1. **Course title:** FUNDAMENTALS OF SIGNAL PROCESSING

2. **Course code:**

3. **Validity of course description:** 2016/2017

4. **Level of studies:** 1st cycle of higher education

5. **Mode of studies:** intramural studies

6. **Field of study:** AUTOMATIC CONTROL AND ROBOTICS, ELECTRONICS, TELECOMMUNICATION AND INFORMATICS

7. **Profile of studies:** general

8. **Programme:** n/a

9. **Semester:** 5

10. **Faculty teaching the course:** Faculty of Automatic Control, Electronics and Computer Science

11. **Course instructor:** Katarzyna Moscinska, PhD

12. **Course classification:** common courses

13. **Course status:** compulsory

14. **Language of instruction:** English

15. **Pre-requisite qualifications:** Algebra, Calculus, Circuit Theory. Course attendants should possess satisfactory knowledge of the following issues: complex numbers, derivatives and integrals, AC circuits, frequency description of systems. Students are supposed to possess basic computer programming skills.

16. **Course objectives:** The goal of the course is to make students acquainted with various methods of signals and systems representation. Course participants become familiar with fundamental methods of analog and digital signal processing. The course serves as foundation to more specialized courses, like digital signal processing and analog circuit design.

17. **Description of learning outcomes:**

<table>
<thead>
<tr>
<th>Nr</th>
<th>Learning outcomes description</th>
<th>Method of assessment</th>
<th>Teaching methods</th>
<th>Learning outcomes reference code</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>Knows various methods of signal and analog system description in time and frequency domain</td>
<td>short test, assessment test</td>
<td>lecture</td>
<td>K_W5</td>
</tr>
<tr>
<td>W2</td>
<td>Knows various methods of discrete systems description</td>
<td>short test, assessment test</td>
<td>lecture</td>
<td>K_W5, K_W13</td>
</tr>
<tr>
<td>U1</td>
<td>Can apply basic theorems for signal processing</td>
<td>short test, assessment test</td>
<td>lecture</td>
<td>K_U13</td>
</tr>
<tr>
<td>U2</td>
<td>Knows how to calculate basic parameters of the signal</td>
<td>laboratory exercise</td>
<td>laboratory</td>
<td>K_U13</td>
</tr>
<tr>
<td>U3</td>
<td>Can analyze properties of selected signal processing systems</td>
<td>laboratory exercise</td>
<td>laboratory</td>
<td>K_U9, K_U13</td>
</tr>
<tr>
<td>U4</td>
<td>Knows how to apply LabVIEW environment for signal processing</td>
<td>laboratory exercise</td>
<td>laboratory</td>
<td>K_U20</td>
</tr>
</tbody>
</table>

18. **Teaching modes and hours**

Lecture 30 / BA/MA Seminar / Class / Project / Laboratory 30

19. **Syllabus description:**

**Lecture:**

1. Introduction to signal processing: definition of signal, signal properties, some special signals of interest.
7. Fourier transform of discrete – time signals: definition, properties, use in signal processing.
9. Representation of a digital circuit: difference equation, block diagram, system function, pole – zero pattern.
10. DFT and FFT. Definition and properties of DFT. Linear vs circular convolution. Linear convolution with DFT. FFT decimation-in-time algorithm.

**Laboratory:**
1. Basic operations on signals.
2. Transfer function of a filter.
3. Fourier Transform.
5. Individual task – Fourier series expansion and reconstruction.
6. Rectifiers and amplitude modulation.
7. Pulse amplitude modulation.
8. Signal generation and convolution.
9. Z Transform and system function H(z)
10. Discrete Fourier Transform

**Examination:** assessment test

**21. Primary sources:**

**22. Secondary sources:**

**23. Total workload required to achieve learning outcomes**

<table>
<thead>
<tr>
<th>Nr</th>
<th>Teaching mode</th>
<th>Contact hours / Student workload hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lecture</td>
<td>30/5</td>
</tr>
<tr>
<td>2</td>
<td>Classes</td>
<td>/</td>
</tr>
<tr>
<td>3</td>
<td>Laboratory</td>
<td>30/40</td>
</tr>
<tr>
<td>4</td>
<td>Project</td>
<td>/</td>
</tr>
<tr>
<td>5</td>
<td>BA/MA Seminar</td>
<td>/</td>
</tr>
<tr>
<td>6</td>
<td>Other</td>
<td>5/15</td>
</tr>
</tbody>
</table>

Total number of hours: 65/60

**24. Total hours:** 125

**25. Number of ECTS credits:** 5

**26. Number of ECTS credits allocated for contact hours:** 3

**27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects):** 3

**28. Comments:**
Approved:

...........................................................
(date, Instructor's signature)

...........................................................
(date, the Director of the Faculty Unit signature)