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| Name of the module/subject   Analog and digital electronic systems   Pield of study   Profile of study   General academic, practical   Year / Semester   Sective path/especialty   Year / Semester   Year / Year / Semester   Year / Year   | OTUDY MODIUS DECOSIDE ON TODAY            |                           |   |       |   |        |                                |  |
|--|---|---------------------------|---|-------|---|--------|--------------------------------|--|
| Analog and digital electronic systems  | STUDY MODULE DESCRIPTION FORM             |                           |   |       |   |        |                                |  |
| Percentage of standy   |   | •                         | ectronic systems  |       |   |        |                                |  |
| Electrical Engineering   |   |                           |   |       |   |        | 1                              |  |
| Microprocessor's Control Systems in   Polish   Polish  | Elect                                     | trical Engineerin         | g   |       | 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - | ,      | 3/6                            |  |
| Form of study (full-time_part-time)   Form of study (full-time_part-time)  | Elective                                  |                           |   |       | •                                       |        | , , ,                          |  |
| First-cycle studies  No. of hours Lecture: 30 Classes: - Laboratory: 15 Project/seminars: 15 4  Status of the course in the study program (Basic, major, other) (brak)  Education areas and fields of science and art  technical sciences Technic |   | Microproces               | sor's Control Systems in  |       |   |        | obligatory                     |  |
| No. of nours Lecture: 30 Classes: - Laboratory: 15 Project/seminars: 15 4  Status of the course in the study program (Basic, major, other) (brak) (brak)  Education areas and fields of science and art  technical sciences  Technical sciences  Technical sciences  Responsible for subject / lecturer:  dr hab. in2. Michał Gwóźdź email: michał gwoźdź eput. poznan.pl tel. 61 665 2265 Faculty of Electrical Engineering ul. Piotrowo 3A 60-965 Poznan  Prerequisites in terms of knowledge, skills and social competencies:  Knowledge  Knows the rules of operation and parameters of the basic elements of electronic and microelectronic circuits in the primary  Social competencies  Study outcomes and objectives of the course:  Getting to know the principles of operation of complex analog and analog-to-digital electronic circuits. Acquisition of skills to design analog-to-digital electronic circuits, characterize the structure and the use of electronic systems at the primary level.  Study outcomes and reference to the educational results for a field of study  Knowledge:  1. Can describe the operating principles and parameters of specialized microelectronic circuits, characterize the structure and the use of electronic systems at the primary level.  Skills:  1. Knows how to apply the knowledge in electronics circuits, characterize the structure and the use of electronic systems at the primary level.  Study outcomes and reference to the educational results for a field of study  Knowledge:  1. Can describe the operating principles and parameters of specialized microelectronics circuits, characterize the structure and the use of electronics analog-and-digital systems at besic level -  K.W02 + K.W07 + K.W14 + ++   2. Can define the criteria necessary for the proper design of electronics analog-and-digital systems at the basic level -  K.W03 + K.U17 ++   3. Can define the criteria necessary for the proper design of electronics analog-and-digital systems at the basic level -  K.W03 + K.U17 ++  | Cycle of                                  | study:                    |   | Fo    | Form of study (full-time,part-time)     |        |                                |  |
| Lecture: 30 Classes: - Laboratory: 15 Project/seminars: 15 4  Status of the course in the study program (Basic, major, other) (brak) (university-wide, from another field)  Education areas and fields of science and art  technical sciences  Technical sciences  Technical sciences  Technical sciences  Technical sciences  Responsible for subject / lecturer:  dr hab. inz. Michal Gwźdz  email: michal.gwozdz@put.poznan.pl tel. 61 665 2846  Faculty of Electrical Engineering ul. Piotrowo 3A 60-965 Poznań  Frequisites in terms of knowledge, skills and social competencies:  Know the rules of operation and parameters of the basic elements of electronic and microelectronic circuits in the primary  3 Social  competencies  Assumptions and objectives of the course:  Getting to know the principles of operation of complex analog and analog-to-digital electronic systems at the primary level.  Study outcomes and reference to the educational results for a field of study  Knowledge:  1. Can describe the operating principles and parameters of specialized microelectronics circuits, characterize the structure and the use of electronics analog-and-digital systems at the basic level - [K.W02 + K.W07 ++ K.W14 +++]  Skills:  1. Knows how to apply the knowledge in the field of electronic systems - [K.W04 + K.W014+++]  Skills:  1. Knows how to apply the knowledge in the field of electronic systems - [K.W04 + K.W014+++]  Skills:  1. Knows how to apply the knowledge in the field of electronic systems - [K.W04 + K.W014+++]  Scial competencies:   |   | First-cyc                 | cle studies   |       | full-time                               |        |                                |  |
