University of Žilina

Faculty of Electrical Engineering and Information Technology

GUIDE TO DOCTORAL DEGREE STUDY

STUDY PROGRAMME: **PROCESS CONTROL**
FIELD OF STUDY: **CYBERNETICS**

CHAIRPERSON OF THE WORKING GROUP: **doc. Ing. Rastislav Pirník, PhD.**
GUARANTOR OF THE STUDY PROGRAMME: **prof. Ing. Aleš Janota, PhD**

ŽILINA, 2022

1. DETAILS ON THE STUDY PROGRAMME

1.1 Characteristics of the Study Programme

Name of the study programme: Process control

Name of the field of study: Cybernetics

Degree of higher education: Third (doctoral degree study programme)

Form of study: full-time/part-time

Requirements for Applicants for Study: The basic condition for admission to the doctoral degree study (study programme of the third degree) is the full completion of the second degree of higher education in the cybernetics, electrical engineering, or computer science fields of study. Other conditions of admission are stated in the document Principles and rules of the admission procedure for studying at the Faculty of Electrical Engineering and Information Technology (available at: https://feit.uniza.sk/en/doctoral-studies/)

1.1.1 Graduate Profile

The graduate of the doctoral study program (SP) Process Control in the field of Cybernetics represents a qualified technician (expert) with unique knowledge and skills reflecting current and modern trends in the areas of process control, automation, computerization, and robotics. The added value of the study in the field of Cybernetics in the given program is the improvement of knowledge in the area of functional and technical safety of control systems, including the basics of cyber security.

The Ph.D. graduate has extensive professional knowledge in several areas of the field, which serves as a basis for research and development and the creation of new knowledge in traditional fields such as: process modelling and control methods, design of robotic and mechatronic systems, new software, and communication systems for management of complex systems. The Ph.D. graduate has professional and methodological knowledge of an interdisciplinary nature, based on which he/she can profile himself/herself in the penetration areas of artificial intelligence, cognition, adaptation, communication, connectivity, biosystems, social systems, and so on. The Ph.D. graduate solves research problems in specialized areas of industry and other application areas in terms of priorities formulated for areas of basic and applied research. The Ph.D. graduate has demonstrated a systematic understanding of the field of study and has mastered the skills and methods of scientific research associated with the field corresponding to the current state of knowledge in cybernetics, masters and can choose specific scientific methods of basic and applied research in one of cybernetics, automation, and mechatronics fields. He/She is capable of critical analysis, abstraction, evaluation, and generalization of the issue and synthesis of new and complex concepts. He or she demonstrates the ability to design, construct, implement and modify a substantial part of research with scientific integrity. He/She applies and implements his/her findings of the theoretical analysis and complex scientific research in solving problems. Through the original research, he/she contributes to broadening the boundaries of scientific knowledge through the implementation of an extensive set of papers, some of which are worthy of peer-reviewed publication at the national or international level. The Ph.D. graduate is characterized by independent, critical, and analytical thinking, which he or she applies in changing conditions. The Ph.D. graduate can communicate with colleagues, the wider scientific community, and the general public about the field of expertise and can independently and professionally present the results of research and development at home and abroad. He/She takes into account social, scientific, and ethical aspects when formulating research intentions and interpreting research results. He/She can determine the aim of research and coordinate the team in the relevant scientific field. In an academic and professional context, his/her ability to support technological, social, or cultural progress in a knowledge-based society is expected.

1.1.2 Parts of the Doctoral Degree Study

The study of a doctoral degree study programme (hereinafter referred to as "doctoral degree study") is governed by the provisions stipulated in the Directive No. 110 – Study Regulations for the Third Degree of the University Study at the University of Žilina *https://uniza.sk/images/pdf/kvalita/EN/smernica-UNIZA-c-110-en.pdf* and the Directive No. 216 – Quality Assurance of the Doctoral Degree Studies at the University of Žilina *https://uniza.sk/images/pdf/kvalita/EN/smernica-UNIZA-c-216-en.pdf* and/or the Directive No. 198 – Support for Applicants for Study and Students with Specific Needs at the University of Žilina Smernicou č. 198 *Podpora uchádzačov o štúdium a študentov so špecifickými potrebami na Žilinskej univerzite v Žiline*.) The doctoral degree study at the Faculty of Electrical Engineering and Information Technology is monitored by a working group of the field committee (WG FC) established for a given study programme (see Chapter 2 for more details).

The doctoral degree study is conducted according to an individual study plan under the guidance of a supervisor, while the set of knowledge, skills, and abilities is adapted to the specific topic of the dissertation. The basis for the set of knowledge comprises the following disciplines: control and automation of processes, intelligent control systems, risk analysis and safety of controlled processes, robotic and autonomous systems, computerization and cyber security.

The individual study plan (hereinafter referred to as **ISP**) is elaborated by the supervisor in cooperation with a PhD. student according to the needs of the selected dissertation in accordance with the assurance of the required quality of scientific work and education of PhD. students. Subsequently, it is submitted for approval to the members of the WG FC through its chairperson and to the guarantor of the relevant study programme (hereinafter referred to as SP). WG FC is established according to the internal regulations of the faculty. After its approval, the dean of the faculty finally comments on it.

As part of the evaluation of the study, credits are allocated to a PhD. student for individual activities. A prerequisite for the successful completion of the doctoral degree study is that the PhD. student has obtained at least 180 credits during the doctoral degree study. The doctoral degree study consists of a study, a scientific and a pedagogical part.

The study part represents at least 50 credits of the ISP. It consists of the study of two compulsory courses, two compulsory elective courses, and the compulsory course 'Essay to Dissertation Examination and Defence of Written Project for Dissertation Examination'. The compulsory courses are 'Basics of Research Practice' and 'Foreign Language'. Selection of the two compulsory elective courses depends on a topic of a dissertation thesis and it is specified in the ISP of a PhD. student. All courses of the study part are the state examination courses. A more detailed description is given in the section 1.2.

The scientific part represents at least 130 credits of the ISP. It is conducted by means of dissertation projects I to IV, individual and team scientific work, including the elaboration and the defence of the dissertation thesis. Dissertation projects I, II, III, and IV represent consequential parts (stages) of the dissertation thesis. The allocation of credits for individual and team scientific work is determined by Table 1, while the number of credits for published scientific papers shall be determined according to the percentage share of the PhD. student in the publication output.

