### COURSE DESCRIPTION

1. **Course title:** INDUSTRIAL REAL-TIME SYSTEMS
2. **Course code:** IRTS
3. **Validity of course description:** 2019/2020
4. **Level of studies:** 2nd cycle of higher education
5. **Mode of studies:** intramural studies
6. **Field of study:** INFORMATICS
7. **Profile of studies:** general academic
8. **Specialty:** INDUSTRIAL INFORMATICS SYSTEMS
9. **Semester:** II
10. **Faculty teaching the course:** Institute of Informatics
11. **Course instructor:** Prof. Andrzej Kwiecień
12. **Course classification:** common courses
13. **Course status:** obligatory
14. **Language of instruction:** English
15. **Pre-requisite qualifications:** Computer Networks, Computers Structure
16. **Course objectives:**
   The course is associated with computer networks and real-time systems. The goal of the course is to present knowledge on real-time systems construction and implementation especially considering industrial systems. During the lecture the issue of team work and cooperation will be addressed.
17. **Description of learning outcomes:**

<table>
<thead>
<tr>
<th>No.</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 the construction and operation of programmable logic controllers PLC and Computerized Numerical Control CNC devices. Knows and understands their role in industrial computer systems</td>
<td>EP</td>
<td>WM</td>
<td>K2A_W03</td>
</tr>
<tr>
<td>W2</td>
<td>Knows methods of shortening the PLC automata cycle</td>
<td>EP</td>
<td>WM</td>
<td>K2A_W06</td>
</tr>
<tr>
<td>W3</td>
<td>Knows Ethernet based industrial protocols used in open communication systems and industrial databases</td>
<td>EP</td>
<td>WM</td>
<td>K2A_W08</td>
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<tr>
<td>U1</td>
<td>Can program PLC controller used in a number of sample applications</td>
<td>PS</td>
<td>L</td>
<td>K2A_U08</td>
</tr>
</tbody>
</table>
18. Teaching modes and hours
Lecture: 30 h, Class: -, Laboratory: 30h

19. Syllabus description:

Lectures:
- Basic definitions: distributed system, real-time systems, hierarchical structure, functions etc.
- Models of communication networks nodes and methods of their assessment
- Controllers (PLC, CNC) – construction, operation and fields of application
- Operation cycles, programming methods
- Methods of shortening of automata cycle
- Influence of shortening of automata cycle on communication medium access delay
- Embedded controllers with PC functions
- Remote Input/Output communication nodes
- Redundancy of communication medium
- Redundancy of computer system nodes
- Cost of redundancy in computer systems
- Ethernet based protocol example – EtherCAT
- Integration of industrial systems using Ethernet networks
- Application of open communication systems and industrial databases

Laboratory classes:
- Regulation loops
- Frequency inverters
- Models of industrial objects (elevators, robots, production lines, press)

20. Examination: yes

21. Primary sources:

22. Secondary sources:
- Materiały konferencyjne
- Instrukcje laboratoryjne
### 23. Total workload required to achieve learning outcomes

<table>
<thead>
<tr>
<th>No.</th>
<th>Teaching mode</th>
<th>Contact hours / Student workload hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lecture</td>
<td>30/30</td>
</tr>
<tr>
<td>2</td>
<td>Classes</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Laboratory</td>
<td>30/30</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 (exam)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Total number of hours</td>
<td>60/60</td>
</tr>
</tbody>
</table>

### 24. Total hours: 120

### 25. Number of ECTS credits: 5

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

### 27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects): 2

### 28. Comments: none