. Different types of screens in terms of jet systems and mask shape. Equipment with vacuum projection screens. LCD projectors. TV screen walls. Reflection mirror DLP projectors. Laser projection. Active mozaic imaging planes. EIDOPHOR systems and ILA systems. 3D stereoscopic imaging.
Ionizing Radiation Imaging (17MPZMI)  
Weekly load (hours): 2 P+0 C
Lecturer: Ing. Stanislav Pospíšil, DrSc.
Elementary information about ion radiation sources, and ion radiation interaction with substances (of animated and inanimate nature). Radiation detectors and their characteristics. Physical principles of the methods (emission, transmission, etc.). Detection systems, resolution, sources of errors, radiation load. Image reconstruction. Interpretation of results.

Laser Application in Biomedicine (17MPALB)  
Weekly load (hours): 2 P+0 C
Lecturer: prof. Ing. Helena Jelínková, DrSc.
Explanation of laser radiation interaction with tissues. Implementation of lasers in treatment in ophthalmology, dermatology, surgery, cardiology and angioplasty, dentistry, urology, ORL, orthopedics, and photodynamic therapy.

Laser Technology (17MPLT)  
Weekly load (hours): 1 P+1 C
Lecturer: prof. Ing. Miroslava Vrbová, CSc.

Magnetic Resonance Imaging and Impedance Tomography (17MPZMR)  
Weekly load (hours): 1 P+1 C
Lecturer: Doc. Ing. Karel Roubík, Ph.D.
Physical principles of nuclear magnetic resonance (NMR). Relation of atoms and nucleuses to magnetism and magnetic field, concept of "spin", relation between magnetism and energy states, precession, Larmor frequency. Radio frequency in magnetic fields, phase coherence and precession, resonance. VF pulse, magnetization vector tilting, MR signal generation – longitudinal and cross magnetisation components and relationship between the two, relaxation between magnetization components and free recession signal FID. Relaxation, definition, relaxation time or T1 time constant, relationship between T1 and tissue type and magnetic field non-homogeneity, use of 180° VF pulse as means of correction of elementary spin sequencing. Relationship between pulse sequences and contrast or relationship between the intensity of generated MR signal of different tissue types, pulse frequency and T1 and T2 relaxation times, image contrast defined by T1 and T2 relaxation time and proton density, definition of SR, SE and IR sequences T1, T2 and proton density weighted image and relationship to TE and TR times. Coding of volume element location (voxel) – definition of gradient, magnetic field gradient generation, section choice and thickness, image matrix coding – pixel, definition, use of Fourier transformation apparatus, rate coding of columns and rate-coding magnetic field gradient, phase coding of lines and phase-coding magnetic field gradient, importance of pulse diagrams, frequency and phase management during SE sequence. Principles of the Fourier reconstruction method. Overview of sequences currently used and principles of proposed new sequences. Basic components of MR system, types of magnets, important component characteristics, History of EIT. Definitions. Introduction to bioimpedance. Comparison of EIT and other imaging methods. Image types in EIT. EIT principles (electric characteristics of tissues, frequencies). EIT phantoms. System description (block chart). Reconstruction methods. 3D EIT. Other methods of impedance tomography (Magnetic Induction Tomography, Magnetic resonance electrical impedance tomography (MREIT)). Application in medicine.
Methods and Devices (HW+SW) for Processing, Compression and Recording of Image Signal (17MPMPZ)  PV
Weekly load (hours): 1 P+1 C 2 credits Conclusion: kl. z
Lecturer: prof. Ing. Miloš Klíma, CSc.
Reconstruction of analogue signal from sequence of numbers. Overview and function of A/D converters.
Amplitude characteristic of digital-analogue converter. A/D converter input filter. Sampling and converter
error due to spectrum overlapping. Technologies and circuits for digital processing of image signal
(unipolar and bipolar IO, surface wave circuits, charge transfer circuits, GaAs use). Digital TV, Impulse
modulation and PCM. Aspects of digital transfer of image signal. Component coding and sampling.
Sampling structure concept. Fixed structures. Sampled image spectrums at different sampling structures.
Subjective tests of sampling structure. Sampling in different TV broadcasting systems. Sub-Nyquist
sampling possibilities. 2D filtering. Coding using orthogonal transformations. Software for image
processing. In classes, students will use technologies and software to get better understanding of the issues.
Image properties, image as information medium. Compression method characteristics. Wireless
compression methods. Predictive methods. Dictionary methods. Huffman and arithmetic coding. Lossy and
Vector quantisation. Methods based on image model and probability methods. Animation and vide
sequencing (basic principles, motion prediction, two-way image interpolation, H.261, MPEG 1-4
standards). New trends in image compression (transformation compression, image compression using
for image compression. Introduction to and history of image recording and image signal. Overview of
image recording methods. Mechanical recording, renewal of archive images. Optical recording of sound
signal on film. Dolby-SR, Digital Surround, Sony SDDS. Magnetically recording of analogue signal. Magnetic
media. Tapes. Recording and reproduction correction. Signal recording with width and frequency
Modification of data bitstream for sound signal recording. Error detection and correction. Recording in CD-
Audio, SACD, CD-ROM, CD-R and CD-RW. Optical and magneto-optical re-writable recording.
Minidisc. DVD, DVD+R, DVD-R, DVD+RW, DVD-RW, DVD DL. Recording on hard and floppy discs,
DAT. Digital image recording, Time and control codes. Signal recording in hard memories. New principles
of signal recording.