As a rule, an integral part of the activities of a PhD. student in the full-time form of study, prescribed in the ISP, is the active participation of the PhD. student in a foreign study stay at a partner workplace of the PhD. student's training institute. It is recommended to include in the PhD. student's ISP the completion of a foreign study stays lasting at least two months or one semester (Directive No. 110 – *Study Regulations for the Third Degree of the University Study at the University of Žilina*). For this foreign study stay, the PhD. student is awarded additional credits as stated in Table 3.

A condition for the proper completion of the doctoral degree study is the passing of the Dissertation examination, which is the state examination, and the dissertation thesis' defense. The dissertation

thesis represents a final thesis. After the dissertation thesis has been elaborated, accepted, and defended, the PhD. student will receive 30 credits (the course 'The Thesis and Dissertation Defence ').

The pedagogical part is the teaching activity stipulated in the ISP in the full-time form of study for a maximum of 4 hours per week on average per academic year; in the part-time form of study, there is the obligation to provide selected professional lectures and to perform other professional activities.

Table 1 Allocation of credits for individual and team scientific work

Assessment of the individual and team scientific work	**Credits**
Dissertation projects (they form consequential parts of the dissertation thesis) – **compulsory**	
Dissertation project I Dissertation project II Dissertation project III Dissertation project IV	10 10 10 10
Published scientific papers	
Papers registered in the WoS database** - paper in an impacted journal with quartile Q1 - paper in an impacted journal with quartile Q2 - paper in an impacted journal with quartile Q3 - paper in an impacted journal with quartile Q4 - conference papers and proceedings (collections)	 80* 60* 40* 20* 20*
Papers registered in the SCOPUS database*** - paper in an impacted journal with quartile Q1 - paper in an impacted journal with quartile Q2 - paper in an impacted journal with quartile Q3 - paper in an impacted journal with quartile Q4 - conference papers and proceedings (collections)	 40* 30* 20* 10* 10*
Other papers in journals or conference proceedings in a world language / the Slovak language	8/4*
Paper (chapter) in a monograph, university textbook in a world language / other language	20/10*
Protected outputs related to the dissertation - patent - utility model	 60* 30*
Responses	
citation registered in the SCI citation index	2
Active presentation of results	
- at one international conference abroad or at home in a world language**** - at other conferences	10 5

* the number of credits shall be determined by the percentage share of the PhD. student in the publication output.

** http://www.isiknowledge.com/WOS

*** http://www.scopus.com/home.url

**** also in case of presenting more than one paper

Credits are awarded only for publications related to the topic of the dissertation, elaborated in collaboration with the supervisor. They are listed in the annual evaluation of a PhD. student.

1.1.3 Rules and Conditions for the Elaboration of the Individual Study Plans

The basic rules and conditions for the elaboration of ISP are defined in the provisions stipulated in the Directive No. 110 – *Study Regulations for the Third Degree of the University Study at the University of Žilina* and the Directive No. 216 – *Quality Assurance of the Doctoral Degree Studies at the University of Žilina*.

The ISP of the PhD. student contains a list of courses to be completed by a PhD. student, a list of courses for the Dissertation examination selected from the list approved by the WG FC, and a list of required and recommended literature to be studied by a PhD. student as part of his/her individual preparation for the Dissertation examination. The ISP of a PhD. student also includes the deadlines for the completion of the individual courses and the Dissertation exam. An integral part of the activities of a PhD. student prescribed in the ISP is the active participation of a PhD. student at international conferences, especially those indexed in the international databases (WoS, SCOPUS), and publication in scientific journals, while at least one paper is published in an impacted journal. It is recommended to include the obligation to publish at least one paper in an impacted journal that has been assigned a quartile of at least Q3 in the Web of Science or at least Q2 in the SCOPUS database in the ISP of a PhD. student. It is recommended to include the completion of a foreign study stay in the ISP of a PhD. student.

The ISP is elaborated by a supervisor in collaboration with a PhD. student according to the needs of the selected dissertation thesis in accordance with the quality assurance of the scientific work and education of PhD. students on a prescribed up-to-date form of the Faculty of Electrical Engineering and Information Technology (https://feit.uniza.sk/en/doctoral-studies/)

The standard length of **full-time** study: **3 years**
The standard length of **part-time** study: **4 years**

The division of the study into parts and the conditions for advancement to the next year of study are expressed in terms of the number of credits obtained.

A supervisor continuously assesses the quality and the level of the fulfilment of the ISP of a PhD. student as well as compliance with deadlines, and he/she proposes the allocation of credits for individual and team scientific work.
A supervisor shall elaborate annual evaluation of a PhD. student's fulfilment of the ISP (**Annual Evaluation of a PhD. student**) by August 31 of the corresponding academic year, including a statement as to whether or not he/she recommends the continuation of the doctoral degree study. In doing so, a supervisor shall assess the status and level of fulfilment of the ISP of a PhD. student, compliance with deadlines, award credits, and, if necessary, submit a proposal for modification of the ISP of a PhD. student. The annual evaluation of a PhD. student is approved by a guarantee of a relevant study programme and subsequently by a dean. Based on the annual evaluation of a PhD. student, a dean decides whether a PhD. student may continue his/her study and on any changes to his/her study programme.

1.2 Organisation of the Study - Full-time Study

The basic part of the study is a year of study, which begins on September 1 and ends on August 31 of the relevant academic year. The full-time study is divided into years as follows:
The first year - a student shall obtain a minimum of 40 credits,
The second year - a student shall obtain a minimum of 60 credits or a total of at least 100 credits for the first and the second year.
The third year - a student shall obtain enough credits to achieve a minimum of 180 credits for the entire course of study.

The condition for advancement to the next year of the study is the acquisition of the prescribed number of credits in a given academic year. Failure to meet this requirement will result in the

withdrawal a student from the study. The individual study plan is designed in such a way that by completing it the student will meet the conditions for the proper study completion (graduation) within the standard length of study.

Other conditions for the proper completion of the study:

- successful completion of compulsory and compulsory elective courses of the study programme in accordance with the rules and conditions for the design of the ISP,
- publication of the results obtained during the study, which are related to the topic of the dissertation thesis. The minimum requirement is the publication of at least one scientific paper in a foreign impacted scientific journal, in a world language, which has been assigned a quartile of at least Q3 in the Web of Science or at least Q2 in the SCOPUS database, while a PhD. student as an author or a co-author should have at least 25% share in the respective publication (at the time of the dissertation thesis defense, the PhD. student must submit a published article or a confirmation of its acceptance),
- passing the state examinations (in accordance with the study regulations), which are:
  - dissertation examination – in the full-time form of study, a PhD. student shall apply for the dissertation examination no later than 18 months from the date of enrolment in the study. It is recommended to take the dissertation examination within 12 months from the date of enrolment. The dissertation examination consists of a part consisting of a debate on the written work for the dissertation examination and a part in which a PhD. student shall demonstrate his/her theoretical knowledge in the specified courses of the examination dissertation. A PhD. student may also take examinations from individual courses during the study part of the doctoral degree study before the debate on the written work for the dissertation examination,
  - successful dissertation thesis defense.

