

# BIALYSTOK UNIVERSITY OF TECHNOLOGY



Study programme

automatic control and robotics

full-time Master's degree

seventh level of the Polish Qualifications Framework

Białystok 2019

Table of references of course outcomes to the field outcomes for master degree in *Automatic Control and Robotics* to the second degree characteristic of Polish NQF (Polskiej Ramy Kwalifikacji) levels 6-8 and universal characteristics defined in Polish law established on 22<sup>nd</sup> of December 2015 (Ustawa z dnia 22 grudnia 2015 r. o Zintegrowanym Systemie Kwalifikacji).

Explanation of the table symbols:

EEE1\_Xxx – course outcomes of learning for master degree in *Automatic Control and Robotics*, X: W – knowledge category, U – skills category, K – social competences category, xx – number of the learning outcome;

P7S – outcomes of education for master degree according to Polish NQF (Polska Rama Kwalifikacji) (qualifications achieved with higher education – LEVEL 7, general-academic profile, engineer competences).

| Symbol of the learning outcome for ACR  | Description of the course education outcomes – study programme <i>Automatic Control and Robotics</i> , Master degree, general-academic profile, engineering studies.<br><br>After finishing studies the graduate: | Reference to the second level characteristic of Polish NQF – level 7 for technical sciences (P7S) | Reference to the second level characteristic of Polish NQF – level 7 for engineer competences |
|---|---|---|---|
| <b>Knowledge: knows and understands</b> |   |   |   |
| AR2_W01                                 | in a deepened degree mathematical and physical theories, methods and models, and relationships between them in automatic control and robotics systems   | P7S_WG,<br>P7U_W  | P7S_WG  |
| AR2_W02                                 | in a deepened degree processes occurring in the life cycle of devices, facilities and technical systems in the field of automatic control and robotics  | P7S_WG,<br>P7U_W  | P7S_WG  |
| AR2_W03                                 | in a deepened degree selected facts, objects and phenomena and their methods and theories explaining the complex relationships between them in automatic control and robotics systems                             | P7S_WG,<br>P7U_W  | P7S_WG  |
| AR2_W04                                 | in a deepened degree principles of designing automatic control and robotics systems as well as supporting engineering tools and computer methods  | P7S_WG,<br>P7U_W  | P7S_WG  |
| AR2_W05                                 | in a deepened degree theories, methods and engineering tools necessary to manage the operation of automatic control and robotics systems  | P7S_WG,<br>P7U_W  | P7S_WG  |
| AR2_W06                                 | in a deepened degree principles of conducting research, experiments and simulations, analysis, interpretation and presentation of the results obtained  | P7S_WG,<br>P7U_W  | P7S_WG  |
| AR2_W07                                 | latest development trends in the field of automatic control and robotics  | P7S_WG,<br>P7U_W  | P7S_WG  |

|                    |  |                  |        |
|--------------------|--|------------------|--------|
| AR2_W08            | economic, legal, ethical, civilization and other conditions of various types of activities related to automatic control and robotics   | P7S_WK,<br>P7U_W |        |
| AR2_W09            | principles of protection of industrial property and copyright  | P7S_WK,<br>P7U_W |        |
| AR2_W10            | rules for creating and developing forms of individual entrepreneurship   | P7S_WK,<br>P7U_W | P7S_WK |
| <b>Skills: can</b> |  |                  |        |
| AR2_U01            | use knowledge from various fields of science to formulate and solve complex, unusual problems, and innovatively perform and at least partially implement in practice the tasks appropriate for automatic control and robotics                                      | P7S_UW,<br>P7U_U | P7S_UW |
| AR2_U02            | properly choose sources and information derived from them, make their assessment, critical analysis and synthesis, and creative interpretation and presentation of this information in the field of automatic control and robotics                                 | P7S_UW,<br>P7U_U | P7S_UW |
| AR2_U03            | select and use advanced methods and tools, including information and communication techniques in automatic control and robotics systems  | P7S_UW,<br>P7U_U | P7S_UW |
| AR2_U04            | plan and perform research, experience or observations on cognitive issues in the field of automatic control and robotics   | P7S_UW,<br>P7U_U | P7S_UW |
| AR2_U05            | critically evaluate the results of research, experiments, computer simulations, observations and theoretical calculations, as well as discuss measurement errors and the possibilities of optimizing the procedures used in automatic control and robotics systems | P7S_UW,<br>P7U_U | P7S_UW |
| AR2_U06            | apply the acquired knowledge in the field of automatic control and robotics to solve problems related to similar scientific disciplines  | P7S_UW,<br>P7U_U | P7S_UW |
| AR2_U07            | make economic assessment of the proposed technical solutions, notice their systemic and non-technical aspects in automatic control and robotics systems  | P7S_UW,<br>P7U_U |        |
| AR2_U08            | communicate on specialist topics specific to automatic control and robotics engineer with diverse recipients, and lead the debate  | P7S_UK,<br>P7U_U |        |