Microscopy in Medicine (17MPMMM)  P
Weekly load (hours): 2 P+0 C 2 credits Conclusion: kl. z
Lecturer: prof. Ing. Miroslav Jelínek, DrSc.
Light microscopy techniques, electron microscopy techniques. Digital bioimaging. Fluorescent
microscopy, confocal microscopy, and electron microscopy (SEM, TEM).

Modelling Physiological Systems (17MPMFS)  PV
Weekly load (hours): 1 P+1 C 2 credits Conclusion: kl. z
Lecturer: Ing. Jiří Potůček, CSc.
Basic terminology. Particularity of modelling physiological systems. Models of cardiovascular
system. Models of endocrine system and glands. Models of gastrointestinal system. Models of sensory
perception.

Nanotechnology (17MPNT)  PV
Weekly load (hours): 2 P+0 C 2 credits Conclusion: kl. z
Lecturer: doc. Ing. Miroslav Jelínek, DrSc.
Lectures prepared by leading Czech experts from various academicians institutions and universities.
Introduction to nanotechnology, analytical instrumentation – scanning microscopy, electron microscopy,
nanoparticles, thin films and nano-, polymeric nanocomposites, nanostructures and nanoelectronics, carbon
nanostructures, biosensors, nanowires, nanomedicine, risks of nanotechnology methods for synthesis of
nanoparticles and nanostructures, engineering of nanoparticles, present applications of nanotechnology, etc. The lectures will appear as a textbook.

**Novel Technologies and Characterisation Methods in Biomedicine (17MPMTM)**

Weekly load (hours): 2 P+0 C 2 credits  
Lecturer: prof. Ing. Miroslav Jelínek, DrSc.

Overview of technology processes used in preparation of material and thin layers based on physical (PVD) and chemical (CVD) methods. Laser methods used in material modification and adaptation and layer creation. Mechanism of thin layer growth. Methods for characterisation of the properties of surfaces and thin layers – study of topology, composition, crystallinity, bonds, optical and mechanical properties. Practical examples of development and application of materials and layers in biomedicine.

**Nuclear Medicine Imaging Systems (17MPZSN)**

Weekly load (hours): 1 P+1 C 2 credits  
Lecturer: prof. MUDr. Martin Šámal, DrSc.

Radiobiology on cellular level (effects of radiation on cells, direct and indirect effects of radiation, radiosensitivity of cells), repair mechanisms, factors affecting cell response to radiation (dose rate, linear energy transfer, chemicals, cell cycle phases), effect of full body radiation (radiation-related acute diseases – haematological/marrow form, intestinal form, neuropsychological form), late-onset effects of ionising radiation (somatic and genetic, deterministic and stochastic), small dose issues – effects of small doses on human health, radiation hormesis. Radionuclide and radiopharmaceutical production – radionuclides produced in cyclotrons, radionuclides produced in reactors, radionuclide generators, tracing methods, radiopharmaceuticals used in diagnosis, radiopharmaceuticals for PET, quality control (radionuclide purity, radiochemical purity, chemical purity, sterility, apyrogenicity, toxicity), examples of most commonly used radiopharmaceuticals including their most important clinical applications. Equipment used in nuclear medicine – detection and equipment, gas detectors, scintillation and semiconductor detectors, imaging equipment (space resolution, sensitivity, homogeneity, contrast, quality control), full-body imaging, tomographic imaging systems, hybrid systems, PET/CT, SPECT/CT. Computer data processing in nuclear medicine – data collection (static, dynamic, full-body and tomographic studies, continuous, matrix and interval recording), accumulation, processing and imaging of recorded data, analogue and digital image, image filtering, mathematical image processing – image averaging, background subtraction, functional and parametric imaging, areas of interest, curve generation (processing). Computer data processing in nuclear medicine – tomographic data collection and reconstruction, simple back projection, filtered back projection, iterative algorithms, quantitative imaging, image fusion and registration (correlative imaging), information storage and retrieval, statistical decision theory – SPECT (single-photon emission tomography), radiopharmaceuticals, detection technology, equipment, reconstruction of tomograph images, full-body imaging, space resolution, sensitivity, principles of clinical application, examples of clinical applications. Principles of emission tomography – PET (positron emission tomography, radiopharmaceuticals, detection technology, equipment, reconstruction of tomograph images, full-body imaging, space resolution, sensitivity, principles of clinical application, examples of clinical applications. Description of different types of examinations.