As a rule, active participation of a PhD. student in a foreign study stay at a partner workplace of a PhD. student's training institute of at least two months (cumulatively) is an integral part of the study. In the case of objective reasons, it is possible to establish, in agreement with a dean of the faculty, an alternative fulfilment of the above requirement based on a justified request of a supervisor.

Table 2a Recommended ISP – full-time study

Type of the course (selectiveness)	**Course name**	**Credits**	**The extent of teaching activities**	**Completion**
The first year				
Cmp	Basics of Research Practice	10	2-0-0	SE
Cmp	Process control and automation	10	0-2-0	SE
CmpE	Compulsory elective course	10	2-0-0	SE
Cmp	Foreign Language	10	2-0-0	SE
	Pedagogical Activity	-	0-0-4	-
	Individual and Team Scientific Work	*		C
The second year				
Cmp	Essay to Dissertation Examination and Defence of Written Project for Dissertation Examination	10		SE
	Individual and Team Scientific Work	*		C
	Pedagogical Activity	-	0-0-4	-
	Dissertation project I	10		C

The third year

	Individual and Team Scientific Work	*		C
	Pedagogical Activity	-	0-0-4	-
	Dissertation project II**	10		C
	Dissertation project III**	10		C
	Dissertation project IV	10		C
Cmp	The Thesis and Dissertation Defence	30		SE

* The number of awarded credits is stated in Table 1.

** The student can also take the course during the second year of the doctoral degree study

Notes:

- SE - state examination, C - credits, Cmp – compulsory subject, CmpE – compulsory elective subject
- In any semester a PhD. student may additionally enrol for another compulsory elective course (CmpE)
- The table indicates the weekly range of obligations.

1.3 Organisation of the Study - Part-time Study

The basic part of the study is a year of study, which begins on September 1 and ends on August 31 of the relevant academic year. A part-time student completes his/her study obligations similar to a full-time student, with the exception of a foreign study stay.

In an individual study plan, the study obligations are spread over 4 years of study, provided that the following conditions are met:

The first year - a student shall obtain a minimum of 30 credits,
The second year - a student shall obtain enough credits to achieve a total of at least 90 credits for the first and the second year,
The first year - a student shall obtain a minimum of 45 credits,
The fourth year - a student shall obtain enough credits to achieve a minimum of 180 credits for the entire course of study.

Other conditions for the proper completion of the study are similar to those for the full-time form of study:

- successful completion of compulsory and compulsory elective courses of the study programme in accordance with the rules and conditions for the design of the ISP,
- publication of the results obtained during the study, which are related to the topic of the dissertation thesis. The minimum requirement is the publication of at least one scientific paper in a foreign impacted scientific journal, in a world language, which has been assigned a quartile of at least Q3 in the Web of Science or at least Q2 in the SCOPUS database, while a PhD. student as an author or a co-author should have at least 25% share in the respective publication (at the time of the dissertation thesis defense, the PhD. student must submit a published article or a confirmation of its acceptance),
- passing the state examinations (in accordance with the study regulations), which are:
  - dissertation examination – in the part-time form of study, a PhD. student shall apply for the dissertation examination no later than 36 months from the date of enrolment in the study, it is recommended to do so no later than 24 months. The dissertation examination consists of a part consisting of a debate on the written work for the dissertation examination and a part in which a PhD. student shall demonstrate his/her theoretical knowledge in the specified courses of the dissertation examination. A PhD. student may also take examinations from individual

courses during the study part of the doctoral degree study before the debate on the written work for the dissertation examination,

- successful dissertation thesis defense.

The pedagogical activity may be replaced by the delivery of selected professional lectures and the performance of other professional activities.

Table 2b Recommended ISP – part-time study

Type of the course (selectiveness)	**Course name**	**Credits**	**The extent of teaching activities**	**Completion**
The first year				
Cmp	Basics of Research Practice	10	2-0-0	SE
CmpE	Process control and automation	10	2-0-0	SE
Cmp	Foreign Language	10	2-0-0	SE
	Individual and Team Scientific Work	*		C
The second year				
CmpE	Compulsory elective course	10	2-0-0	SE
Cmp	Essay to Dissertation Examination and Defence of Written Project for Dissertation Examination	10		SE
	Individual and Team Scientific Work	*		C
The third year				
	Individual and Team Scientific Work	*		C
	Dissertation project I	10		C
	Dissertation project II	10		C
The fourth year				
	Individual and Team Scientific Work	*		C
	Dissertation project III	10		C
	Dissertation project IV	10		C
Cmp	The Thesis and Dissertation Defence	30		SE

* The number of awarded credits is stated in Table 1.

Note: See also the notes regarding the study plan for the full-time study.

1.4 List of Compulsory and Compulsory Elective Courses

Compulsory courses

Type of the course (selectiveness)	**Course name**	**Credits**	**The extent of teaching activities**	**Completion**
Comp	Basics of Research Practice	10	2-0-0	SE
Comp	Foreign Language	10	2-0-0	SE
Comp	Essay to Dissertation Examination and Defence of Written Project for Dissertation Examination	10		SE
Comp	The Thesis and Dissertation Defence	30		SE

Compulsory elective courses

Type of the course (selectiveness)	Course name	Credits	The extent of teaching activities	Completion
CmpE	Intelligent control systems	10	0-2-0	SE
CmpE	Risk analysis and safety/security of controlled processes	10	0-2-0	SE
CmpE	Robotic and autonomous systems	10	0-2-0	SE

1.5 Provision of the Individual Study Plan for a PhD. Student

The basic regulation for the provision of individual study plan for a doctoral student is the Directive No. 110 *Study Regulations for the Third Degree of University Study at the University of Žilina*.

PhD. students in the full-time form of doctoral study are bound by the decisions and regulations of a head of the department in cooperation with a supervisor and a head of the training institute where they are studying. They respect the established rules at their workplace. PhD. students in the full-time form of doctoral study take part in activities of their workplace, in line with their individual study plan (regarding its study, scientific as well as pedagogical aspects). Further obligations of PhD. students and the requirements of doctoral study are laid down in Articles 4 and 5 of this Directive.

Obligations of supervisors are governed by Article 6 of the Directive No. 110 *Study Regulations for the Third Degree of the University Study at the University of Žilina*.

