**COURSE GUIDE**

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|---|---|
| Subject name | **Introduction to automation of production processes** |
| Course of study | **Quality and Production Management** |
| The form of study | **Full-time** |
| Level of qualification | **First** |
| Year | **III** |
| Semester | **V** |
| The implementing entity | **Department of Management Information Systems** |
| The person responsible for preparing | **dr hab. inż. Waldemar Jçdrzejczyk, Prof. PCz** |
| Profile | **General academic** |
| ECTS points | **4** |

**TYPE OF TEACHING – NUMBER OF HOURS PER SEMESTER**

| LECTURE | CLASS | LABORATORY | PROJECT | SEMINAR |
|---|---|---|---|---|
| **15** | | **30** | **-** | **-** |

**COURSE AIMS**

Cl. Acquainting with the theoretical basics in the field of automation as well as with issues of design, selection, commissioning and automation systems operation in the field of production engineering.

C2. Presentation of elementary mathematical models used in automation and control theory.

**ENTRY REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

1. Student is able to explain the essence of basic physical phenomena.
2. Student is able to describe electrical and electronic systems as well as explain the rules of their operation.
3. Student is able to present the internal and external environment of production companies and describe the cycle of production processes.

**LEARNING OUTCOMES**

EU1. Student is able to describe phenomena in the field of automation using the Laplace transforms.

EU2. Student is able to present and describe basic problems in the areas of automation. He is able to adapt their principles and justify the reasons for their adaptation in diversified areas of technical sciences.

EU3. Student is able to create models of basic automation terms. He can describe them by determining their time and frequency characteristics.

EU4. Student is able to design and model control systems based on combinational logic circuits.

**COURSE CONTENT**

| Type of teaching – LECTURE | Number of hours |
|---|---|
| W1. Introduction to the subject. Presentation of basic concepts and terms related to the automation of production processes. | 1 |
| W2. Laplace transform. Inverse transform. Properties of Laplace transforms. | 1 |
| W3. Determination of Laplace transforms. Tables of Laplace transforms. | 1 |
| W4,W5. Transfer function of automation basic terms (proportional term - P, integral term - I, derivative term - D, PI term, PD term, PID term). | 2 |
| W6. The response determination of the automation basic terms to the given signals. | 1 |
| W7,W8. Block Diagrams and Transfer Functions. Interconnections of systems: (a) series, (b) parallel and (c) feedback connections. | 2 |
| W9,W10. Relay control systems. | 2 |
| W11,W12. Digital control systems. | 2 |

| | |
|---|---|
| W13,W14. Programmable Logic Controllers - construction and programming. | 2 |
| W15. PLC languages: Ladder Diagram (LD), Instruction List (IL). | 1 |
| **Type of teaching – LABORATORY** | **Number of hours** |
| L1. Introductory classes — principles of performing laboratory exercises. Regulations of the laboratory. | 2 |
| L2. Testing of oscilloscope and function generator. | 2 |
| L3. Modeling of proportional term - time characteristics determination. | 2 |
| L4. Modeling of proportional-integral term - time characteristics determination. | 2 |
| L5,L6. Determination of frequency characteristics of automation basic terms. | 4 |
| L7. Testing of combinational logic circuits. | 2 |
| L8,L9. Designing of control logic circuits. | 4 |
| L10,L11. Programming of control systems in Ladder Diagram (LD) language. | 4 |
| L12-L14. Programming of control systems in Instruction List language. | 6 |
| L15. Evaluation of reports. | 2 |

**TEACHING TOOLS**

1. Books and monographs.
2. Audiovisual presentation.
3. Laboratory devices.

**WAYS OF ASSESSMENT (F – FORMATIVE, P – SUMMATIVE)**

FI. Laboratory tasks - reports.