| Status of the course in the study program (Basic, major, other) (brak)  Education areas and fields of science and art  technical sciences  Technical sciences  Technical sciences  Responsible for subject / lecturer:  dr hab. in2. Michał Gwóźdź email: michał.gwozdz @put.poznan.pl tel. 61 665 2646 Faculty of Electrical Engineering ul. Piotrowo 3A 60-965 Poznań  Prerequisites in terms of knowledge, skills and social competencies:  Know show to apply the knowledge in electronics to analyze the operation of analog and digital electronic circuits in the primary  Social competencies  Assumptions and objectives of the course:  Study outcomes and reference to the educational results for a field of study  Knowledge:  1. Can describe the operating principles and parameters of specialized microelectronics circuits, characterize the structure and the use of electronic analog-and-digital systems at the basic level - [K.W02 + K.W07 ++ K.W14 +++]  Skills:  1. Knows how to apply the knowledge in electronics storal results for a field of study  Knowledge:  1. Can describe the operating principles and parameters of specialized microelectronics circuits, characterize the structure and the use of electronic analog-and-digital systems at the primary level.  Skills:  1. Knows how to apply the knowledge in electronics circuits for a field of study  Knowledge:  1. Can describe the operating principles and parameters of specialized microelectronics circuits, characterize the structure and the use of electronic analog-and-digital systems at basic level - [K.W02 + K.W07 ++ K.W14 +++]  Skills:  1. Knows how to apply the knowledge in the field of electronics design of electronics analog-and-digital systems at the basic level - [K.W02 + K.W014+++]  Scills:  1. Knows how to apply the knowledge in the field of electronics design of electronics analog-and-digital systems at the basic level - [K.W02 + K.W014+++]  Scills:  1. Knows how to apply the knowledge in the field of electronics design of electronics analog-and-digital systems at the basic  | No. of h                                  | ours                      |   |       |   |        | No. of credits                 |  |
| Education areas and fields of science and art   ECTS distribution (number and %)   |   | or or order               |   | 5     | -                                       |        | <u> </u>                       |  |
| Education areas and fields of science and art  technical sciences  Technical sciences  Technical sciences  Technical sciences  Responsible for subject / lecturer:  dr hab. inz. Michał Gwóżdż  email: michal.gwozdz@put.poznan.pl tel. 61 665 2846  Faculty of Electrical Engineering  ul. Piotrowo 3A 60-965 Poznań  Prerequisites in terms of knowledge, skills and social competencies:    Knowledge   | Status o                                  |                           |   |       | (university-wide, from anothe           | '      |                                |  |
| technical sciences Technical sciences Technical sciences Technical sciences  Responsible for subject / lecturer:  dr hab. inż. Michał Gwóżdż email: michał.gwożdż email: adam.gulczyński@put.poznan.pl tel. 61 665 2486 Faculty of Electrical Engineering emul. Piotrowo 3A 60-965 Poznań email: protrowo 3A 60-965 Poznań email: em | Educatio                                  |                           | · /   |       |   | (br    | ·                              |  |
| Technical sciences  Responsible for subject / lecturer:  dr hab. inż. Michał Gwóźdź email: michal.gwozdz@put.poznan.pl tel. 61 665 2846 Faculty of Electrical Engineering ul. Piotrowo 3A 60-965 Poznań  Prerequisites in terms of knowledge, skills and social competencies:  Knowledge  Knows the rules of operation and parameters of the basic elements of electronic and microelectronic circuits in the primary  Social competencies  Assumptions and objectives of the course:  Getting to know the principles of operation of complex analog and analog-to-digital electronic circuits. Acquisition of skills to design analog-to-digital electronics analog-and-digital systems at the primary level.  Study outcomes and reference to the educational results for a field of study  Knowledge:  1. Can describe the operating principles and parameters of specialized microelectronics circuits, characterize the structure and the use of electronics analog-and-digital systems at basic level -  K_W02 + K_W07 + K_W14 + ++  Skills:  1. Knows how to apply the knowledge in the field of electronics design of electronics analog-and-digital systems at the basic cirteria necessary for the proper design of electronics analog-and-digital systems at the basic level -  K_W03 + K_W17 + K_W17 + +  Skills:  1. Knows how to apply the knowledge in the field of electronics design of electronics analog-and-digital systems at the basic level -  K_W03 + K_U17 ++  Scocial competencies:  | Educatio                                  | on areas and helds of scr | erice and art   |       |   |        |                                |  |