1.5.1 Dissertation Examination

The details regarding the dissertation examination are listed in the Decision of the Dean of the Faculty of Electrical Engineering and Information Technology on the Organisation and Administrative Provision for the 3rd Degree of Study (https://feit.uniza.sk/en/doctoral-studies/).

1.5.2 Course Examinations

The examinations regarding the individual courses can be completed even during the study part of the doctoral study, before the dissertation examination, but only following the proposal of the supervisor and after the approval of a chairperson of the working group. A chairperson of the working group can give the approval for one PhD. student for several examinations, or for certain examinations of several PhD. students. In such cases, the examination shall be held in front of a committee, in the presence of a course teacher, a supervisor (in justified cases, a supervisor's delegate), and two other members, one of which is usually from an external environment outside the training institute. The completion of individual courses is evaluated by the grade. All examinations take place in accordance with the provisions found in the Directive No. 110 *Study Regulations for the Third Degree of University Study at the University of Žilina* and in the Decision of the Dean of the Faculty of Electrical Engineering and Information Technology on the Organisation and Administrative Provision for the 3rd Degree of Study in the given academic year.

"Basics of Research Practice" Course Examination

During the semester, a PhD. student attends selected lectures related to their scientific work, including the ethics of scientific work and the presentation of achieved results. A PhD. student continuously studies scientific articles related to the topic of the dissertation thesis and prepare a scientific paper in a world language suitable for publication at an international conference, or in a journal, as well as for the defense in front of professionals. The completed paper along with its presentation will be evaluated by a committee during the oral examination. The examination consists of an oral dispute on the prepared paper by a PhD. student.

"Foreign Language" Course Examination

The examination follows the rules listed below:

- an examiner, in cooperation with a supervisor, determines the scope and range of study from a selected literature in a relevant world language; the recommended range is 100-150 pages;
- a PhD. student presents the acquired knowledges from the literature in a world language within 15 minutes,
- an examiner, appointed by a chairperson of the field committee working group, designates a short text from the prescribed literature to be read and translated by the PhD. student. An examiner shall ensure that the text is available to all members of an examination committee;
- this is followed by a free discussion regarding the topic of the exam, conducted in a relevant world language;
- for the final evaluation of the Foreign Language course, a committee also takes into account the percentage of success in the previous 2 semesters of language education.

Based on the previous approval of a supervisor and a chairperson of the field committee working group, the examination of the "Foreign Language" course can be conducted along with the "Basics of Research Practice" course examination. In this case, the study of scientific articles related to the preparation of the paper for publication represents the selected scientific literature in the relevant world language. An examiner, appointed by a chairperson of the field committee working group, determines the relevant text from the selected scientific literature, which a PhD. student reads and translates. The next part of the examination is the presentation of the paper and a discussion. Each subject is graded individually.

1.5.3 Allocation of Credits for Foreign Study Stay

Before travelling abroad for a study stay within an optional mobility programme, a PhD. student, in cooperation with a supervisor and the host institution, defines a timetable for the stay containing relevant tasks and expected outcomes. Credits will be allocated for the active foreign study stay in the scientific part of the doctoral study according to the duration of the stay.

According to the duration, a PhD. student can take part in a short-term stay – 30 days or fewer, or a long-term stay – 31 days and more.

Table 3 Allocation of Credits *for an Active Participation of a PhD. Student on a Short-term Foreign Study Stay*

Duration of a Foreign Short-term Scholarship of a PhD. Student	**Credits**
7 days or fewer	3
8 ÷ 14 days	6
15 ÷ 21 days	9
22 ÷ 30 days	12

Table 4 Allocation of Credits *for an Active Participation of a PhD. Student on a Long-term Foreign Study Stay*

Duration of a Foreign Long-term Scholarship of a PhD. Student	**Credits**
31 ÷ 60 days	15
61 ÷ 90 days	20
91 ÷ 120 days	25
121 days and more	30

1.1.5. Departmental Dissertation Thesis Defense

The departmental dissertation thesis defense takes place at the department – PhD. student's training workplace, no later than 2 weeks before the dissertation thesis submission date. The departmental dissertation thesis defense aims to critically assess the content of the dissertation thesis and to comprehensively acquaint the department with the results achieved during its completion. For the departmental defense, a PhD. student submits the dissertation in a prescribed form not yet bound. After the submission of the dissertation thesis, a supervisor shall nominate a departmental reviewer to a chairperson of the working group. A chairperson of the working group appoints the departmental reviewer and asks him/her to prepare an expert opinion. After consultation with a reviewer, the chairperson will determine the date of the departmental dissertation thesis defense.

This defense proceeds as follows:

a) a supervisor informs the department of his/her evaluation of a PhD. student;
b) a PhD. student presents his/her dissertation thesis;
c) a departmental reviewer presents his/her expert opinion and comments;
d) a PhD. student provides a detailed response to the reviewer's comments;
e) the defense concludes with mandatory recommendations that a PhD. student must fulfil before the final submission of the dissertation thesis.

1.1.6. Dissertation Thesis

The details regarding the dissertation thesis defense are listed in the Decision of the Dean of the Faculty of Electrical Engineering and Information Technology on the Organisation and Administrative Provision for the 3rd Degree of Study (https://feit.uniza.sk/en/doctoral-studies/).

2. WORKING GROUP OF THE FEIT UNIZA FIELD COMMITTEE

2.1. Introductory Provisions

a) A working group of a field committee (hereinafter referred to as WG FC) is a group established for doctoral study according to Part 5, Section 54, par. 17 of Act No. 131/2002 Coll. on Higher Education Institutions and on Amendments to Certain Acts, as amended (hereinafter referred to as the Act). For the accredited study programme Process control of the study field Cybernetics (hereinafter referred to as the field) of the doctoral study for providing and awarding the academic title „Philosophiae doctor" (abbreviation PhD.), the working group Process control of the field committee Cybernetics is established.
b) The establishment of the WG FC follows the Directive No. 110 *Study Regulations for the Third Degree of University Study at the University of Žilina* and the Directive No. 216 *Quality Assurance of the Doctoral Degree Studies at the University of Žilina*.

2.2. Rules of Procedure for the Field Committee Working Group

The field committee working group is appointed by a dean after the approval of the Faculty's Scientific Board. The composition of the WG FC follows the Directive No. 110 *Study Regulations for the Third Degree of the University Study at the University of Žilina*. At the first meeting, governed by a dean of the faculty, the members of the WG FC shall vote a chairperson of the WG FC.

