

**Course Title:** Biophysical fundamentals of medical technologies

**Coordinator /contact:** Prof. Eugeniusz Rokita/e-mail:ufrokita@cyf-kr.edu.pl

**Responsible person/contact:** Prof. Eugeniusz Rokita (seminar)/email:  
ufrokita@cyf-kr.edu.pl, Dr hab. G. Tatoń  
(laboratory)/e-mail: mmtaton@cyf-kr.edu.pl

**Address:** Department of Biophysics, Św. Łazarza 16

**Year:** 2

**Total number of hours:** 50

**Lectures:** -

**Seminars:** 20

**Labs/Practicals:** 28

**Others (e.g. recitation):** -

**Exams:** 2

**Conduct/Dress Code:**

**Student's Evaluation:**

**-credit requirements:** Seminar/Laboratory credits – see remarks

**-attendance requirements:** Seminar 1 + Laboratory 1

**-type of the final exam:** Test exam

**-retake information:** May/June, 2018

|   | Da<br>y | Time                                | Type<br>of<br>class<br>es | NO<br>of<br>hour<br>s | Grou<br>p | Topic   | teacher | place |
|---|---------|-------------------------------------|---------------------------|-----------------------|-----------|---|---------|-------|
| week 16<br>February<br>19 - 23          | Tu      | 15 <sup>00</sup> – 16 <sup>30</sup> | sem                       | 2                     | B         | Biophysical description of biological systems | ER      | S2    |
|   | Tu      | 15 <sup>00</sup> – 16 <sup>30</sup> | lab                       | 2                     | A         | Digital processing of data and images         | BL/TR   | 201   |
|   | We      | 14 <sup>45</sup> – 16 <sup>15</sup> | sem                       | 2                     | A         | Biophysical description of biological systems | ER      | S2    |
|   | We      | 14 <sup>45</sup> – 16 <sup>15</sup> | lab                       | 2                     | B         | Digital processing of data and images         | BL/DD   | 201   |
|   | Th      | 14 <sup>30</sup> – 16 <sup>00</sup> | sem                       | 2                     | D         | Biophysical description of biological systems | ER      | S2    |
|   | Th      | 14 <sup>30</sup> – 16 <sup>00</sup> | lab                       | 2                     | C         | Digital processing of data and images         | GT/MS   | 201   |
|   | Fr      | 14 <sup>45</sup> – 16 <sup>15</sup> | sem                       | 2                     | C         | Biophysical description of biological systems | ER      | S2    |
|   | Fr      | 14 <sup>30</sup> – 16 <sup>00</sup> | lab                       | 2                     | D         | Digital processing of data and images         | DD/GT   | 201   |
| week 17<br>February<br>26 -<br>March 02 | Tu      | 15 <sup>00</sup> – 16 <sup>30</sup> | sem                       | 2                     | B         | Structure of matter and conservation laws     | ER      | S2    |
|   | Tu      | 15 <sup>00</sup> – 16 <sup>30</sup> | lab                       | 2                     | A         | Data acquisition and evaluation               | BL/TR   | 201   |
|   | We      | 14 <sup>45</sup> – 16 <sup>15</sup> | sem                       | 2                     | A         | Structure of matter and conservation laws     | ER      | S2    |
|   | We      | 14 <sup>45</sup> – 16 <sup>15</sup> | lab                       | 2                     | B         | Data acquisition and evaluation               | BL/DD   | 201   |
|   | Th      | 14 <sup>30</sup> – 16 <sup>00</sup> | sem                       | 2                     | D         | Structure of matter and conservation laws     | ER      | S2    |
|   | Th      | 14 <sup>30</sup> – 16 <sup>00</sup> | lab                       | 2                     | C         | Data acquisition and evaluation               | GT/MS   | 201   |
|   | Fr      | 14 <sup>45</sup> – 16 <sup>15</sup> | sem                       | 2                     | C         | Structure of matter and conservation laws     | ER      | S2    |
|   | Fr      | 14 <sup>30</sup> – 16 <sup>00</sup> | lab                       | 2                     | D         | Data acquisition and evaluation               | DD/GT   | 201   |