**Numerical Methods (17MPNM)**

Weekly load (hours): 2 P+2 C 4 credits  
Lecturer: RNDr. Eva Feuerstein, Ph.D.

Optics in Biology and Medicine (17MPOP)
Weekly load (hours): 1 P+1 C 2 credits Conclusion: kl. z
Lecturers: Ing. Marie Pospíšilová, CSc., Ing. Jiří Novák, Ph.D.

Organic Chemistry (17MPOCH)
Weekly load (hours): 2 P+2 C 5 credits Conclusion: z, zk
Lecturer: doc. RNDr. Martin Michl, Ph.D.
This course covers the area of organic chemistry with a particular focus on electronic structure, stereochemistry, chemical reactivity, reaction mechanisms, important natural species, and organic analysis.

Presenting One´s Results in English (17MPPVA)
Weekly load (hours): 0 P+2 C 2 credits Conclusion: kl. z
Lecturer: doc. Vladimír Rogalewicz, CSc.
Formal as well as unwritten rules of scientific result presentation. Personal presentation on a workshop. Each lesson will contain about 30 minutes of theory (language tools, visual tools, basic techniques, utilization of equipment, moderating a discussion). Basic rules for publishing.

Project I (17MPPJ1)
Weekly load (hours): 0 P+3 C 2 credits Conclusion: z
Lecturer: individual
Students take part in regular seminars of the working group. Students discuss their results with their thesis supervisors.

Project I - Seminar (17MPSP1)
Weekly load (hours): 0 P+1 C 2 credits Conclusion: z
Lecturer: /NTB prof. Ing. Miroslava Vrbová, CSc., /ZSL prof. Ing. Peter Kneppo, DrSc.
Students take part in regular seminars of the working group. Students discuss their results with their thesis supervisors.

Project II (17MPPJ2)
Weekly load (hours): 0 P+7 C 8 credits Conclusion: kl. z
Lecturer: individual
Students take part in regular seminars of the working group. Students discuss their results with their thesis supervisors.

Project II - Seminar (17MPSP2)
Weekly load (hours): 0 P+1 C 2 credits Conclusion: z
Lecturer: /NTB prof. Ing. Miroslava Vrbová, CSc., /ZSL prof. Ing. Peter Kneppo, DrSc.
Students take part in regular seminars of the working group. Students discuss their results with their thesis supervisors.

Radiation Therapy and Dosimetry (17MPRTD)
Weekly load (hours): 2 P+0 C 2 credits Conclusion: kl. z
Lecturer: doc. Ing. Jozef Sabol, DrSc.
Principles and practise of radiation therapy. Radiation therapy – teletherapy, brachytherapy, 3-D conform radiation therapy, IMRT, hadron radiation therapy.

Selected Chapters in Mathematics (17MPVMA)
Weekly load (hours): 2 P+2 C 5 credits
Lecturer: doc. Vladimír Rogalewicz, CSc.
Overview of mathematics as a scientific branch and its historical development. Partial differential equations, wave equation. Introduction into complex analysis.

Selected Chapters in Physics (17MPVKF)
Weekly load (hours): 2 P+2 C 5 credits
Lecturer: Dr. Ing. Jaroslav Kuba, Ph.D.
The "Selected Chapters in Physics" course is an advanced physics course for master students. The course overviews fundamentals in thermodynamics, statistical physics and electrodynamics. Students will go through an arsenal of methods and procedures that they will utilize in their further study. The main stress is given on understanding of laws and principles, and students' ability to solve examples.

Simulation in Biomedical Engineering (17MPSMI)
Weekly load (hours): 2 P+0 C 2 credits
Lecturer: doc. RNDr. Zdeněk Kluiber, CSc., Ph.D.

Solid Substances in Biology and Medicine (17MPPLB)
Weekly load (hours): 2 P+0 C 2 credits
Lecturer: doc. RNDr. Zdeněk Kluiber, CSc. Ph.D.
Solid state physics is a very wide branch of physics with many applications. Topics of lectures: structure of solids, bonds, mechanical qualities, specific heat, electrical qualities, superconductivity, belts theory, physics of semiconductors, optical qualities of solids, luminescence, liquid crystals, application at biomedical engineering.