|  |  |                             |  |
|--|--|-----------------------------|--|
| AR2_U09                                | use a foreign language at at least B2+ level of the European System of Language Description in the area of specialist terminology, for the free use of professional literature, as well as the preparation and presentation of presentations on the implementation of a project or research task | P7S_UK,<br>P7U_U            |  |
| AR2_U10                                | manage the team's work, plan and implement lifelong learning and guide others in this area   | P7S_UO,<br>P7S_UU,<br>P7U_U |  |
| <b>Social competences: is ready to</b> |  |                             |  |
| AR2_K01                                | analyze on its merits the received content and for its critical evaluation   | P7S_KK,<br>P7U_K            |  |
| AR2_K02                                | use expert opinions and recognize the importance of knowledge in the field of technical sciences and humanities, economics and social sciences necessary in solving cognitive and practical problems   | P7S_KK,<br>P7U_K            |  |
| AR2_K03                                | meet social needs, undertake and coordinate initiatives for the social environment   | P7S_KO,<br>P7U_K            |  |
| AR2_K04                                | act for the public interest  | P7S_KO<br>P7U_K             |  |
| AR2_K05                                | think and act in an entrepreneurial way in the field of professional roles   | P7S_KO,<br>P7U_K            |  |
| AR2_K06                                | responsibly fulfill professional duties, continuously train in issues related to the nature of professional roles  | P7S_KR,<br>P7U_K            |  |
| AR2_K07                                | comply with the rules of professional ethics and take steps to comply with these principles by subordinate personnel   | P7S_KR,<br>P7U_K            |  |

## Study programme for full-time studies *Automatic Control and Robotics*

Full-time study programme

Study programme: *Automatic Control and Robotics*

Master degree, general-academic profile

### Semester I

| No           | Module ID   | Module name                       | Hours of teaching |           |           |           |           |            | ECTS      |
|--------------|-------------|-----------------------------------|-------------------|-----------|-----------|-----------|-----------|------------|-----------|
|              |             |                                   | L                 | C         | LC        | P         | SW        | Total      |           |
| 1            | MYAR2S01001 | Optimization methods              | 30                | --        | --        | 15        | --        | 45         | 3         |
| 3            | MYAR2S01002 | Control theory (E)                | 30                | 30        | --        | 15        | --        | 75         | 6         |
| 4            | MYAR2S01003 | Real time controllers             | 15                | --        | --        | 30        | --        | 45         | 4         |
| 5            | MYAR2S01004 | Artificial intelligence systems   | 30                | --        | --        | --        | 15        | 45         | 3         |
| 6            | MYAR2S01005 | Signal and image processing       | 30                | --        | 30        | --        | --        | 60         | 5         |
| 8            | MYAR2S01006 | Control systems for robots (E)    | 15                | --        | 30        | --        | --        | 45         | 4         |
| 9            | MYAR2S01007 | Identification of control systems | 30                | --        | --        | 15        | --        | 45         | 3         |
| 10           | MYAR2S01008 | Foreign language English (B2+) *  | --                | 30        | --        | --        | --        | 30         | 2         |
|              | MYAR2S01009 | Foreign language English (C1) *   |                   |           |           |           |           |            |           |
|              | MYAR2S01010 | Foreign language Russian *        |                   |           |           |           |           |            |           |
|              | MYAR2S01011 | Foreign language German *         |                   |           |           |           |           |            |           |
| <b>Total</b> |             |                                   | <b>180</b>        | <b>60</b> | <b>60</b> | <b>75</b> | <b>15</b> | <b>390</b> | <b>30</b> |

### Semester II

| No               | Module ID | Module name   | Hours of teaching |          |           |            |           |            | ECTS      |
|------------------|-----------|---|-------------------|----------|-----------|------------|-----------|------------|-----------|
|                  |           |   | L                 | C        | LC        | P          | SW        | Total      |           |
| 1                |           | Specialization courses: industrial process control (2E) * | 150               | --       | 60        | 150        | --        | 360        | 30        |
| <b>Total IPC</b> |           |   | <b>150</b>        | <b>0</b> | <b>60</b> | <b>150</b> | <b>0</b>  | <b>360</b> | <b>30</b> |
| 2                |           | Specialization courses: computer systems (2E) *           | 150               | --       | 45        | 135        | 30        | 360        | 30        |
| <b>Total CS</b>  |           |   | <b>150</b>        | <b>0</b> | <b>45</b> | <b>135</b> | <b>30</b> | <b>360</b> | <b>30</b> |

