Biomedical engineering master program in Hungary for engineers and medical doctors

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Federation of 120,000 biomedical engineers
CRITERIA FOR THE ACCREDITATION OF BIOMEDICAL ENGINEERING PROGRAMS IN EUROPE

BIOMEDEA
There are no predetermined curricula, nor specific requirements or percentages for individual courses in the different categories. With regard to accreditation, the outcome, i.e. the aptitude or the acquired skills of the graduates, is more important than the curriculum that may very well contain some specific local profile.

More important than adherence to the listed percentages is a reasonable concept for the curriculum. Therefore, the application for accreditation must contain a detailed description for the objectives of the program, its quality and compatibility as well as the professional qualification of its graduates. It should be explained how students can acquire the general professional competencies.
7.2. **Organization of Programs**

As general guidelines, the following principles should be adhered to:

1. In addition to lectures, practice, lab courses and projects must be offered. Professionally oriented Programs should normally offer at least 30% of courses as practice or lab courses. In research oriented programs, all mandatory courses should be complemented by practice.

2. The curriculum of Bachelor programs should contain at least one project.

3. Groups should have the following sizes:
   a. Practice: no more than 15 students
   b. Lab courses: 1 or 2 students per workplace
   c. Projects: 5 to 12 students, depending on conception and goals.

4. All mandatory courses must be offered on an annual basis, or each semester if new students are admitted each semester.

5. The workload caused by mandatory and optional courses must be limited such that the students have the opportunity for additional, self-determined studies.

6. The percentage of necessary optional courses being offered must be sufficient, and they should be distributed equally on summer and winter semesters. There should be a sufficient number to allow a genuine selection, i.e. about twice the amount of necessary courses.

7. There should be a selection of courses being offered in the English language.

8. The course offering should normally be such that the program can be completed as a part time study.

9. Intensive counseling must be available.
TEMPUS IV

CRH-BME

CURRICULA REFORMATION AND HARMONISATION IN THE FIELD OF BIOMEDICAL ENGINEERING
BME studies in Europe in 2000

Study performed by INBIT in 2000 reveals:

• 50 Universities deliver BME program
  – 26 Undergraduate, 30 Postgraduate programs
  – 6 of them offer more than one program

• 33 Institutions run their program within a national or international inter-university collaboration scheme
  – 15 under the ERASMUS program

• 20 Universities apply ECTS
• 29 Institutions apply Quality Assessment schemes
WP1 Preliminary Results

Review of the BME programs in Europe

- 50 Countries in Europe covered
- 38 Countries have BME program
- ~ 150 Universities across Europe
- 295 BME programs
  - 77 Undergraduate - BSc
  - 218 Postgraduate - 159 MSc, 59 PhD

26 % BSc, 54 % MSc, 20% PhD
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Nobel laureates of the university
Dénes GÁBOR (1900 – 1979)
holography, in 1971

Jenő WIGNER (1902 – 1995)
theoretical physics, in 1963

György OLÁH (1927 – 2017)
organic chemistry, in 1994
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The chart illustrates the number of foreign and Hungarian students from 2012 to 2017.

- **2012:**
  - Foreign students: 881
  - Hungarian students: 23,285
  - Overall: 24,166

- **2013:**
  - Foreign students: 1,127
  - Hungarian students: 23,342
  - Overall: 24,469

- **2014:**
  - Foreign students: 1,381
  - Hungarian students: 23,047
  - Overall: 24,428

- **2015:**
  - Foreign students: 1,308
  - Hungarian students: 22,465
  - Overall: 23,773

- **2016:**
  - Foreign students: 1,298
  - Hungarian students: 21,522
  - Overall: 22,820

- **2017:**
  - Foreign students: 1,686
  - Hungarian students: 20,525
  - Overall: 22,211

Growth rates:
- **2012-2013:** 3.6%
- **2013-2014:** 4.6%
- **2014-2015:** 5.7%
- **2015-2016:** 5.5%
- **2016-2017:** 5.7%

The chart indicates an overall increase in the number of students from 2012 to 2017, with a notable growth rate of 7.6% in 2017.
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A BME NEMZETKÖZI FORRÁSBÓL SZÁRMAZÓ BEVÉTELEI 2012-2017
INCOMES FROM INTERNATIONAL SOURCES OF BME 2012-2017
BME education in Hungary

up to 1995: a BME specialization existed within electrical engineering programs.