Spectroscopy in Biology and Medicine (17MPSBL)
Weekly load (hours): 1 P+1 C 2 credits
Lecturer: doc. Dr. Martin Hof, DrSc.
Fluorescence spectroscopy techniques, basic instrumentation and selected applications. Fluorescent probes in Biosciences and Medical Diagnostics. Fluorescence microscopy – confocal, two-photon. Techniques of GFP technology in Biosciences.

Technical and Program Tools for Telemedicine, Multimedia and Virtual Reality (17MPTPP)
Weekly load (hours): 1 P+1 C 2 credits
Lecturer: Ing. Karel Hána, Ph.D.
Telemedicine (telematics for healthcare) – WHO definition, content – telemedicine, telematics for healthcare service management, telemedicine history in the context of IT and communications development, teleradiodagnosis, teledermatology, telepathology, telesurgery, teleophthalmology, teleorthopaedics, telegeriatrics, telepsychiatry, telecardiology, telecardiosurgery, telegenetics, teleanaesthesiology, teleendoscopy, teleothorhinolaryngology, telepediatrics, telepulmonology, public telehealthcare, primary telecare and veterinary telemedicine, videoconference vs. electronic mail, communication protocols, special technology for telemedicine, ethical, legal, organisational and financial issues, situation in the Czech Republic. Application of technical and programme means using multimedia technology and
virtual reality in medicine. Overview and principles of different types of simulators (for surgery, ophthalmology, endoscopy, etc.).

**Technology of the Vacuum and Work with Gases (17MPTVP)**  
Weekly load (hours): 1 P+1 C  
2 credits  
Conclusion: kl. z  
Lecturer: doc. RNDr. Zdeněk Kluiber, CSc. Ph.D.  
Problems of the physics of a low pressure are a fundamental part of physics. Main topics: vacuum, qualities of gases, kinetic theory, surface processes, vacuum systems, theory of evacuation, vacuum – materials, methods for obtaining a low pressure, measuring pressure.

**Television, Thermovision and Endoscopic Imaging Systems (17MPTTE)**  
Weekly load (hours): 1 P+1 C  
2 credits  
Conclusion: kl. z  
Lecturer: prof. Ing. Miloš Klíma, CSc.  

**Ultrasound and Doppler Imaging Systems (17MPUDS)**  
Weekly load (hours): 1 P+1 C  
2 credits  
Conclusion: kl. z  
Lecturer: doc. Ing. Jiří Hozman, Ph.D.  
Work with Information Sources and Research Methodology (17MPPIZ)  

Weekly load (hours): 2 P+0 C  
2 credits  
Conclusion: kl. z

Lecturer: doc. Ing. Karel Roubík, Ph.D.

Doctoral study program
Biomedical and Clinical Technology

Organization and structure of the study

The doctoral study program Biomedical and Clinical Technology is a three-year study program finished by the comprehensive doctoral examination and than the defense of a dissertation. It is a university study that is a part of so called structured university education.

This study program is not divided into branches, and can be studied as full-time or part-time.

The study is carried out according to individual curricula under the lead of a supervisor. Individual curricula shall be approved and evaluated by the Branch Board. Requirements for individual curricula are defined in the Study and Examination Code of CTU. The Code also determines rules for comprehensive doctoral examinations and for dissertations.

Furthermore, the following minimum requirements for individual curricula are given:

- a study block, finished by completion of 4 exams in selected professional courses;
- demonstration of English language knowledge; presentation of results in English at a scientific conference;
- continuously monitored completion of progress stages of the dissertation;
- taking part in teaching of courses related to the dissertation topic;
- at least one paper published or accepted for publishing in a reputable journal; the share of the student has to be clearly determined in case of more authors;

It is recommended:

- to designate a specialist supervisor, so that the student had instructors both from engineering and from biological/medical fields;
- to carry out a longer scientific visit at a foreign university specialized in the topic of the student’s dissertation;
- to submit the dissertation in English language; it is possible to submit it as a set of published papers extended by a general introduction and discussion;

Study plan

The week load of all classes is 2+0 (5 credits). Further self-study (at least of 0+2) is expected for all courses. All courses are finished by an exam.

Obligatory specialization course Progress in Biomedical Engineering is compulsory for all students of full-time and part-time types of doctoral study. This course will take place in the winter semester. The course will have a contact form and will be held in the FBME’s premises in Kladno. The course will consist of 12 individual lectures in the winter semester. In each of them, a different FBME professor will introduce the students to the current state of his scientific field. This way, students will obtain an overview of (i) the range of problems solved in selected areas of biomedical engineering, (ii) the latest knowledge in this field, and (iii) the research problems solved at FBME.