|  |           |  |            |          |          |  |              |            |
|--|-----------|--|------------|----------|----------|--|--------------|------------|
| <b>week 18</b><br><br><b>March 05 - 09</b>   | <b>Tu</b> | <b>15<sup>00</sup> – 16<sup>30</sup></b> | <b>sem</b> | <b>2</b> | <b>B</b> | <b>Introduction to transport phenomena</b>                 | <b>ER</b>    | <b>S2</b>  |
|  | <b>Tu</b> | <b>15<sup>00</sup> – 17<sup>15</sup></b> | <b>lab</b> | <b>3</b> | <b>A</b> | <b>LAB 3-10</b>  | <b>BL/TR</b> | <b>201</b> |
|  | <b>We</b> | <b>14<sup>45</sup> – 16<sup>15</sup></b> | <b>sem</b> | <b>2</b> | <b>A</b> | <b>Introduction to transport phenomena</b>                 | <b>ER</b>    | <b>S2</b>  |
|  | <b>We</b> | <b>14<sup>45</sup> – 17<sup>00</sup></b> | <b>lab</b> | <b>3</b> | <b>B</b> | <b>LAB 3-10</b>  | <b>BL/DD</b> | <b>201</b> |
|  | <b>Th</b> | <b>14<sup>30</sup> – 16<sup>00</sup></b> | <b>sem</b> | <b>2</b> | <b>D</b> | <b>Introduction to transport phenomena</b>                 | <b>ER</b>    | <b>S2</b>  |
|  | <b>Th</b> | <b>14<sup>30</sup> – 16<sup>45</sup></b> | <b>lab</b> | <b>3</b> | <b>C</b> | <b>LAB 3-10</b>  | <b>GT/MS</b> | <b>201</b> |
|  | <b>Fr</b> | <b>14<sup>45</sup> – 16<sup>15</sup></b> | <b>sem</b> | <b>2</b> | <b>C</b> | <b>Introduction to transport phenomena</b>                 | <b>ER</b>    | <b>S2</b>  |
| <b>week 19</b><br><br><b>March 12 - 16</b>   | <b>Fr</b> | <b>14<sup>30</sup> – 16<sup>45</sup></b> | <b>lab</b> | <b>3</b> | <b>D</b> | <b>LAB 3-10</b>  | <b>DD/GT</b> | <b>201</b> |
|  | <b>Tu</b> | <b>15<sup>00</sup> – 16<sup>30</sup></b> | <b>sem</b> | <b>2</b> | <b>B</b> | <b>Biophysical background of electrophysiology</b>         | <b>ER</b>    | <b>S2</b>  |
|  | <b>Tu</b> | <b>15<sup>00</sup> – 17<sup>15</sup></b> | <b>lab</b> | <b>3</b> | <b>A</b> | <b>LAB 3-10</b>  | <b>BL/TR</b> | <b>201</b> |
|  | <b>We</b> | <b>14<sup>45</sup> – 16<sup>15</sup></b> | <b>sem</b> | <b>2</b> | <b>A</b> | <b>Biophysical background of electrophysiology</b>         | <b>ER</b>    | <b>S2</b>  |
|  | <b>We</b> | <b>14<sup>45</sup> – 17<sup>00</sup></b> | <b>lab</b> | <b>3</b> | <b>B</b> | <b>LAB 3-10</b>  | <b>BL/DD</b> | <b>201</b> |
|  | <b>Th</b> | <b>14<sup>30</sup> – 16<sup>00</sup></b> | <b>sem</b> | <b>2</b> | <b>D</b> | <b>Biophysical background of electrophysiology</b>         | <b>ER</b>    | <b>S2</b>  |
|  | <b>Th</b> | <b>14<sup>30</sup> – 16<sup>45</sup></b> | <b>lab</b> | <b>3</b> | <b>C</b> | <b>LAB 3-10</b>  | <b>GT/MS</b> | <b>201</b> |
| <b>week 20</b><br><br><b>March 19 - 23</b>   | <b>Fr</b> | <b>14<sup>45</sup> – 16<sup>15</sup></b> | <b>sem</b> | <b>2</b> | <b>C</b> | <b>Biophysical background of electrophysiology</b>         | <b>ER</b>    | <b>S2</b>  |
|  | <b>Fr</b> | <b>14<sup>30</sup> – 16<sup>45</sup></b> | <b>lab</b> | <b>3</b> | <b>D</b> | <b>LAB 3-10</b>  | <b>DD/GT</b> | <b>201</b> |
|  | <b>Tu</b> | <b>15<sup>00</sup> – 16<sup>30</sup></b> | <b>sem</b> | <b>2</b> | <b>B</b> | <b>Biophysics of senses</b>                                | <b>ER</b>    | <b>S2</b>  |
|  | <b>Tu</b> | <b>15<sup>00</sup> – 17<sup>15</sup></b> | <b>lab</b> | <b>3</b> | <b>A</b> | <b>LAB 3-10</b>  | <b>BL/TR</b> | <b>201</b> |
|  | <b>We</b> | <b>14<sup>45</sup> – 16<sup>15</sup></b> | <b>sem</b> | <b>2</b> | <b>A</b> | <b>Biophysics of senses</b>                                | <b>ER</b>    | <b>S2</b>  |
|  | <b>We</b> | <b>14<sup>45</sup> – 17<sup>00</sup></b> | <b>lab</b> | <b>3</b> | <b>B</b> | <b>LAB 3-10</b>  | <b>BL/DD</b> | <b>201</b> |
|  | <b>Th</b> | <b>14<sup>30</sup> – 16<sup>00</sup></b> | <b>sem</b> | <b>2</b> | <b>D</b> | <b>Biophysics of senses</b>                                | <b>ER</b>    | <b>S2</b>  |
| <b>week 21</b><br><b>March 26 - April 06</b> | <b>Th</b> | <b>14<sup>30</sup> – 16<sup>45</sup></b> | <b>lab</b> | <b>3</b> | <b>C</b> | <b>LAB 3-10</b>  | <b>GT/MS</b> | <b>201</b> |
|  | <b>Fr</b> | <b>14<sup>45</sup> – 16<sup>15</sup></b> | <b>sem</b> | <b>2</b> | <b>C</b> | <b>Biophysics of senses</b>                                | <b>ER</b>    | <b>S2</b>  |