**STUDENT WORKLOAD**

| **Form of activity** | | **Average number of hours for realization of the activity** | | |
|---|---|---|---|---|
| | | [h] | ECTS | ECTS |
| Contact hours with the teacher | Lecture | 15 | 0.6 | 0.6 |
| Contact hours with the teacher | Laboratory | 30 | 1.2 | 2.6 |
| Preparation of the laboratory, preparation of reports | | 35 | 1.4 | |
| Getting acquainted with the indicated literature | | 15 | 0.6 | 0.6 |
| Consultation | | 5 | 0.2 | 0.2 |
| **TOTAL NUMBER OF HOURS / ECTS POINTS FOR THE COURSE** | | **100** | **4** | |

**BASIC AND SUPPLEMENTARY RESOURCE MATERIALS**

**Basic resources**


1. Trevathan V.L. (ed.) Research Triangle Park. NC, USA, International Society of Automation.A Guide to the Automation Body of Knowledge, 2006.
2. Frohm J. Levels of Automation in Production Systems. Chalmers University of Technology, 2008.
3. Kandray D. Programmable Automation Technologies. Industrial Press, 2010.


**Supplementary resources**


1. Świć A., Lipski J. (eds.) Automation and Control in Industry. Wydaw. Politechniki Lubelskiej, Lublin, 2008.
2. Methods and Models in Automation and Robotics: 15th International Conference, 23-26 August 2010, Międzyzdroje, Poland.


**TEACHERS (NAME, SURNAME, E-MAIL ADDRESS)**


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**MATRIX OF LEARNING OUTCOMES REALISATION**

| Learning outcome | Reference of given outcome to outcomes defined for whole program (PRK) | Course aims | Course content | Teaching tools | Ways of assessment |
|---|---|---|---|---|---|
| **EU1** | K_W09, K_U01, K_U02, K_U04, K_U07, K_U10 | Cl, C2 | W1-W3 | 1, 2 | F1 |
| **EU2** | K_W09 | Cl | W4-W8 | 1,2 | F1 |
| **EU3** | K_W09, K_U02, K_U07 | C1, C2 | L1-L6 | 3 | F1 |
| **EU4** | K_W01, K_W05, K_U08, K_U07, K_K01 | C1 | W9-W15, L7-L15 | 1, 2, 3 | F1 |

**FORM OF ASSESSMENT - DETAILS**

| | grade 2 | grade 3 | grade 4 | grade 5 |
|---|---|---|---|---|
| **EU1** | Student cannot describe phenomena of automation fields using the Laplace transforms. | Student is able to describe only chosen phenomena in the field of automation using few Laplace transforms. | Student is able to describe a few phenomena in the field of automation using the Laplace transforms. | Student is able to describe most phenomena in the field of automation using the Laplace transforms. |
| **EU2** | Student cannot present and describe basic problems in the areas of automation. He isn't able to adapt their principles and justify the reasons for their adaptation in diversified areas of technical sciences. | Student is able to present and describe few basic problems in the areas of automation. He isn't able to adapt their principles and justify the reasons for their adaptation in diversified areas of technical sciences. | Student is able to present and describe few basic problems in the areas of automation. He is able to adapt their principles and justify the reasons for their adaptation in few areas of technical sciences. | Student is able to present and describe most of the basic problems in the areas of automation. He is able to adapt their principles and justify the reasons for their adaptation in diversified areas of technical sciences. |
| **EU3** | Student cannot create models of basic automation terms. He cannot describe them by determining their time and frequency characteristics. | Student is able to create models of only chosen terms of automation. He can describe them by determining their only time characteristics. | Student is able to create models of the basic terms of automation. He can describe them by determining their time characteristics. | Student is able to create models of the basic terms of automation. He can describe them by determining their time and frequency characteristics. |
| **EU4** | Student cannot design and model elementary control systems based on combinational logic circuits. | Student is able to design elementary control systems based on combinational logic circuits. | Student is able to design and model elementary control systems based on combinational logic circuits. | Student is able to design and model advanced control systems based on combinational logic circuits. |

**ADDITIONAL USEFUL INFORMATION ABOUT THE COURSE**

1. Information where presentation of classes, instruction, subjects of seminars can be found, etc. - presented to students during first classes, if required by the formula classes are sent electronically to the e-mail addresses of individual dean groups.
2. Information about the place of classes - Information can be found on the website of the Faculty of Management.
3. Information about the timing of classes (day of the week / time) - Information can be found on the website of the Faculty of Management.
4. Information about the consultation (time + place) - Information can be found on the website of the Faculty of Management.