The course Introduction to human physiology and pathological physiology shall be registered by all the students that did not pass a similar course during their bachelor or master studies. The course has a contact form.

All the other (compulsory optional) courses will be held in a contact form, providing the minimum of 5 students will register for them; otherwise, they will be held in a form of a monitored self-study (this rule can differ for some courses carried out at external workplaces).

Next to courses listed here, a student can register for any course of doctoral study at the following faculties:

- all CTU’s faculties,
Charles University: 1st Medical Faculty, 2nd Medical Faculty, 3rd Medical Faculty,
Institute of Chemical Technology Prague, Faculty of Food and Biochemical Technology,
Technical University of Liberec, Faculty of Textile Engineering.
This option is only valid in the case that the supervisor recommends the particular course, and no similar course is available in the FBME offer.
A completion of any course within bachelor or master degree studies will not be recognized for the doctoral degree study, and the students shall choose another course.

Health and safety at work

Each student of the doctoral study program Biomedical and Clinical Technology, while registering for the 1st semester of the study, has to pass the basic occupational health and safety training according to the given curriculum. The basic health and safety training records are archived. Even if a student already studied at FBME, he has to attend the basic health and safety training again. This training is carried out simultaneously with trainings related to professional capability in electrotechnology and to the work in all types of laboratories at FBME. If students attend courses in facilities of another university as well, they have to pass a special health and safety training in the particular facility.

Objectives of the field of study

The objective of the study is to obtain skills and abilities for creative scientific work in an international environment. Doctoral students will take part in scientific and research projects in their supervising workplaces in line with their previous master degree study, and will be motivated by study conditions to define and solve their own scientific and research projects. During the course of their study, they will be encouraged to independently publish their scientific results.

Total profile of the graduate

The graduate of this study program will be equipped with the latest knowledge in a suitable combination of scientific fields to have a grasp of both medical and technological environments. He/she will be prepared for work in an interdisciplinary team. He/she will also be able to independently plan, perform, control and present research activities. He/she can find employment in research institutions, in R&D laboratories of large companies, in health care services, or in firms dealing with sale and/or service of medical technology or medical software. Within a team, he/she will be an engineer, a developer or a scientist that is able to communicate with participating experts from various fields (engineering sciences, natural sciences, medical sciences), and integrate their approaches.
The study plan for doctoral study programme BMCT (full-time study and part-time study)

### Compulsory Course:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>Obligation</th>
<th>Extent</th>
<th>Credits</th>
<th>Conclusion</th>
<th>Lecturer</th>
<th>Department of guarantee</th>
</tr>
</thead>
<tbody>
<tr>
<td>17DBPBI</td>
<td>Advances in biomedical engineering</td>
<td>P</td>
<td>2+0</td>
<td>5</td>
<td>zk</td>
<td>prof. Ing. Kneppo Peter, CSc.</td>
<td>FBMI KBT</td>
</tr>
</tbody>
</table>

### Compulsory Course (if the student did not pass a similar course during his/her previous study)

<table>
<thead>
<tr>
<th>Code</th>
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</tr>
</thead>
<tbody>
<tr>
<td>17DBFP</td>
<td>Introduction to human physiology and pathological physiology</td>
<td>P</td>
<td>2+0</td>
<td>5</td>
<td>zk</td>
<td>doc. MUDr. Navrátil Leoš, CSc.</td>
<td>FBMI KLHO</td>
</tr>
</tbody>
</table>