Meetings of the WG FC are governed by the following principles:

- The meetings of WG FC take place usually twice a year; meeting of the WG FC is called by a chairperson, who simultaneously sets the agenda for the meeting of the WG FC. In special cases, the meeting of WG FC may be called by a dean of the Faculty of Electrical Engineering and Information Technology (FEEIT), UNIZA. If this happens, a dean also sets the agenda for the meeting.

- A dean of the Faculty of Electrical Engineering and Information Technology has the right to participate in the meetings of the WG FC, but does not have the right to vote if he/she is not member of the WG FC;
- a chairperson of the WG FC submits the copy of the minutes from the WG FC meeting to the Student Affairs Department for archiving; the meeting of the WG FC shall be governed by the set agenda; the WG FC has a quorum if at least 1/2 of its members are present; a vote shall be valid if the majority of present members vote in favour of a proposal;
- in exceptional cases, voting may be carried out by correspondence or by electronic means. A correspondence or electronic voting shall be valid provided that 2/3 of the WG FC members are present. For a valid vote, the approval of a majority of the voting members is required.

The list of WG FC members for the doctoral study: Process control is available at the faculty's website: (https://feit.uniza.sk/en/doctoral-studies/).

3. FINAL PROVISIONS

Related mandatory documentation on the organisation of the doctoral study and activities of the field committee's working group:

Act No. 131/2002 Coll. *on Higher Education Institutions and on Amendments to Certain Acts, as amended*.

Directive No.110 *Study Regulations for the Third Degree of University Study at the University of Žilina.*

Directive No. 216 *Quality Assurance of the Doctoral Degree Studies*

Directive No.215 *On Final, Rigorous, and Habilitation Theses under the Conditions of the University of Žilina*

METHODOLOGICAL GUIDELINE No. 3/2022 to Directive No. 215 On Final, Rigorous and Habilitation Theses under the Conditions of the University of Žilina

Directive No.207 *UNIZA Code of Ethics*

Directive No. 226 *On Copyright Ethics and the Elimination of Plagiarism under the Conditions of the University of Žilina*

Methodological guideline 56/2011 of the Ministry of Education, Science, Research and Sport of the Slovak Republic.

Further information and forms regarding the doctoral study (available at FEIT website: https://feit.uniza.sk/en/doctoral-studies/):

• Decision of the dean on the organisation and administrative provision for the third degree of study in the given academic year;
• Study plan of a FEEIT PhD. Student;
• Examination protocol of a FEEIT PhD. Student;
• Annual evaluation of a FEIT PhD. Student;
• Lists of study programme guarantors, members of field committee's working group, supervisors, course information sheets and further instructions, current information, and directives.

APPENDICES

APPENDIX No. 1

Course information sheets

Higher education institution: University of Žilina	
Faculty: Faculty of Electrical Engineering and Information Technology	
Course ID: 3D0KE01	**Course name:** Basics of Research Practice (BRP)
Selectiveness: Compulsory; **Completion**: Exam	
Profile course: - ***Core course*****:** -	
Form, extent, and method of teaching activities:	
Number of classes per week in the form of lectures, laboratory exercises, seminars, or clinical practice	Lectures: 2.0 Seminars: 0.0 Lab exercises 0.0
Methods by which the educational activity is delivered	The present form of education
Methods for achieving learning outcomes	Lectures: lectures with problem-based components, interactive lectures with discussions, lectures with multimedia elements, interviews, and consultations with feedback.
Number of credits: 10	
Study workload: 300 hours; 2h*13 (a present form of education) 100h (project preparation – drafting a paper for publication) 74h (consultations regarding the preparation of the paper) 100h (self-study)	
Recommended term of study: 1. year, summer semester	
Level of study: 3	
Required subsidiary courses: Prerequisites: - Co-requisites: -	
Course requirements: **Continuous assessment/evaluation:** Students deal with scientific papers covering the area of the dissertation and prepare their own scientific paper for publication and its defense in front of the scientific community (the experts), which, together with other activities, will be evaluated by the scientific committee during the oral examination. **Final assessment/evaluation:** The examination consists of an oral dispute on the prepared paper. The specific way of assessment of students' work during the semester and the examination will be specified at the beginning of the semester by the course teacher. The final evaluation of the students' study results resulting from the completion of the subject follows Articles 8 a 9 of the Study Regulations for the Third Degree of University Study at the University of Žilina. **The minimum score for registration for the exam is not specified.**	

Forms and methods of assessment	Predetermined weight %	Field of knowledge, skills, and competencies
Scientific paper for submission	40	Professional knowledge, working with information, teamwork, and presentation skills
portfolio	10	Professional knowledge, working with information, independent and teamwork
Examination	50	Professional knowledge, presentation skills

Course outcomes:

Students can handle publication databases, from which they can obtain relevant information, publications, and resources for further application within their dissertation. Students can analyse information obtained by the study of scientific resources, they can evaluate and select important facts and assess relevant connections in terms of dissertation objectives.
Students will be able to formulate their own conclusions and hypotheses using the obtained knowledge. They will analyse the data from research activities, namely independent research work and scientific research activities in the research team aimed at confirmation of the stated hypotheses. They design and present research reports.
Students can create their own scientific papers for submission and defend them in front of the scientific community (the experts).
Students can independently present the results of their own scientific and research activities, as well as the activities of the research team.

Course scheme:

Sources to obtain relevant information for scientific research activities. Nature and structure of modern science. Scientific and non-scientific methods – types and characteristics. Methods of collection of scientific information. Methods of processing and evaluation of scientific information. Research process and its stages. Types of research and design of research project. Ethics of scientific work and presentation of its outputs.

Recommended literature:

[1] Kumar, R: Research methodology: A step-by-step guide for beginners, SAGE, 2014.
[2] Hulín I et al.: Úvod do vedeckého bádania. Slovak Academic Press Bratislava, 2003, 553 p.
[3] Hanáček J, Javorka K a kol. Základy vedecko-výskumnej práce. Príručka pre doktorandov a mladých vedeckých pracovníkov. Osveta Martin, 1. issue, 2008.

Instruction language: English

Notes:

Course evaluation:

Total number of evaluated students: 0

A	B	C	D	E	FX
0 %	0 %	0 %	0 %	0 %	0 %

Course teachers:

Lectures - prof. Ing. Peter Brída, PhD.
Lectures - prof. Ing. Michal Frivaldský, PhD.
Lectures - prof. Ing. Aleš Janota, PhD.
Lectures - prof. Ing. Ladislav Janoušek, PhD.
Lectures - prof. Ing. Dušan Pudiš, PhD.
Lectures - prof. Ing. Pavol Špánik, PhD.