## Semester III

| No           | Module ID   | Module name                                     | Hours of teaching |           |           |           |          |            | ECTS         |
|--------------|-------------|---|-------------------|-----------|-----------|-----------|----------|------------|--------------|
|              |             |   | L                 | C         | LC        | P         | SW       | Total      |              |
| 1            | MYAR2S03001 | Implementation of control algorithms            | 15                | --        | 15        | 30        | --       | 60         | 4            |
| 2            | MYAR2S03002 | Diploma seminar *                               | --                | --        | --        | 30        | --       | 30         | 2            |
| 3            | MYAR2S03003 | Innovative enterprise and technology transfer * | 15                | 15        | --        | --        | --       | 30         | 3            |
| 4            | MYAR2S03004 | HES II, HES III (2 of 6):<br>World economy *    | 2 x 15<br>= 30    | --        | --        | --        | --       | 30         | 2 x 1 =<br>2 |
|              | MYAR2S03005 | Founding and financing of start-ups *           |                   |           |           |           |          |            |              |
|              | MYAR2S03006 | Market investigations *                         |                   |           |           |           |          |            |              |
|              | MYAR2S03007 | Industrial marketing *                          |                   |           |           |           |          |            |              |
|              | MYAR2S03008 | Management of project teams *                   |                   |           |           |           |          |            |              |
|              | MYAR2S03009 | Management of career *                          |                   |           |           |           |          |            |              |
| 5            | MYAR2S03010 | Specialistic lecture *                          | 30                | --        | --        | --        | --       | 30         | 2            |
| 6            | MYAR2S03011 | Diploma thesis *                                | --                | --        | --        | --        | --       | --         | 15           |
| 7            | MYAR2S03012 | Vocational training *                           | --                | --        | --        | --        | --       | --         | 2            |
| <b>Total</b> |             |   | <b>90</b>         | <b>15</b> | <b>15</b> | <b>60</b> | <b>0</b> | <b>180</b> | <b>30</b>    |

**Specialization: industrial control**

## Semester II

| No           | Module ID   | Module name                                 | Hours of teaching |          |           |            |          |            | ECTS      |
|--------------|-------------|---|-------------------|----------|-----------|------------|----------|------------|-----------|
|              |             |   | L                 | C        | LC        | P          | SW       | Total      |           |
| 1            | MYAR2S12001 | Interim work project *                      | --                | --       | --        | 30         | --       | 30         | 2         |
| 2            | MYAR2S12002 | Networked automation systems (E) *          | 30                | --       | 15        | 15         | --       | 60         | 5         |
| 3            | MYAR2S12003 | Testing of control systems *                | 15                | --       | 30        | --         | --       | 45         | 4         |
| 4            | MYAR2S12004 | Decision support in technical diagnostics * | 15                | --       | --        | 15         | --       | 30         | 2         |
| 5            | MYAR2S12005 | Automation and robotization systems *       | 45                | --       | --        | 30         | --       | 75         | 6         |
| 6            | MYAR2S12006 | Nonlinear control systems (E) *             | 30                | --       | --        | 30         | --       | 60         | 6         |
| 7            | MYAR2S12007 | Control of manufacturing processes *        | 15                | --       | 15        | 30         | --       | 60         | 5         |
| <b>Total</b> |             |   | <b>150</b>        | <b>0</b> | <b>60</b> | <b>150</b> | <b>0</b> | <b>360</b> | <b>30</b> |

**Specialization: informatics systems**

## Semester II

| Lp.          | Kod przedmiotu | Nazwa przedmiotu                                    | Liczba godzin |          |           |            |           |            | Punkty ECTS |
|--------------|----------------|---|---------------|----------|-----------|------------|-----------|------------|-------------|
|              |                |   | W             | C        | L         | P          | SW        | Suma       |             |
| 1            | MYAR2S22001    | Interim work project *                              | --            | --       | --        | 30         | --        | 30         | 2           |
| 2            | MYAR2S22002    | Ethernet industrial networks (E) *                  | 30            | --       | 15        | 15         | --        | 60         | 5           |
| 3            | MYAR2S22003    | Artificial neural networks and expert systems (E) * | 30            | --       | --        | --         | 30        | 60         | 5           |
| 4            | MYAR2S22004    | Cooperation of robots *                             | 15            | --       | --        | 30         | --        | 45         | 4           |
| 5            | MYAR2S22005    | Intelligent technical systems *                     | 15            | --       | --        | 30         | --        | 45         | 4           |
| 6            | MYAR2S22006    | Automation systems *                                | 30            | --       | --        | 15         | --        | 45         | 4           |
| 7            | MYAR2S22007    | Autonomous systems *                                | 30            | --       | 30        | 15         | --        | 75         | 6           |
| <b>Total</b> |                |   | <b>150</b>    | <b>0</b> | <b>45</b> | <b>135</b> | <b>30</b> | <b>360</b> | <b>30</b>   |