### Compulsory Optional Courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>Obligation</th>
<th>Extent</th>
<th>Credits</th>
<th>Conclusion</th>
<th>Lecturer</th>
<th>Department of guarantee</th>
</tr>
</thead>
<tbody>
<tr>
<td>17DBANM</td>
<td>Algorithms of numerical methods</td>
<td>PV</td>
<td>2+0</td>
<td>5</td>
<td>zk</td>
<td>prof. Ing. Čulík Jan, DrSc.</td>
<td>FBMI KPO</td>
</tr>
<tr>
<td>17DBA3D</td>
<td>Analysis of 3D microscopic images in biomedicine</td>
<td>PV</td>
<td>2+0</td>
<td>5</td>
<td>zk</td>
<td>RNDr. Kubínová Lucie, CSc.</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td>17DBAIS</td>
<td>Signal analysis and interpretation</td>
<td>PV</td>
<td>2+0</td>
<td>5</td>
<td>zk</td>
<td>doc. RNDr. Ing. Jiřína Marcel, Ph.D.</td>
<td>FBMI KBI</td>
</tr>
<tr>
<td>17DBATM</td>
<td>Application and utilisation of technological methods and procedures in clinical practice</td>
<td>PV</td>
<td>2+0</td>
<td>5</td>
<td>zk</td>
<td>prof. MUDr. RNDr. Beneš Jiří, CSc.</td>
<td>FBMI KPO</td>
</tr>
<tr>
<td>17DBALA</td>
<td>Laser applications in biomedicine</td>
<td>PV</td>
<td>2+0</td>
<td>5</td>
<td>zk</td>
<td>prof. Ing. Jelínková Helena, DrSc.</td>
<td>FBMI KBO</td>
</tr>
<tr>
<td>17DBAOPT</td>
<td>Applied optoelectronics in medicine</td>
<td>PV</td>
<td>2+0</td>
<td>5</td>
<td>zk</td>
<td>prof. Dr.-Ing. Dr.h.c. Blažek Vladimír</td>
<td>FBMI KPO</td>
</tr>
<tr>
<td>17DBBEMG</td>
<td>Bioelectromagnetism</td>
<td>PV</td>
<td>2+0</td>
<td>5</td>
<td>zk</td>
<td>prof. Ing. Kneppo Peter, DrSc.</td>
<td>FBMI KBT</td>
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<tr>
<td>17DBBFT</td>
<td>Biophotonics</td>
<td>PV</td>
<td>2+0</td>
<td>5</td>
<td>zk</td>
<td>doc. Ing. Jelínek Miroslav, DrSc.</td>
<td>FBMI KPO</td>
</tr>
<tr>
<td>17DBBSCS</td>
<td>Biomechanics of cardiovascular system</td>
<td>PV</td>
<td>2+0</td>
<td>5</td>
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<td>RNDr. Pražák Josef, CSc.</td>
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**Glossary:**
- **P**: compulsory course
- **PV**: compulsory optional course
- **compulsory course**
- **compulsory optional course**
OPTIONAL COURSES

Choice of optional courses and rules for course selection and registration

Optional courses are announced in a single set of courses for all study branches for the winter and summer semesters. A FBME student may register any compulsory or compulsory optional course at FBME or at CTU as his/her optional course. Optional courses are credited and the credits are recognised as equivalent but are not included in the compulsory credit requirement. Optional course credits are earned above the study plan.

At FBME, typical optional courses include foreign languages and physical education including sports weeks. Students also have the option to take courses that help them revise or deepen their secondary-school education or, on the other hand, give them opportunity to test and experiment with complex methods taught in chemistry courses beyond the standard demonstrations during the Chemistry course. There are also courses that allow all Faculty students to improve their understanding of selected principles of their special fields in biomedicine engineering independently of their main line of study.

Official course registration follows the same rules as registration of any other FBMI course.
List of offered optional courses in winter semester

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<td>German Language for Intermediate students 2</td>
<td>0+2</td>
<td>2</td>
<td>z</td>
<td>PhDr. Markéta Blažejová</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td>17VFC</td>
<td>First Certificate in English</td>
<td>0+2</td>
<td>2</td>
<td>z</td>
<td>Mgr. Eva Motyčková</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td>17VSC</td>
<td>Chemistry Seminars</td>
<td>0+2</td>
<td>2</td>
<td>z</td>
<td>RNDr. Jana Šerá</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td>17VRG</td>
<td>X-Ray Radiation</td>
<td>2+0</td>
<td>2</td>
<td>kl. z</td>
<td>prof. Ing. Miroslava Vrbová, CSc.</td>
<td>FBMI KPO</td>
</tr>
<tr>
<td>17VUIB</td>
<td>Artificial Intelligence for Biomedical Engineering</td>
<td>2+0</td>
<td>2</td>
<td>kl. z</td>
<td>doc. RNDr. Ing. Marcel Jiřina, Ph.D.</td>
<td>FBMI KBT</td>
</tr>
<tr>
<td>17VEMH</td>
<td>Experimental Methods in Hemodynamics</td>
<td>2+0</td>
<td>2</td>
<td>kl. z</td>
<td>prof. Ing. Jiří Nožička, CSc.</td>
<td>FBMI KPO</td>
</tr>
<tr>
<td>17VZPS</td>
<td>The SolidWorks CAD System Fundamentals</td>
<td>0+2</td>
<td>2</td>
<td>z</td>
<td>doc. Ing. Jiří Hozman, Ph.D., Bc. Leoš Nešvera</td>
<td>FBMI KBT</td>
</tr>
</tbody>
</table>
Annotations

Annotations show only approximate contents of courses. Specific contents are given by curricula that will be provided to students in the beginning of each particular course.