| Responsible for subject / lecturer:  dr hab. in2. Michał Gwóźdź email: michał.gwozdz@put.poznan.pl tel. 61 665 2646 Faculty of Electrical Engineering ul. Piotrowo 3A 60-965 Poznań  Prerequisites in terms of knowledge, skills and social competencies:    Knowledge   Knows how to apply the knowledge in the primary level.    Skills   Social competencies  | techn                                     | ical sciences             |   |       |   |        | 4 100%                         |  |
| dr hab. inž. Michał Gwóźdź email: michal.gwozdz@put.poznan.pl tel. 61 665 2646 Faculty of Electrical Engineering ul. Piotrowo 3A 60-965 Poznań  Prerequisites in terms of knowledge, skills and social competencies:  Knowledge Knows the rules of operation and parameters of the basic elements of electronic and microelectronic  Skills Social competencies  Assumptions and objectives of the course:  Getting to know the principles of operation of complex analog and analog-to-digital electronic circuits. Acquisition of skills to design analog-to-digital electronic systems at the primary level.  Study outcomes and reference to the educational results for a field of study  Knowledge:  1. Can describe the operating principles and parameters of specialized microelectronics circuits, characterize the structure and the use of electronics analog-and-digital systems at basic level - [K_W02 + K_W07 ++ K_W14 +++] Skills:  1. Knows how to apply the knowledge in the field of electronic sessary for the proper design of electronics analog-and-digital systems at the basic level - [K_W03 ++ K_W014+++] Skills:  1. Knows how to apply the knowledge in the field of electronics design of electronics analog-and-digital systems at the basic level - [K_W03 ++ K_W014+++] Scial competencies:  |   | Technical scie            | ences   |       |   |        | 4 100%                         |  |
| dr hab. inž. Michał Gwóźdź email: michal.gwozdz@put.poznan.pl tel. 61 665 2646 Faculty of Electrical Engineering ul. Piotrowo 3A 60-965 Poznań  Prerequisites in terms of knowledge, skills and social competencies:  Knowledge Knows the rules of operation and parameters of the basic elements of electronic and microelectronic  Skills Social competencies  Assumptions and objectives of the course:  Getting to know the principles of operation of complex analog and analog-to-digital electronic circuits. Acquisition of skills to design analog-to-digital electronic systems at the primary level.  Study outcomes and reference to the educational results for a field of study  Knowledge:  1. Can describe the operating principles and parameters of specialized microelectronics circuits, characterize the structure and the use of electronics analog-and-digital systems at basic level - [K_W02 + K_W07 ++ K_W14 +++] Skills:  1. Knows how to apply the knowledge in the field of electronic sessary for the proper design of electronics analog-and-digital systems at the basic level - [K_W03 ++ K_W014+++] Skills:  1. Knows how to apply the knowledge in the field of electronics design of electronics analog-and-digital systems at the basic level - [K_W03 ++ K_W014+++] Scial competencies:  |   |                           |   |       |   |        |                                |  |
| email: michal.gwozdz@put.poznan.pl tel. 61 665 2646 Faculty of Electrical Engineering ul. Piotrowo 3A 60-965 Poznań  Prerequisites in terms of knowledge, skills and social competencies:    Knowledge   | Resp                                      | onsible for subj          | ect / lecturer:   | R     | esponsible for subj                     | ect /  | lecturer:                      |  |
| tel. 61 665 2646 Faculty of Electrical Engineering ul. Piotrowo 3A 60-965 Poznań  Prerequisites in terms of knowledge, skills and social competencies:    Knowledge  |   |                           |   |       | ,                                       |        |                                |  |
| Faculty of Electrical Engineering ul. Piotrowo 3A 60-965 Poznań ul. Piotrowo 3A 60-965 Poznań ul. Piotrowo 3A 60-965 Poznań  Prerequisites in terms of knowledge, skills and social competencies:    Knowledge   |   |                           | ut.poznan.pl  |       |   |        |                                |  |
| Prerequisites in terms of knowledge, skills and social competencies:    Knowledge  |   |                           | neering   |       |   |        |                                |  |