|  | <b>Fr</b> | <b>14<sup>30</sup> – 16<sup>45</sup></b> | <b>lab</b> | <b>3</b> | <b>D</b> | <b>LAB 3-10</b>  | <b>DD/GT</b> | <b>201</b> |
|  |           |  |            |          |          |  |              |            |
|  |           |  |            |          |          | <b>Day off</b>   |              |            |
|  |           |  |            |          |          |  |              |            |
|  |           |  |            |          |          |  |              |            |
| <b>week 22</b><br><br><b>April 09 - 13</b>   | <b>Tu</b> | <b>15<sup>00</sup> – 16<sup>30</sup></b> | <b>sem</b> | <b>2</b> | <b>B</b> | <b>Interaction of EM radiation with biological systems</b> | <b>ER</b>    | <b>S2</b>  |
|  | <b>Tu</b> | <b>15<sup>00</sup> – 17<sup>15</sup></b> | <b>lab</b> | <b>3</b> | <b>A</b> | <b>LAB 3-10</b>  | <b>BL/TR</b> | <b>201</b> |
|  | <b>We</b> | <b>14<sup>45</sup> – 16<sup>15</sup></b> | <b>sem</b> | <b>2</b> | <b>A</b> | <b>Interaction of EM radiation with biological systems</b> | <b>ER</b>    | <b>S2</b>  |
|  | <b>We</b> | <b>14<sup>45</sup> – 17<sup>00</sup></b> | <b>lab</b> | <b>3</b> | <b>B</b> | <b>LAB 3-10</b>  | <b>BL/DD</b> | <b>201</b> |
|  | <b>Th</b> | <b>14<sup>30</sup> – 16<sup>00</sup></b> | <b>sem</b> | <b>2</b> | <b>D</b> | <b>Interaction of EM radiation with biological systems</b> | <b>ER</b>    | <b>S2</b>  |
|  | <b>Th</b> | <b>14<sup>30</sup> – 16<sup>45</sup></b> | <b>lab</b> | <b>3</b> | <b>C</b> | <b>LAB 3-10</b>  | <b>GT/MS</b> | <b>201</b> |
|  | <b>Fr</b> | <b>14<sup>45</sup> – 16<sup>15</sup></b> | <b>sem</b> | <b>2</b> | <b>C</b> | <b>Interaction of EM radiation with biological systems</b> | <b>ER</b>    | <b>S2</b>  |
| <b>week 23</b><br><br><b>April 16 - 20</b>   | <b>Fr</b> | <b>14<sup>30</sup> – 16<sup>45</sup></b> | <b>lab</b> | <b>3</b> | <b>D</b> | <b>LAB 3-10</b>  | <b>DD/GT</b> | <b>201</b> |
|  | <b>Tu</b> | <b>15<sup>00</sup> – 16<sup>30</sup></b> | <b>sem</b> | <b>2</b> | <b>B</b> | <b>Medical application of radioisotopes/radiotherapy</b>   | <b>ER</b>    | <b>S2</b>  |
|  | <b>Tu</b> | <b>15<sup>00</sup> – 17<sup>15</sup></b> | <b>lab</b> | <b>3</b> | <b>A</b> | <b>LAB 3-10</b>  | <b>BL/TR</b> | <b>201</b> |
|  | <b>We</b> | <b>14<sup>45</sup> – 16<sup>15</sup></b> | <b>sem</b> | <b>2</b> | <b>A</b> | <b>Medical application of radioisotopes/radiotherapy</b>   | <b>ER</b>    | <b>S2</b>  |
|  | <b>We</b> | <b>14<sup>45</sup> – 17<sup>00</sup></b> | <b>lab</b> | <b>3</b> | <b>B</b> | <b>LAB 3-10</b>  | <b>BL/DD</b> | <b>201</b> |
|  | <b>Th</b> | <b>14<sup>30</sup> – 16<sup>00</sup></b> | <b>sem</b> | <b>2</b> | <b>D</b> | <b>Medical application of radioisotopes/radiotherapy</b>   | <b>ER</b>    | <b>S2</b>  |
|  | <b>Th</b> | <b>14<sup>30</sup> – 16<sup>45</sup></b> | <b>lab</b> | <b>3</b> | <b>C</b> | <b>LAB 3-10</b>  | <b>GT/MS</b> | <b>201</b> |
| <b>week 24</b><br><br><b>April 23 - 27</b>   | <b>Fr</b> | <b>14<sup>45</sup> – 16<sup>15</sup></b> | <b>sem</b> | <b>2</b> | <b>C</b> | <b>Medical application of radioisotopes/radiotherapy</b>   | <b>ER</b>    | <b>S2</b>  |
|  | <b>Fr</b> | <b>14<sup>30</sup> – 16<sup>45</sup></b> | <b>lab</b> | <b>3</b> | <b>D</b> | <b>LAB 3-10</b>  | <b>DD/GT</b> | <b>201</b> |
|  | <b>Tu</b> | <b>15<sup>00</sup> – 16<sup>30</sup></b> | <b>sem</b> | <b>2</b> | <b>B</b> | <b>Radiology</b>   | <b>ER</b>    | <b>S2</b>  |
|  | <b>Tu</b> | <b>15<sup>00</sup> – 17<sup>15</sup></b> | <b>lab</b> | <b>3</b> | <b>A</b> | <b>LAB 3-10</b>  | <b>BL/TR</b> | <b>201</b> |
|  | <b>We</b> | <b>14<sup>45</sup> – 16<sup>15</sup></b> | <b>sem</b> | <b>2</b> | <b>A</b> | <b>Radiology</b>   | <b>ER</b>    | <b>S2</b>  |
|  | <b>We</b> | <b>14<sup>45</sup> – 17<sup>00</sup></b> | <b>lab</b> | <b>3</b> | <b>B</b> | <b>LAB 3-10</b>  | <b>BL/DD</b> | <b>201</b> |
|  | <b>Th</b> | <b>14<sup>30</sup> – 16<sup>00</sup></b> | <b>sem</b> | <b>2</b> | <b>D</b> | <b>Radiology</b>   | <b>ER</b>    | <b>S2</b>  |
|  | <b>Th</b> | <b>14<sup>30</sup> – 16<sup>45</sup></b> | <b>lab</b> | <b>3</b> | <b>C</b> | <b>LAB 3-10</b>  | <b>GT/MS</b> | <b>201</b> |