Last update: 2022-07-29 08:50:56.430

The person responsible for the course: prof. Ing. Pavol Špánik, PhD.

Higher education institution: University of Žilina

Faculty: Faculty of Electrical Engineering and Information Technology

Course ID: 3D0AE07	**Course name:** World language (WL)

Selectiveness: Compulsory; **Completion**: Examination

Profile course: - ***Core course*:** Yes

Form, extent, and method of teaching activities:

Number of classes per week in the form of lectures, laboratory exercises, seminars, or clinical practice	Lectures: 2.0 Practical classes 0.0 Lab exercises 0.0
Methods by which the educational activity is delivered	The present form of education
Methods for achieving learning outcomes	guided discussion/interviews/colloquium utilizing direct method/peer learning/buzz groups; presentations; simulations of real foreign

	language environment; continuing oral and/or written knowledge assessment; feedback

Number of credits: 10

Study workload: 300 hours;
Study workload: 300 hours;
200h (consultations + exam)
100h (self-study)

Recommended term of study: 1. year, summer semester

Level of study: 3

Required subsidiary courses:
Prerequisites:
Co-requisites:

Course requirements:

Continuous assessment/evaluation:

Active participation in language learning in the scope of two semesters. During this period, the student is to complete the following duties (activities) related to the issues addressed in his/her dissertation:
– preparation of a scientific article in a foreign language in the required format.
– preparation and delivery of a professional presentation.
Both activities will be summarised by percentage (0 – 100%). The percentage obtained for successful completion of language learning reflects the quality of knowledge and skills acquisition in accordance with the learning objective.

Final assessment/evaluation:

An oral examination before a committee consists of a "presentation of a professional text" part and a "conversation regarding professional and specialised topics" part. For the final evaluation of the World Language course, the committee also takes into account the percentage of success in language learning. The final course evaluation is governed by Directive No. 110 Study Regulations for the Third Degree of the University Study at the University of Žilina.

The minimum score for registration for the exam is not specified.

Forms and methods of assessment	Predetermined weight %	Field of knowledge, skills, and competencies
Successful completion of language education	40	presentation skills, language productive skills, independence, creativity, dealing with professional texts
evaluation by the state examination committee	60	professional knowledge; professional text handling, presentation skills; information handling; independence

Education outcomes:

English for Specific Purposes education aims at the student's intentional acquisition of new linguistic competencies in the field of so-called soft skills together with the development of vocabulary in the thematic areas of theoretical electrical engineering. In the language learning process, the student develops and reinforces existing linguistic competencies and simultaneously acquires those relevant to academic practice within the study programme context.

The student can effectively use linguistic means to express attitudes, present his/her own conclusions, and formulate ideas, arguments, and scientific conclusions in the world language.
The student is familiar with and uses academic and professional presentation and writing techniques during his/her study in the relevant study programme. The student can correctly reinterpret a professional text in a world language and independently prepare his/her own text based on the results of scientific research. The student shall be able to actively participate in teamwork and simultaneously independently present respective findings and/or conclusions at various international events, including conferences.

During the foreign study stay, the student shall be able to perceive the cultural differences between the home and host country and the acquired knowledge, skills and strategies will enable him/her to act expertly at an international level.

Course scheme:

Active participation in language education in the scope of two semesters (1st and 2nd study semester). During this period of study, the student is to complete the following duties (activities) related to the issues addressed in his/her dissertation:
– preparation of a scientific article in a foreign language in the required format.
– preparation and delivery of a professional presentation.
2. Content processing of approx. 100-150 pages of professional text related to the topic of the dissertation (determined in cooperation with the supervisor), presentation of the acquired knowledge in the world language during the examination in the scope of up to 15 minutes.
3. Preparation for conversational topics corresponding with the professional text and specialized topics on which the doctoral student will give his/her opinion in the examination discussion:
– Topic of my dissertation.
– Characterization of my workplace.
– Doctoral study in my field of study.
– Current state and global trends in the field of my dissertation.
– Opportunities to study abroad.

Recommended literature:
[1] 100-150 pages of the professional text prescribed by the supervisor according to the topic of the dissertation within the doctoral student's specialization.
[2] Professional literature recommended by the supervisor in the selected world language.

Instruction language: English

Notes:

Course evaluation:
Total number of evaluated students: 0

A	B	C	D	E	FX
0 %	0 %	0 %	0 %	0 %	0 %

Course teachers:
Lectures - doc. Ing. Dušan Nemec, PhD.
Lectures - prof. Ing. Aleš Janota, PhD.

Last update: 2022-08-23 13:30:57.563

The person responsible for the course: doc. Ing. Dušan Nemec, PhD.

Higher education institution: University of Žilina

Faculty: Faculty of Electrical Engineering and Information Technology

Course ID: 3D0AE03	**Course name:** Process control and automation (PCA)

Selectiveness: Compulsory; **Completion**: Exam

Profile course: Yes ***Core course*:** Yes

Form, extent, and method of teaching activities:

Number of classes per week in the form of lectures, laboratory exercises, seminars, or clinical practice	Lectures: 0.0 Seminars: 2.0 Lab exercises 0.0
Methods by which the educational activity is delivered	The present form of education
Methods for achieving learning outcomes	Lectures: lectures with problem-based components, interactive lectures with discussions, lectures with multimedia elements, interviews, and consultations with feedback.

Number of credits: 10

Study workload: 300 hours;
2h*13+0h*13+0h*13 (on-site education)
100h (self-study)
174h (project-based learning)

Recommended term of study: 1. year, winter semester

Level of study: 3

Required subsidiary courses:

Prerequisites: -
Co-requisites: -

Course requirements:

Continuous assessment/evaluation:

Students complete an individual project in which they process selected topics from the course scheme based on the objectives of their dissertation thesis. They will follow the requirements of their supervisors and course teacher/s. Project results will be presented during the oral examination in front of an examination board.

Final assessment/evaluation:

Article 9 of UNIZA Directive no. 110, The Study Regulations for the third degree of university studies at the University of Žilina, specifies the final assessment by the mark.

Forms and methods of assessment	Predetermined weight %	Field of knowledge, skills, and competencies
1 implemented project assignment	35%	Professional knowledge, working with information, independence
1 presentation	15%	Presentation skills
oral examination	50%	Professional knowledge

Education outcomes:

Students can critically assess and select methods suitable for the solution of a problem and tasks defined in the semester assignment.
Students demonstrate the application of selected methods in the design of simulation models and calculations.
Students evaluate obtained results and implement them in the scientific paper.
Students formulate a project text that will be applied within their dissertation theses.
Students can present the output of their works.
Students, based on obtained knowledge, can assess and explain the efficiency of the application of selected methods in terms of their dissertation theses.