| Knowledge  Knows the rules of operation and parameters of the basic elements of electronic and microelectronic  Knows how to apply the knowledge in electronics to analyze the operation of analog and digital electronic circuits in the primary  Social competencies  Is able to think and act in an entrepreneurial way in the area of electronic design  Assumptions and objectives of the course:  Getting to know the principles of operation of complex analog and analog-to-digital electronic circuits. Acquisition of skills to design analog-to-digital electronic systems at the primary level.  Study outcomes and reference to the educational results for a field of study  Knowledge:  1. Can describe the operating principles and parameters of specialized microelectronics circuits, characterize the structure and the use of electronics analog-and-digital systems at basic level - [K_W02 + K_W07 ++ K_W14 +++]  2. Can describe the basic criteria of the design of electronic systems - [K_W04 + K_W014+++]  Skills:  1. Knows how to apply the knowledge in the field of electronics design of electronics analog-and-digital systems - [K_U03 ++ K_U17 ++]  2. Can define the criteria necessary for the proper design of electronics analog-and-digital systems at the basic level - [K_U03 ++ K_U07 ++]  Social competencies:  | ul. P                                     | Piotrowo 3A 60-965 Po     | oznań   |       | ul. Piotrowo 3A 60-965 P                | oznaı  | ำ                              |  |
| Skills  Knows how to apply the knowledge in electronics to analyze the operation of analog and digital electronic circuits in the primary  Social competencies  Is able to think and act in an entrepreneurial way in the area of electronic design  Assumptions and objectives of the course:  Getting to know the principles of operation of complex analog and analog-to-digital electronic circuits. Acquisition of skills to design analog-to-digital electronic systems at the primary level.  Study outcomes and reference to the educational results for a field of study  Knowledge:  1. Can describe the operating principles and parameters of specialized microelectronics circuits, characterize the structure and the use of electronics analog-and-digital systems at basic level - [K_W02 + K_W07 ++ K_W14 +++]  2. Can describe the basic criteria of the design of electronic systems - [K_W04 + K_W014+++]  Skills:  1. Knows how to apply the knowledge in the field of electronics design of electronics analog-and-digital systems - [K_U03 ++ K_U17 ++]  2. Can define the criteria necessary for the proper design of electronics analog-and-digital systems at the basic level - [K_U03 ++ K_U07 ++]  Social competencies:  | Prere                                     | quisites in term          | s of knowledge, skills and  | d s   | social competencies                     | S:     |                                |  |
| Skills   | 1   | Knowledge                 |   | ıd pa | arameters of the basic ele              | ments  | s of electronic and            |  |
| Assumptions and objectives of the course:  Getting to know the principles of operation of complex analog and analog-to-digital electronic circuits. Acquisition of skills to design analog-to-digital electronic systems at the primary level.  Study outcomes and reference to the educational results for a field of study  Knowledge:  1. Can describe the operating principles and parameters of specialized microelectronics circuits, characterize the structure and the use of electronics analog-and-digital systems at basic level - [K_W02 + K_W07 ++ K_W14 +++]  2. Can describe the basic criteria of the design of electronic systems - [K_W04 + K_W014+++]  Skills:  1. Knows how to apply the knowledge in the field of electronics design of electronics analog-and-digital systems - [K_U03 ++ K_U17 ++]  2. Can define the criteria necessary for the proper design of electronics analog-and-digital systems at the basic level - [K_U03 ++ K_U07 ++]  Social competencies:   | 2   | Skills                    |   |       | e in electronics to analyze t           | he op  | peration of analog and digital |  |
| Getting to know the principles of operation of complex analog and analog-to-digital electronic circuits. Acquisition of skills to design analog-to-digital electronic systems at the primary level.  Study outcomes and reference to the educational results for a field of study  Knowledge:  1. Can describe the operating principles and parameters of specialized microelectronics circuits, characterize the structure and the use of electronics analog-and-digital systems at basic level - [K_W02 + K_W07 ++ K_W14 +++]  2. Can describe the basic criteria of the design of electronic systems - [K_W04 + K_W014+++]  Skills:  1. Knows how to apply the knowledge in the field of electronics design of electronics anlog-and-digital systems - [K_U03 ++ K_U17 ++]  2. Can define the criteria necessary for the proper design of electronics analog-and-digital systems at the basic level - [K_U03 ++ K_U07 ++]  Social competencies:   | 3   |                           | Is able to think and act in an entrepreneurial way in the area of electronic design |       |   |        |                                |  |