|                                    |    |                                     |     |   |   |                 |       |     |
|------------------------------------|----|-------------------------------------|-----|---|---|-----------------|-------|-----|
|                                    | Fr | 14 <sup>45</sup> – 16 <sup>15</sup> | sem | 2 | C | Radiology       | ER    | S2  |
|                                    | Fr | 14 <sup>30</sup> – 16 <sup>45</sup> | lab | 3 | D | LAB 3-10        | DD/GT | 201 |
| week 25<br>April<br>30 – May<br>04 |    |                                     |     |   |   |                 |       |     |
|                                    |    |                                     |     |   |   | Day off         |       |     |
|                                    |    |                                     |     |   |   |                 |       |     |
| week 26<br><br>May<br>07 - 11      | Tu | 15 <sup>00</sup> – 16 <sup>30</sup> | sem | 2 | B | CT and MRI      | ER    | S2  |
|                                    | Tu | 15 <sup>00</sup> – 17 <sup>15</sup> | lab | 3 | A | LAB 3-10        | BL/TR | 201 |
|                                    | We | 14 <sup>45</sup> – 16 <sup>15</sup> | sem | 2 | A | CT and MRI      | ER    | S2  |
|                                    | We | 14 <sup>45</sup> – 17 <sup>00</sup> | lab | 3 | B | LAB 3-10        | BL/DD | 201 |
|                                    | Th | 14 <sup>30</sup> – 16 <sup>00</sup> | sem | 2 | D | CT and MRI      | ER    | S2  |
|                                    | Th | 14 <sup>30</sup> – 16 <sup>45</sup> | lab | 3 | C | LAB 3-10        | GT/MS | 201 |
|                                    | Fr | 14 <sup>45</sup> – 16 <sup>15</sup> | sem | 2 | C | CT and MRI      | ER    | S2  |
|                                    | Fr | 14 <sup>30</sup> – 16 <sup>45</sup> | lab | 3 | D | LAB 3-10        | DD/GT | 201 |
| week 27<br>May<br>14 - 18          | Tu | 15 <sup>00</sup> – 16 <sup>30</sup> | sem | 2 | B | Ultrasonography | ER    | S2  |
|                                    | Tu | 15 <sup>00</sup> – 17 <sup>15</sup> | lab | 3 | A | LAB 3-10        | BL/TR | 201 |
|                                    | We | 14 <sup>45</sup> – 16 <sup>15</sup> | sem | 2 | A | Ultrasonography | ER    | S2  |
|                                    | We | 14 <sup>45</sup> – 17 <sup>00</sup> | lab | 3 | B | LAB 3-10        | BL/DD | 201 |
|                                    | Th | 14 <sup>30</sup> – 16 <sup>00</sup> | sem | 2 | D | Ultrasonography | ER    | S2  |
|                                    | Th | 14 <sup>30</sup> – 16 <sup>45</sup> | lab | 3 | C | LAB 3-10        | GT/MS | 201 |
|                                    | Fr | 14 <sup>45</sup> – 16 <sup>15</sup> | sem | 2 | C | Ultrasonography | ER    | S2  |
|                                    | Fr | 14 <sup>30</sup> – 16 <sup>45</sup> | lab | 3 | D | LAB 3-10        | DD/GT | 201 |