2009 – : 120 ECTS credit MSc course, (no BME BSc course exists)

Budapest University of Technology and Economics in co-operation with Semmelweis University of Medicine
MSc course: entry requirements

• natural sciences (35 credits): mathematics (12 credits), physics (5 credits), anatomy (6 credits), physiology (6 credits), biochemistry (5 credits).

• engineering basics (10 credits): design and analysis of systems.

• basic programming (5 credits).

• economic and social skills (10 credits): economics, management, quality assurance.
Biomedical engineers: excellent workers

Biomedical engineers are good at individual work, are able to communicate with specialists of another field.

The workload of the program exceeds the average of engineering programs thus students of the BME master program are highly motivated.

These are invaluable features even if they start working on a field different from biomedical applications.
Twenty years of experience of our BME program

BME program can be composed for students with different first degrees (engineers, medical doctors, pharmacists, computer scientists, physicists, medical analysts).

Students with different first degrees help each other very effectively.

Individual (project) work is extremely important, it may add up to one third of the total credits.
International co-operation of Budapest University of Technology and Economics

in the field of
bioinformatics,
biomechanics,
robots in rehabilitation,
medical image processing,
pharmaceutical engineering,
biomedical engineering,
biosensors.
International co-operation of Budapest University of Technology and Economics
in the field of biotechnology and biomedical engineering:

UCL,
KU Leuven,
Janssen (J & J),
Sanofi,
Servier,
Pfizer,
GE Healthcare,
Richter Gedeon,
EGIS,
B. Braun,
University of Minnesota.
Research topics related to healthcare

- home health monitoring,
- bioinformatics,
- new generation medical implants,
- genetics,
- biochemistry,
- medical image processing,
- intelligent data analysis.
Smart Nine-Hole Peg Tester
Smart Nine-Hole Peg Tester
Simple 2-D movement analyzer, PAM
Marker trajectories

samples (100/s)
Objective assessment of Parkinsonians
Objective assessment of Parkinsonians
Finger tapping - young healthy subject

- Right hand
- Left hand
- Right middle finger
- Left middle finger
Finger tapping - Parkinsonian patient, H – Y scale 1
Feature extraction: regularity characterised by SVD

healthy subject

Parkinsonian patient
Characterisation of regularity

\[ y = y(1) \ y(2) \ldots \ y(k) \ldots y(\lambda) \]

\[ X = \begin{bmatrix}
\text{yr}(1,1) & \text{yr}(1,2) & \ldots & \text{yr}(1,n) \\
\text{yr}(2,1) & \text{yr}(2,2) & \ldots & \text{yr}(2,n) \\
\vdots & \vdots & \ddots & \vdots \\
\text{yr}(m,1) & \text{yr}(m,2) & \ldots & \text{yr}(m,n)
\end{bmatrix} \]

\[ PM = \frac{\sigma_1^2}{\sum_{i=1}^{n} \sigma_i^2} \]
Suggested parameter to characterise finger-tapping

Speed: \( \text{amxfr} = \text{amplitude} \times \text{frequency} \)

Regularity: PM computed using SVD

Score of Finger Tapping, FTTS

\[ \text{FTTS} = \text{PM} \times \text{amxfr} \]
FTTS of senior healthy subjects
FTTS of Parkinsonian patients

H-Y: 0-1 1 0-1 1 1 1 1 1 1 1-2 2 2 3
Habilitation aid Huple®
Object moving in 1D
Object moving in 1D
Monitor Your Own Health

You live in your body every day, which makes you the best judge of your own health. You just need to know what to look for—such as your heartbeat after exercise and unusual hair loss. This checklist will allow you to play medical detective between checkups.

Think PERF

Every evening, think PERF. Essentially, there are four things you should monitor every day to make sure you are living healthy:

- **Produce**: the amount of vegetables and fruits you ate that day.
- **Exercise**: whether you walked and were active.
- **Relaxation**: whether you got at least 15 minutes of laughter and fun time for yourself.
- **Fibre**: whether you got enough beans, grains, and other high-fiber food in your diet.
Involving people in their own health and care:
Statutory guidance for clinical commissioning groups
and NHS England

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Blood pressure measurement

152/82

138/78

138/67

150/66
Device for home health monitoring
Thank you for your attention!