| Study outcomes and reference to the educational results for a field of study  Knowledge:  1. Can describe the operating principles and parameters of specialized microelectronics circuits, characterize the structure and the use of electronics analog-and-digital systems at basic level - [K_W02 + K_W07 ++ K_W14 +++]  2. Can describe the basic criteria of the design of electronic systems - [K_W04 + K_W014+++]  Skills:  1. Knows how to apply the knowledge in the field of electronics design of electronics anlog-and-digital systems - [K_U03 ++ K_U17 ++]  2. Can define the criteria necessary for the proper design of electronics analog-and-digital systems at the basic level - [K_U03 ++ K_U07 ++]  Social competencies:  | Assumptions and objectives of the course: |                           |   |       |   |        |                                |  |
| Knowledge:  1. Can describe the operating principles and parameters of specialized microelectronics circuits, characterize the structure and the use of electronics analog-and-digital systems at basic level - [K_W02 + K_W07 ++ K_W14 +++]  2. Can describe the basic criteria of the design of electronic systems - [K_W04 + K_W014+++]  Skills:  1. Knows how to apply the knowledge in the field of electronics design of electronics anlog-and-digital systems - [K_U03 ++ K_U17 ++]  2. Can define the criteria necessary for the proper design of electronics analog-and-digital systems at the basic level - [K_U03 ++ K_U07 ++]  Social competencies:  |   |                           |   |       |   |        |                                |  |
| 1. Can describe the operating principles and parameters of specialized microelectronics circuits, characterize the structure and the use of electronics analog-and-digital systems at basic level - [K_W02 + K_W07 ++ K_W14 +++]  2. Can describe the basic criteria of the design of electronic systems - [K_W04 + K_W014+++]  Skills:  1. Knows how to apply the knowledge in the field of electronics design of electronics anlog-and-digital systems - [K_U03 ++ K_U17 ++]  2. Can define the criteria necessary for the proper design of electronics analog-and-digital systems at the basic level - [K_U03 ++ K_U07 ++]  Social competencies:  |   | Study outco               | mes and reference to the  | ec    | ducational results fo                   | or a f | field of study                 |  |
| and the use of electronics analog-and-digital systems at basic level - [K_W02 + K_W07 ++ K_W14 +++]  2. Can describe the basic criteria of the design of electronic systems - [K_W04 + K_W014+++]  Skills:  1. Knows how to apply the knowledge in the field of electronics design of electronics anlog-and-digital systems - [K_U03 ++ K_U17 ++]  2. Can define the criteria necessary for the proper design of electronics analog-and-digital systems at the basic level - [K_U03 ++ K_U07 ++]  Social competencies:   | Know                                      | /ledge:                   |   |       |   |        |                                |  |
| Skills:  1. Knows how to apply the knowledge in the field of electronics design of electronics anlog-and-digital systems - [K_U03 ++ K_U17 ++]  2. Can define the criteria necessary for the proper design of electronics analog-and-digital systems at the basic level - [K_U03 ++ K_U07 ++]  Social competencies:  |   |                           |   |       |   |        |                                |  |
| 1. Knows how to apply the knowledge in the field of electronics design of electronics anlog-and-digital systems - [K_U03 ++ K_U17 ++]  2. Can define the criteria necessary for the proper design of electronics analog-and-digital systems at the basic level - [K_U03 ++ K_U07 ++]  Social competencies:   | ,   |                           |   |       |   |        |                                |  |
| [K_U03 ++ K_U17 ++]  2. Can define the criteria necessary for the proper design of electronics analog-and-digital systems at the basic level - [K_U03 ++ K_U07 ++]  Social competencies:   |   |                           |   |       |   |        |                                |  |
| [K_U03 ++ K_U07 ++]  Social competencies:  | [K_U03 ++ K_U17 ++]                       |                           |   |       |   |        |                                |  |
| ·  |   |                           | essary for the proper design of ele   | CC    | ionics analog-and-digital s             | ysten  | is at the pasic level -        |  |
| 1. Able to think and act in an entrepreneurial way in the area of design of electronics systems - [K_K02 ++]   |   |                           |   |       |   |        |                                |  |
|  | 1. Able                                   | e to think and act in ar  | n entrepreneurial way in the area o   | of d  | design of electronics system            | ns - [ | K_K02 ++]                      |  |