#### Abbreviations:

ER – Prof. Eugeniusz Rokita  
 GT – Grzegorz Tatoń, PhD  
 BL – Bartosz Lisowski, MSc  
 TR - Tomasz Rok, PhD  
 DD – Daniel Dziob, MSc  
 MS – Michał Świątek, MSc

#### Remarks:

#### SEMINARS - 1|10 □ week 16|27

At the end of each seminar student has to solve 4÷5 problems directly correlated with the topic of the seminar. The solution of problems will be evaluated using (0|10) point scale.

#### LAB - 1|2 □ week 16|17

First and second meetings are treated as an introduction to the laboratory. Students will be split into 2-person teams and will complete one exercise (Data acquisition and evaluation) for training. Moreover, detailed schedule of the laboratory (Lab 3|10) for each team will be announced during 2<sup>nd</sup> laboratory.

#### LAB - 3|10 □ week 18|27

Each team has to complete 8 exercises from the list given below (1 per week).

| LAB | Description                               |
|-----|---|
| 3.  | Ultrasonic imaging.                       |
| 4.  | Principles of magneto-therapy.            |
| 5.  | Electrocardiography.                      |
| 6.  | Applanation tonometry                     |
| 7.  | Digital subtraction angiography.          |
| 8.  | Strength of bone.                         |
| 9.  | Model of the respiratory system.          |
| 10. | Model of the cardiovascular system.       |
| 11. | Haemodialysis, blood purification system. |
| 12. | Electro-therapy.                          |

To pass each exercise student has to complete himself a simple experiment and has to prepare a report containing results, calculations, discussion of the results and final conclusions. The report will be evaluated using (0|10) point scale.

Seminar/Laboratory credit □ 60% of maximal number of points (60/48 - sem/lab)