Course scheme:

Thematic areas for the semester project:
The system and its properties; systems classification; system structure and hierarchy; system behavior, system states, and functions; system environment. Elements of the classical control system and its properties concerning control levels, hierarchical process control, systems integration, and interoperability; control system modeling; models classification; analytical and empirical methods of system identification, computer modeling, and suitable software tools; simulation experiment and approaches to simulation (Monte Carlo, discrete simulation, system dynamics, multiagent system); computer support tools; development of the process model and its phases; process dynamics; the concept of time (real, model, machine); methods of generating random variables; models of selected application areas and their specifics (industry, robotics, railway transport, road transport, etc.), the concept of industry 4.0 / 5.0 and exponential technologies; standards; technical documentation; selected topics of advanced mathematics.
The preferred thematic areas of the subject are, depending on the topic of the dissertation, more precisely specified in the doctoral student's study plan.

Recommended literature:

Specific recommended references depend on the selected range of topics according to the focus of the dissertation project.
Generally:
[1] Weidong Zhang, Quantitative Process Control Theory. CRC Press, 2012
[2] Practical Instrumentation for Automation and Process Control for Engineers and Technicians. IDC Technologies, 2012
[3] Connel, Bob: Basic Math for Process Control. ISA, 2003
[4] Sharma K.r.: Continuous Process Dynamics, Stability, Control and Automation. Nova Publishers, 2015
[5] Stenerson Jon: Industrial Automation and Process Control. Prentice-Hall, 2002
[6] Stewart Robinson: Simulation. The Practice of Model Development and Use. John Wiley and Sons, Ltd., 2014
[7] Connel, Bob: Basic Math for Process Control. ISA, 2003
[8] Printy Jacques: System Architecture and Complexity. Contribution of Systems of Systems to System

Thinking. Volume 2. Wiley, 2020
[9] Weilkiens T. et al.: Model-Based System Architecture. Wiley, 2015.
[10] Whitaker J.C., Mancini R.K.: Technical Documentation and Process. CRC Press, 2013

Instruction language: English

Notes:

Course evaluation
Total number of evaluated students: 0

A	B	C	D	E	FX
0 %	0 %	0 %	0 %	0 %	0 %

Course teachers:
Seminars: doc. Ing. Jozef Hrbček, PhD.
Seminars: doc. Ing. Marián Hruboš, PhD.
Seminars: prof. Ing. Aleš Janota, PhD.
Seminars: doc. Ing. Peter Peniak, PhD.
Seminars: doc. Ing. Rastislav Pirník, PhD.
Seminars: prof. Ing. Karol Rástočný, PhD.
Seminars: doc. Ing. Vojtech Šimák, PhD.
Seminars: doc. Dr. Ing. Peter Vestenický
Seminars: doc. Ing. Juraj Ždánsky, PhD.

Last update: 2022-08-08 15:39:13.283

The person responsible for the course: prof. Ing. Aleš Janota, PhD.

Higher education institution: University of Žilina

Faculty: Faculty of Electrical Engineering and Information Technology

Course ID: 3D0AE04	**Course name:** Intelligent control systems (ICS)

Selectiveness: Compulsory; **Completion**: Examination

Profile course: Yes ***Core course*:** Yes

Form, extent, and method of teaching activities:

Number of classes per week in the form of lectures, laboratory exercises, seminars, or clinical practice	Lectures: 0.0 Practical classes 2.0 Lab exercises 0.0
Methods by which the educational activity is delivered	The present form of education
Methods for achieving learning outcomes	Seminars: incentive discussion, explanation, project-based learning, self-study using available resources, experiment, simulations, programming, question-answer method, project work.

Number of credits: 10

Study workload: 300 hours;
2h*13+0h*13+0h*13 (on-site education)
100h (self-study)
174h (project-based learning)

Recommended term of study: 1. year, winter semester

Level of study: 3

Required subsidiary courses:
Prerequisites:
Co-requisites:

Course requirements:

Continuous assessment/evaluation:
Students complete an individual project in which they process selected topics from the course scheme based on the objectives of their dissertation thesis. They will follow the requirements of their supervisors and course teacher/s. Project results will be presented during the oral examination in front of an examination board.

Final assessment/evaluation:

Article 9 of UNIZA Directive no. 110, The Study Regulations for the third degree of university studies at the University of Žilina, specifies the final assessment by the mark.

The minimum score for registration for the exam is not specified.

Forms and methods of assessment	Predetermined weight %	Field of knowledge, skills, and competencies
1 implemented project assignment	35%	Professional knowledge, working with information, independence
1 presentation	15%	Presentation skills
oral examination	50%	Professional knowledge

Education outcomes:

Students can critically assess and select methods suitable for the solution of a problem and tasks defined in the semester assignment.

Students demonstrate the application of selected methods in the design of simulation models and calculations.

Students evaluate obtained results and implement them in the scientific paper.
Students formulate a project text that will be applied within their dissertation theses.
Students can present the output of their works.

Students, based on obtained knowledge, can assess and explain the efficiency of the application of selected methods in terms of their dissertation theses.

Course scheme:

Thematic areas for the semester project:

Interdisciplinary design of an intelligent control system; human-machine interaction; representation / model of the surrounding world; detection and identification of conditions and events; reasoning and making decisions about the world; impact on the world (in real-time as needed); signal processing; computer vision; information theory; coding and database theory; bus structures; communication protocols; radio frequency identification; wireless systems; real-time operating systems and databases; use of concepts from the theory of statistical detection; hypothesis testing; pattern recognition; time series analysis and artificial intelligence; ubiquitous computing; traditional theory of mathematical optimization; current near-optimal approaches (eg evolutionary calculations); system of systems and its management (hierarchical, decentralized, cooperative, networked, etc.); design of the observer; fuzzy control systems; machine learning; IoT; Big Data; cloud technologies; neural network-based control; adaptation of reward-based behaviour; intelligent systems applications; advanced human-machine (human-computer) interface; selected topics of advanced mathematics.

The preferred thematic areas of the subject are, depending on the topic of the dissertation, more precisely specified in the doctoral student's study plan.

Recommended literature:

Specific recommended references depend on the selected range of topics according to the focus of the dissertation project.