# Assessment methods of study outcomes

## **Faculty of Electrical Engineering**

#### Lecture

- Assess the knowledge and skills indicated in a written test,

Project classes and laboratory exercises:

- Test and rewarding knowledge necessary for the accomplishment of the problems in the area of ??tasks in the laboratory,
- Continuous assessment, rewarding gain skills they met the principles and methods
- Assess the knowledge and skills related to the implementation of laboratory exercises, evaluation reports performed exercise.

Get extra points for the activity in the classroom, and in particular for:

- Proposing to discuss additional aspects of the subject;
- The effectiveness of the application of knowledge when solving a given problem;
- Ability to work within a team practically performing the task detailed in the laboratory;
- Comments relating to the improvement of teaching materials;
- Aesthetic diligence reports and tasks? in the framework of self-study

#### Course description

Properties of specialized microelectronic circuits for analog signal processing. Introduction to the analog-to-digital signals. Construction and performance analog-to-digital and digital-to-analog. Construction and design principles of signal path from a transmitter physical quantity into an electrical signal. Analog-to-digital and digital-to-analog system microprocessor. Principles of designing analog-to-digital electronic systems.

#### Basic bibliography:

- 1. Z. Kulka, M. Nadachowski, Analogowe układy scalone, WKŁ, W-wa, 1980
- 2. A. Borkowski, Układy scalone w stabilizatorach napięcia stałego, WNT, Warszawa, 1985
- 3. Z. Kulka, A. Libura, M. Nadachowski, Przetworniki analogowo-cyfrowe i cyfrowo-analogowe, WKiŁ, Warszawa, 1987
- 4. W. Borodziewicz, K. Jaszczak, Cyfrowe przetwarzanie sygnałów, WNT, Warszawa, 1987

### Additional bibliography:

- 1. J. W. Cofron, W. E. Long, Technika sprzęgania układów w systemach mikroprocesorowych, WNT, Warszawa, 1988
- 2. D.F. Hoeschele, Analog-to-digital and digital-to-analog conversion techniques, John Wiley & Sons, New York, 1994

#### Result of average student's workload

| Activity   | Time (working hours) |
|--|----------------------|
| 1. Participation in classes                                | 60                   |
| 2. Participation in consultations                          | 10                   |
| 3. Individual development of the project (project classes) | 15                   |
| 4. Udział w opracowaniu sprawozdań (zajęcia laboratoryjne) | 10                   |

#### Student's workload

| Source of workload   | hours | ECTS |
|----------------------|-------|------|
| Total workload       | 95    | 4    |
| Contact hours        | 70    | 3    |
| Practical activities | 15    | 1    |