COURSE DESCRIPTION

1. Course title: COMPUTER MEASUREMENT SYSTEMS
2. Course code: CMS

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: I

10. Faculty teaching the course: Institute of Informatics

11. Course instructor: PhD Wojciech Mielczarek

12. Course classification:

13. Course status: obligatory

14. Language of instruction: English

15. Pre-requisite qualifications: circuit theory, operating systems, embedded systems, programming in C

16. Course objectives:
The course gives students familiarity with the following topics:
- analog and digital Data Acquisition Systems (DAS),
- interfacing DAS to a microcontroller and PC computer,
- computer controlled measurement systems basing on DAS cards and measurement instruments attached by standard interfaces like RS-232, RS-422, RS-485, USB, IEEE-488.2 (GPIB),
- Standard Commands for Programmable Instruments (SCPI language),
- data acquisition and control programming in Agilent VEE and LabView,
- good practices of communication with peripheral equipment (including protection against noise).

17. Description of learning outcomes:

<table>
<thead>
<tr>
<th>Nb.</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>Understanding fundamentals of analog measurement data acquisition in a computer system.</td>
<td>Final test</td>
<td>Lecture</td>
<td>K2A_W02; K2A_W14</td>
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<tr>
<td>2.</td>
<td>Knowledge on: conditioning, scaling, multiplexing, sampling and converting (A/D) analog measurement signals, converting D/A, DAS systems configurations.</td>
<td>Final test</td>
<td>Lecture</td>
<td>K2A_W02; K2A_W11</td>
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<tr>
<td>4.</td>
<td>Skills, how to choose, install and configure (setting parameters) analog data acquisition system.</td>
<td>Laboratory exercise</td>
<td>Laboratory, project</td>
<td>K2A_U10; K2A_U12; K2A_U13</td>
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<td>5.</td>
<td>Skills, how to configure data acquisition system based on SCPI compatible instruments, attached to a controller by standard serial ports (RS-232, RS-485, USB), LAN port or GPIB bus.</td>
<td>Laboratory exercise</td>
<td>Laboratory</td>
<td>K2A_U07; K2A_U10; K2A_U12; K2A_U13</td>
</tr>
<tr>
<td>6.</td>
<td>Skills for controlling SCPI compatible peripheral devices; building an application oriented on data acquisition and control in Agilent VEE or LabView environments.</td>
<td>Laboratory exercise</td>
<td>Laboratory</td>
<td>K2A_U07; K2A_U10; K2A_U13</td>
</tr>
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</table>

18. Teaching modes and hours

Lecture: 15 h
Laboratory: 30 h
19. Syllabus description:

Lectures:
1. Data acquisition systems – inputting/outputing analog and digital signals to and from a microprocessor.
2. DAS cards for a PC computer
4. USB based measurement systems
5. IEEE-488.2 (GPIB) interface
6. Controlling the instruments in SCPI language.
7. Visual programming environments Agilent VEE an LabView
8. Protection of data transmission circuits against noises.

Labs:
1. Interfacing DAS to a microcontroller.
2. Controlling the measurement system based on asynchronous, serial transmission and multiport RS-232 switches.
3. The fieldbus based on RS-485 and MODBUS protocol.
5. Controlling the SCPI instruments.
6. Programming in Agilent VEE.
7. Programming in LabView
8. Data transmission circuits protection against noises – physical aspects

20. Examination: none

21. Primary sources:
1. Engineering Staff of Analog Devices: Analog - Digital conversion handbook, Analog Devices Inc., Norwood, Massachusetts 02062 USA

22. Secondary sources:
W. Mielczarek: Szeregowe interfejsy cyfrowe, Helion 1993
W. Mielczarek: USB – Uniwersalny interfejs szeregowy, Helion 2006
W. Mielczarek: Tłumienie zakłóceń i ochrona informacji w systemach pomiarowych, Wydawnictwo Politechniki Śląskiej, skrypt nr 1921, Gliwice 1995
W. Mielczarek: Urządzenia pomiarowe i systemy kompatybilne ze standardem SCPI, Helion 1999
W. Mielczarek: Komputerowe systemy pomiarowe, Standardy IEEE-488.2 i SCPI, Wydawnictwo Politechniki Śląskiej, Gliwice 2002
D. Caban, W. Mielczarek, R. Pawłowski: Komputerowe systemy pomiarowe, ćwiczenia laboratoryjne, Wydawnictwo Politechniki Śląskiej, Gliwice 2004

It is possible to download 5 presentations as pdf files:
Analog Data Acquisition Systems
RS-232 – serial communication port
IEEE-488 and SCPI standards
USB – Universal Serial Bus
Noise reduction in distributed computer systems

23. Total workload required to achieve learning outcomes

<table>
<thead>
<tr>
<th>Nb</th>
<th>Teaching mode :</th>
<th>Contact hours / Student workload hours</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Lecture</td>
<td>15/15</td>
</tr>
<tr>
<td>2</td>
<td>Classes</td>
<td>30/15</td>
</tr>
<tr>
<td>3</td>
<td>Laboratory</td>
<td>/</td>
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<tr>
<td>4</td>
<td>Project</td>
<td>/</td>
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<tr>
<td>5</td>
<td>BA/ MA Seminar</td>
<td>/</td>
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<tr>
<td>6</td>
<td>Other</td>
<td>/</td>
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<td></td>
<td>Total number of hours</td>
<td>45/30</td>
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</table>

24. Total hours: 75

25. Number of ECTS credits: 2
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<tbody>
<tr>
<td>26. Number of ECTS credits allocated for contact hours:</td>
<td>1</td>
</tr>
<tr>
<td>27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects):</td>
<td>1</td>
</tr>
<tr>
<td>28. Comments:</td>
<td></td>
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