1. Course title: ELECTROMAGNETIC COMPATIBILITY
2. Course code: EMC

4. Level of studies: BSc programme
5. Mode of studies: intramural studies
6. Field of study: ELECTRONICS AND TELECOMMUNICATION (FACULTY SYMBOL) RAU
7. Profile of studies: general

8. Programme:

9. Semester: 6

10. Faculty teaching the course: Institute of Electronics, RAu3, Faculty of Automatic Control, Electronics and Computer Science
11. Course instructor: Artur Noga, PhD, Eng.
12. Course classification: general course
13. Course status: compulsory
14. Language of instruction: English
15. Pre-requisite qualifications: Course attendants are supposed to have general knowledge concerning theory of electromagnetic fields and electronic circuit design. It is assumed that students passed the following courses: Physics, Circuit theory, Introduction to electronics, Digital circuits.

16. Course objectives: The course offers a basic knowledge of the principles of the EMC theory, including typical sources and characteristics of radiated and conducted electromagnetic interference (EMI), transfer (coupling) paths, and methods to prevent EMI; EMC design techniques, i.e. filters, PCBs, minimizing cable crosstalk, screening, shielding and grounding. A part of the course is devoted to the EMC Directive 2004/108/EC, relevant EMC standards and EMC measurements and testing.

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>1.</td>
<td>Knows the basic problems associated with the sources and coupling paths of electromagnetic interferences (radiated/conducted emission and susceptibility)</td>
<td>test</td>
<td>lecture</td>
<td>K1_W04 K1_W18</td>
</tr>
<tr>
<td>2.</td>
<td>Has a basic knowledge about legislation (EMC Directive) and testing for EMC compliance</td>
<td>test</td>
<td>lecture</td>
<td>K1_W15 K1_W21</td>
</tr>
<tr>
<td>3.</td>
<td>Knows and can use models of basic elements at high frequency</td>
<td>test</td>
<td>classes</td>
<td>K1_U07 K1_U17</td>
</tr>
<tr>
<td>4.</td>
<td>Based on knowledge of the system can identify which elements of the circuit will be the main source of noise (EMI - electromagnetic interferences)</td>
<td>test</td>
<td>classes</td>
<td>K1_U15</td>
</tr>
<tr>
<td>5.</td>
<td>Can estimate the emission levels for simple circuits</td>
<td>test</td>
<td>classes</td>
<td>K1_U07</td>
</tr>
</tbody>
</table>

18. Teaching modes and hours
   Lecture / BA/MA Seminar / Class / Project / Laboratory
   lecture - 30 h., class - 15 h

19. Syllabus description:
   Semester 6:
   Lecture:
   1. Introduction to Electromagnetic Compatibility (EMC). History of EMC. Fundamental definitions. EMC Regulations. Examples of EMC problems.
   2. Signal spectra. Differential and common mode. Decomposition of the EMC coupling problem. Typical noise sources. Transfer (coupling) paths (radiated...
and conducted emissions).
3. Nonideal behaviour of components (resistors, capacitors, inductors, ferrite beads, common-mode chokes).
4. Conducted emissions and susceptibility. Power supplies and power supply filters.
7. Electrostatic Discharge. Sources and methods of noise reduction: electrostatic models, the primary and secondary effects of ESD.
9. Testing for EMC compliance (conducted testing, radiated testing, test facilities, instrumentation).

Classes:
2. Nonideal behavior of components (capacitors, inductors, common-mode chokes, mechanical switches, etc.).
5. Simple emission models for common and differential mode current.

20. Examination: no exam

21. Primary sources:

22. Secondary sources:
Alain Charoy, Kompatybilność elektromagnetyczna: Zakłócenia w urządzeniach elektronicznych, Tom 1,2,3,4, WNT,1999.

23. Total workload required to achieve learning outcomes

<table>
<thead>
<tr>
<th>Lp.</th>
<th>Teaching mode</th>
<th>Contact hours / Student workload hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lecture</td>
<td>30/0</td>
</tr>
<tr>
<td>2</td>
<td>Classes</td>
<td>15/15</td>
</tr>
<tr>
<td>3</td>
<td>Laboratory</td>
<td>/</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>0/0</td>
</tr>
<tr>
<td></td>
<td>Total number of hours</td>
<td>45/15</td>
</tr>
</tbody>
</table>

24. Total hours: 60

25. Number of ECTS credits: 2

26. Number of ECTS credits allocated for contact hours: 2

27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects): 0

28. Comments:

Approved:

(date, Instructor’s signature) (date, the Director of the Faculty Unit signature)