1. **Course title:** Model Based Visualization for Manufacturing Systems

2. **Course code:** MBV

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:** III

10. **Faculty teaching the course:** Institute of Informatics

11. **Course instructor:** Rafał Cupek, PhD, DSc

12. **Course classification:** common courses

13. **Course status:** obligatory

14. **Language of instruction:** English

15. **Pre-requisite qualifications:**

   It is assumed, that the student has a basic knowledge of computer networks, computer programming (C#) and PLC programming presented in subjects of 1st cycle of higher education and preceding courses Industrial Informatics Systems specialization.

16. **Course objectives:**

   The aim of the course is to introduce students into advanced topics of the designing industrial process visualization systems including: local Human Machine Interfaces (HMI), Supervisory Control and Data Acquisition (SCADA) and Manufacturing Execution Systems (MES). The students get acquainted with model based information models dedicated for industrial computer systems and problems related to model based visualization in manufacturing systems.

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>1</td>
<td>Student gets knowledge on designing, commissioning and testing of industrial process visualization systems.</td>
<td>Test, reports</td>
<td>Lectures, laboratory</td>
<td>K2A_W05</td>
</tr>
<tr>
<td>2</td>
<td>Student acquires knowledge on technologies and network services used in distributed industrial process visualization systems.</td>
<td>Test, reports</td>
<td>Lectures, laboratory</td>
<td>K2A_W14</td>
</tr>
<tr>
<td>3</td>
<td>Student gets knowledge on distributed, object oriented information modeling with focus on SCADA and MES</td>
<td>Test, reports</td>
<td>Lectures, laboratory</td>
<td>K2A_W08</td>
</tr>
<tr>
<td>4</td>
<td>Student is able to design and prepare complex engineering tasks related to the design of information systems for industrial process visualization</td>
<td>Reports</td>
<td>Laboratory</td>
<td>K2A_U01, K2A_U07</td>
</tr>
</tbody>
</table>

18. **Teaching modes and hours**  
   **Lecture:** 15 h.,  **Class:** -,  **Laboratory:** 15 h.  

19. **Syllabus description:**  
   **Lecture:**  
   Presentation of the hierarchical and functional structure of industrial visualization systems, presentation of the contemporary used information models applied for manufacturing systems visualization, presentation of use cases, tools. Detailed presentation of issues:  
   - Reference Architectural Models for Industry (CIM, Automation Pyramid, RAMI 4.0)  
   - Service oriented and model based communication in visualization systems (OPC UA)  
   - Object oriented data model in SCADA (Supervisory Control and Data Acquisition - Wonderware Archestra)  
   - Methods of presentation and exchange of information in Manufacturing Execution Systems (ISA95)  
   **Laboratory:**  
   - Supervisory Control and Data Acquisition (SCADA)  
   - OPC UA Data Access and Methods  
   - OPC UA Alarms, Events and Historical Data  
   - Manufacturing Execution Systems (MES)  

20. **Examination:** no  

21. **Primary sources:**  
   1. - D. Bailey; Practical SCADA for industry  
   2. - S. Boyer; Supervisory Control And Data Acquisition  
   3. - F. Iwanitz, J. Lange; OPC Fundamentals, Implementation and Application  
   4. - Jurgen Keletti: Manufacturing Execution System – MES.
22. Secondary sources:
   1. https://opcfoundation.org

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>15 / 15</td>
</tr>
<tr>
<td>2</td>
<td>Classes</td>
<td>- / -</td>
</tr>
<tr>
<td>3</td>
<td>Laboratory</td>
<td>15 / 15</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>30 / 30</td>
</tr>
</tbody>
</table>

24. Total hours: 60

25. Number of ECTS credits: 2 (sem. III)

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

27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects): 1

28. Comments:

   Approved:

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