List of abbreviations: P – compulsory, PV – compulsory optional, V – optional
Load (hours/weekly): P – lecture, C – tutorial, L – laboratory exercise, S – seminar
Conclusion: z – assessment, kl. z. – graded assessment, zk – examination

1 Credit = 1 ECTS

Artificial Intelligence for Biomedical Engineering (17VUIB) V
Weekly load (hours): 2 P+0 C  2 credits  Conclusion: kl. z
Lecturer: doc. RNDr. Ing. Marcel Jiřina, Ph.D.


Bioinformatics (17VBIF) V
Weekly load (hours): 1 P+1 C  2 credits  Conclusion: kl. z
Lecturer: RNDr. Bruno Sopko, Ph.D.

The aim of this course is to provide basic ideas and concepts of computer usage in biological, biochemical and medical research and laboratory practice. The focus is on the genetics and biochemical protein interactions. Structure and types of information received from molecular biology and biochemistry. Simple and complex alignment of DNA, RNA and protein sequences. Scoring functions. Advanced statistical methods. Modelling of the protein-environment interaction.

English Language I (17VJA1) V
Weekly load (hours): 0 P+2 C  2 credits  Conclusion: z
Lecturer: PhDr. Stanislava Pattonová

English language classes focused on vocabulary and essential grammar. Introduction to basic terminology of biomedical engineering.

English Language II (17VJA2) V
Weekly load (hours): 0 P+2 C  2 credits  Conclusion: z
Lecturer: PhDr. Stanislava Pattonová

Professional English specialising in Biomedical Engineering. Vocabulary and communication covering Natural Sciences (Mathematics, Chemistry, Biology, Physics, Nuclear Sciences, Informatics, Computer Sciences and Biomedical Engineering), Medicine (Basic Organ Systems) and Medical Equipment. English Grammar covers basic rules of written and spoken English.

Experimental Methods in Haemodynamics (17VEMH) V
Weekly load (hours): 2 P+0 C  2 credits  Conclusion: kl. z

Introduction to experimental methods used to determine the flow characteristics in haemodynamics experiments. First, the course discusses the basic principles of each method and then practical examples of measurements on cardiovascular system models are demonstrated during lectures.
First Certificate in English Course (17VFCE)  
Weekly load (hours): 0 P+2 C 2 credits Conclusion: z  
Lecturer: Mgr. Eva Motyčková  
This course serves as a preparation for the internationally recognised FCE. The course develops all skills: reading, writing, listening, comprehensive grammar and conversation. FCE exam is an official certificate of knowledge of English accepted and often requested by employers and universities.

Fundamentals of Pharmacokinetics (17VZFK)  
Weekly load (hours): 1 P+1 C 2 credits Conclusion: z  
Lecturer: Ing. Jiří Potůček, CSc.  
Physiological factors affecting the process of medicament absorption, compartment and noncompartment kinetic models, ways of administering medicaments into organisms and medicament absorption, medicaments distribution and interrelation, excretion and clearance. Explanation of basic pharmacokinetic parameters, biological accessibility and biological equivalences, pharmacokinetics of repeated administration of medicaments, mathematical fundamentals of pharmacokinetics, design of optimum medicament dosis.

German Pre-Intermediate 1 (17VNJ1)  
Weekly load (hours): 0 P+2 C 2 credits Conclusion: z  
Lecturer: PhDr. Markéta Blažejová  
General and specialized topics conversation. Writing and speaking skills. Ability to express one’s opinion in discussions on specific topics. Strategy training for the "Das Goethe-Zertifikat C1" exam. Language skills for the following situations: telephoning, interviews, meeting communication, sales negotiations, communication of a physician or biomedical technician with a patient, letter and email correspondence, professional and private interpersonal communication, office communication in German speaking countries. German grammar for these topics. Professional vocabulary for medicine and biomedical engineering.

German Pre-Intermediate 2 (17VNJ2)  
Weekly load (hours): 0 P+2 C 2 credits Conclusion: z  
Lecturer: PhDr. Markéta Blažejová  
General and specialized topics conversation. Writing and speaking skills. Ability to express one’s opinion in discussions on specific topics. Strategy training for the "Das Goethe-Zertifikat C1" exam. Language skills for the following situations: telephoning, interviews, meeting communication, sales negotiations, communication of a physician or biomedical technician with a patient, letter and email correspondence, professional and private interpersonal communication, office communication in German speaking countries. German grammar for these topics. Professional vocabulary for medicine and biomedical engineering.

Chemistry Seminars (17VSCH)  
Weekly load (hours): 0 P+2 C 2 credits Conclusion: z  
Lecturers: RNDr. Jana Šerá  
Introduction to chemistry, categorization and properties of substances, chemical bonds, chemical reactions, elements in periodic table, organic chemistry fundamentals, natural substances, polymers, analytical methods – instrumental analysis, chemical calculations, chemical equations.

