### COURSE DESCRIPTION

<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 possesses basic knowledge of distributed system.</td>
<td>Participation in laboratory exercises</td>
<td>Lecture Laboratory</td>
<td>K2A_W11, K2A_W14, K2A_U11, K2A_U13</td>
</tr>
<tr>
<td>2</td>
<td>Student possesses basic knowledge of real-time systems.</td>
<td>Participation in laboratory exercises</td>
<td>Lecture Laboratory</td>
<td>K2A_W09, K2A_W11, K2A_W14, K2A_U11, K2A_U13</td>
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<tr>
<td>3</td>
<td>Student possesses basic knowledge of industrial architecture.</td>
<td>Participation in laboratory exercises</td>
<td>Lecture Laboratory</td>
<td>K2A_W05, K2A_W11, K2A_W14, K2A_U11, K2A_U13</td>
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<tr>
<td>4</td>
<td>Student possesses basic knowledge of industrial communication protocols.</td>
<td>Participation in laboratory exercises</td>
<td>Lecture Laboratory</td>
<td>K2A_W11, K2A_W14, K2A_U11, K2A_U13</td>
</tr>
<tr>
<td>5</td>
<td>Student understands the fundamental industrial deterministic networks.</td>
<td>Participation in laboratory exercises</td>
<td>Lecture Laboratory</td>
<td>K2A_W11, K2A_W14, K2A_U13</td>
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</tbody>
</table>

#### Course objectives:
The lecture global scope is to present good practice during industrial distributed real-time system designing. A stronger emphasis was put on communication as a backbone of any efficient control or/and supervisory IT industrial system. Those problems were divided into three thematic groups:

- computer distributed systems and real-time systems,
- node model of distributed system,
- time analysis of data flow between application program, network coprocessor and communication protocol.

The listed above topics of the lecture are closely bound to computer networks and computer distributed systems.

#### Teaching modes and hours
- Lecture: 30
- Laboratory: 30
19. Syllabus description:

Lectures:

The target of lectures is a presentation of fundamental problems in building distributed informatics systems in industry area. Most of important feature of almost industry informatics system is works in real-time. From this point of view, acknowledgment of deterministic networks protocol is most important and fundamental for design process of industry systems. Three of basic topics must be present:

- an idea of distributed informatics system in industry applications,
- deterministic process of control and monitoring as a goal of real-time systems,
- time analysis of global informatics system from point of view:
  - architecture of computer node and methods of it programming,
  - analyzing possibilities and features of network coprocessors,
  - time analyzing of deterministic network protocols.

After discussion of all of these problems, is possible answer for question about parameters of designed system.

1. Introduction. Definition of industry distributed system. Definition and partition of real-time systems
2. Model of informatics distributed real-time system (DRTS)
3. Phenomenon on the border between: software application and coprocessor and coprocessor and network protocol
4. Programming the node of system and methods of CPU cycle shorten
5. Presentation of industrial computer protocols
6. Presentation of token-bus protocol:
   a. Methods of network cycle construction,
   b. Time analysis
7. Presentation of Master-Slave protocol
   a. Build and parameterization of exchange scenario
   b. Time analysis
8. Presentation of PDC protocol
9. Macro and micro cycles
   a. Time analysis
   b. Improvement of time data exchanges in industry protocols.
10. Presentation of protocols build on Ethernet layer
11. Examples

Laboratory:

1. Presentation of basic information about PLC programming and configuration
2. Configuration of typical industry network
   a. How to choose protocol.
   b. Set of groups parameters into PLC (Programmable Logic Controller).
3. Token-Bus network on GeFanuc PLC
   a. Exchanges parameterization
   b. Measurement of time data exchange
4. Modbus protocol (Master-Slave Protocol)
   a. Exchanges parameterization
   b. Measurement of time data exchange
5. FIP protocol (PDC protocol)
   a. Exchanges parameterization
   b. Measurement of time data exchange
6. ProFiBus protocol
   a. Exchanges parameterization
   b. Measurement of time data exchange

20. Examination: no
<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>0/0</td>
</tr>
<tr>
<td>3</td>
<td>Laboratory</td>
<td>30/30</td>
</tr>
<tr>
<td>4</td>
<td>Project</td>
<td>0/0</td>
</tr>
<tr>
<td>5</td>
<td>BA/ MA Seminar</td>
<td>0/0</td>
</tr>
<tr>
<td>6</td>
<td>Other</td>
<td>15/15</td>
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<tr>
<td></td>
<td>Total number of hours</td>
<td>75/75</td>
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24. Total hours: 150

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): 1

28. Comments:

Approved:

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