Information Analysis of Biological Systems and Signals (17VIAB)  
Weekly load (hours): 1 P+1 C 2 credits Conclusion: z  
Lecturer: Ing. Pavel Smrčka, Ph.D.  
Information entropy, applications. Average mutual information. Continuous and discrete communication channels. Relationship of information and thermodynamic entropy. The principle of maximum entropy.
Biosystem organization, models and system identification. Introduction to statistical decision making, testing of statistical hypotheses, Bayesian approach.

**Introduction to Computational Fluid Dynamics (17VUPD)**

Weekly load (hours): 2 P+0 C

2 credits

Conclusion: kl. z


The aim of this course is to cover basic aspects of computational fluid dynamics, and to show applications.

**Mathematical Seminars (17VSM)**

Weekly load (hours): 0 P+2 C

2 credits

Conclusion: z

Lecturer: Helena Říhová, CSc.

Seminar providing students with a possibility to repeat high-school mathematics. The content will be variable according to knowledge and interests of the students.

**Neurophysiology (17VNRF)**

Weekly load (hours): 1 P+1 C

2 credits

Conclusion: z

Lecturer: doc. MUDr. Stanislav Jeřábek, CSc.


**Neurotechnology (17VNRT)**

Weekly load (hours): 1 P+1 C

2 credits

Conclusion: z

Lecturer: Ing. Karel Hána, Ph.D.


**Physical Education I to VI, IA to VIA (17VT1 to 17VT6, 17VT1A to 17VT6A)**

Weekly load (hours): 0 P+2 C

2 credits

Conclusion: z

Lecturer: Mgr. Martin Vosyka

Sports and activities available at ČVUT: aerobics (different forms), amateur bodybuilding, basketball, rock climbing, beach volleyball, archery, bowling, swimming, BUDO (judo, karate), table tennis, football, squash, frisbee, softball, floorball, tennis, golf, hiking, hockey, volleyball, canoe (for swimmers only), special physical education, karate. Some of the above are available in Kladno. The above sports and activities may be pursued either as leisure or on a professional level in ČVUT sports clubs and teams. Each semester, there are 2-4 hours for physical education. Students will pursue the sports or activities under the supervision of an experienced PE and sports teacher at the Sletiště location, in sports halls in Kladno or in the Pod Juliskou facility in Prague. For more information visit http://www.utvs.cvut.cz or read page 19 of the White Book.

**Physical Seminars (17VSF)**

Weekly load (hours): 0 P+2 C

2 credits

Conclusion: z

Lecturer: doc. RNDr. Zdeněk Kluiber, CSc., Ph.D.

Seminar providing students with a possibility to repeat high-school physics. The content will be variable according to knowledge and interests of the students.
Real-Time Measuring and Processing Biosignals (17VMZB)  
Weekly load (hours): 1 P+1 C  
Lecturer: Ing. Karel Hána, Ph.D.  

Selected Topics in Professional English (17VVKA)  
Weekly load (hours): 0 P+2 C  
Lecturers: PhDr. Stanislava Pattonová  
This course is for students with sufficient knowledge of English at the level of a secondary school curriculum. It focuses on scientific and technical language, its characteristics, and practicing relevant grammar.

The SolidWorks CAD System Fundamentals (17VZPS)  
Weekly load (hours): 0 P+2 C  
Lecturer: Bc. Leoš Nešvera  

Training Camp I to III (17VTVK1 to 17VTVK3)  
Weekly load (hours): 7 days  
Lecturer: Mgr. Martin Vosyka  
Downhill and cross-country skiing, snowboarding. Outdoor sports (hiking, cycling, canoe, mountaining), windsurfing, ball games, floorball, aerobics, general sports. For more information visit http://www.utvs.cvut.cz or read page 23 of the this booklet.
Students of CTU FBME shall comply with CTU’s common internal regulations and FBME’s dean’s directives

1. CTU’s Statute
2. Statute of CTU FBME
3. The Study and Examination Code for Students of CTU in Prague
4. The Scholarship Code of the CTU in Prague
5. The Accommodation Code of the CTU in Prague
6. The Disciplinary Code for Students of CTU in Prague
7. The Admission Procedure Code of CTU in Prague
8. Conditions of Study at CTU in Prague for Foreigners

Full versions of the regulations are available from the internet addresses:
http://www.cvut.cz/current-students/legislative
http://en.fbmi.cvut.cz/faculty/documents

9. CTU Accommodation Scenario 2009/2010

The full wording of the scenario is available at http://www.suz.cvut.cz/scenar10.doc

10. Directive of the Dean for Bachelor and Master Study Programs