Generally:

[1] Thrishantha Nanayakkara, Ferat Sahin, Mo Jamshidin: Intelligent Control Systems with an Introduction to System of Systems Engineering. CRC Press, 2010
[2] M. Rao: Integrated System for Intelligent Control. Springer-Verlag Berlin-Heidelberg, 1992
[3] Marinescu D.C.: Cloud Computing. Theory and Practice. Morgan Kaufmann, 2017
[4] Badr Benmammar (Ed.): Intelligent Network Management and Control. ISTE Ltd. 2020
[5] M. Gopal: Digital Control and State Variable Methods. Conventional and Intelligent Control Systems (4th ed.). Tata McGraw-Hill Publishing Company Limited, 2012
[6] Intelligent Control of Robotic Systems. (Behera L. et al, Eds.), CRC Press, 2020
[7] Clarence W. de Silva: Intelligent Control. Fuzzy Logic Applications. CRC Press, 2018
[8] Cognitive Architectures. (Ferreira M.I.A. et. al., Eds.), Springer, 2019
[9] Pradeep Tomar: Integration and Implementation of the Internet of Things Through Cloud Computing. IGI Global, 2021
[10] Handbook of Research for Big Data. Concepts and Techniques. (Mishra B.K. et al, Eds.), AAP, 2022

Instruction language: English

Notes:

Course evaluation:
Total number of evaluated students: 0

A	B	C	D	E	FX
0 %	0 %	0 %	0 %	0 %	0 %

Course teachers:
Seminars: doc. Ing. Jozef Hrbček, PhD.
Seminars: doc. Ing. Marián Hruboš, PhD.
Seminars: prof. Ing. Aleš Janota, PhD.
Seminars: doc. Ing. Peter Peniak, PhD.
Seminars: doc. Ing. Rastislav Pirník, PhD.
Seminars: prof. Ing. Karol Rástočný, PhD.
Seminars: doc. Ing. Vojtech Šimák, PhD.
Seminars: doc. Dr. Ing. Peter Vestenický
Seminars: doc. Ing. Juraj Ždánsky, PhD.

Last update: 2022-08-08 15:41:36.377

The person responsible for the course: doc. Ing. Dušan Nemec, PhD.

Higher education institution: University of Žilina

Faculty: Faculty of Electrical Engineering and Information Technology

Course ID: 3D0AE05	**Course name:** Risk analysis and safety/security of controlled processes (RASCP)

Selectiveness: Compulsory; **Completion**: Examination

Profile course: Yes ***Core course*:** Yes

Form, extent, and method of teaching activities:

Number of classes per week in the form of lectures, laboratory exercises, seminars, or clinical practice	Lectures: 0.0 Practical classes 2.0 Lab exercises 0.0
Methods by which the educational activity is delivered	The present form of education
Methods for achieving learning outcomes	Seminars: incentive discussion, explanation, project-based learning, self-study using available resources, experiment, simulations, programming, question-answer method, project work.

Number of credits: 10

Study workload: 300 hours;
2h*13+0h*13+0h*13 (on-site education)
100h (self-study)
174h (project-based learning)

Recommended term of study: 1. year, winter semester

Level of study: 3

Required subsidiary courses:
Prerequisites:
Co-requisites:

Course requirements:

Continuous assessment/evaluation:
Students complete an individual project in which they process selected topics from the course scheme based on the objectives of their dissertation thesis. They will follow the requirements of their supervisors and course teacher/s. Project results will be presented during the oral examination in front of an examination board.

Final assessment/evaluation:
Article 9 of UNIZA Directive no. 110, The Study Regulations for the third degree of university studies at the University of Žilina, specifies the final assessment by the mark.
The minimum score for registration for the exam is not specified.

Forms and methods of assessment	Predetermined weight %	Field of knowledge, skills, and competencies
1 implemented project assignment	35%	Professional knowledge, working with information, independence
1 presentation	15%	Presentation skills
oral examination	50%	Professional knowledge

Education outcomes:

Students can critically assess and select methods suitable for the solution of a problem and tasks defined in the semester assignment.

Students demonstrate the application of selected methods in the design of simulation models and calculations.

Students evaluate obtained results and implement them in the scientific paper.

Students formulate a project text that will be applied within their dissertation theses.

Students can present the output of their works.

Students, based on obtained knowledge, can assess and explain the efficiency of the application of selected methods in terms of their dissertation theses.

Course scheme:

Thematic areas for the semester project:

Dependability (reliability, availability, maintainability, safety, security) of technical systems - factors and their indicators, analytical methods for estimating dependability indicators, dependability tests, methods for increasing dependability; risk - risk analysis process, problems of quantitative risk assessment, individual and collective risk, determination of tolerable risk, the definition of objectives and safety functions; safety/security (s/s) of control, information and communication systems - safety indicators, factors influencing s/s, methods applicable to s/s assessment, comprehensive approach to s/s assessment, s/s analysis of complex controllers, resp. multi-factor communication systems; procedures for the design of the management, information, and communication system ensuring that its required dependability and safety characteristics are achieved; modern mathematical principles in the field of cryptography and cryptanalysis and their specifics in applications in safety-related control systems; selected topics of advanced mathematics.

The preferred thematic areas of the subject are, depending on the topic of the dissertation, more precisely specified in the doctoral student's study plan.

Recommended literature:

Specific recommended references depend on the selected range of topics according to the focus of the dissertation project.

Generally:

[1] Pasman Hans: Risk Analysis and Control for Industrial Processes - Gas, Oil and Chemicals. A system Perspective for Assessing and Avoiding Low-Probability. High-Consequence Events. Elsevier, 2015

[2] Rychlik Igor – Rydén Jesper: Probability and Risk Analysis. An Introduction for Engineers. Springer, 2006

[3] Smith J. David, Simpson G.L. Kenneth: The Safety Critical Systems Handbook. Elsevier, 2015

[4] Smith J. David: Reliability, Maintainability and Risk.(7th ed.), Elsevier, 2005

[5] Sterpone Luca: Electronics System Design Techniques for Safety Critical Applications. Lecture Notes in Electrical Engineering, Springer, 2008

[6] Martins L. E. G. and Gorschek T. (Eds.): Requirements Engineering for Safety-Critical Systems. River Publishers, 2021

[7] Rausand M.: Reliability of Safety-Critical Systems. Theory and Application. Wiley, 2014

[8] SafeScrum® - Agile Development of Safety-Critical Software. Springer, 2018.

[9] Hobbs Chris: Embedded Software Development for Safety-Critical Systems (2nd ed.). CRC Press, 2020

[10] Chengwei Wu, Weiran Yao, Guanghui Sun, Ligang Wu: Security of Cyber-Physical Systems: State Estimation and Control, Springer, 2021

Instruction language: English

Notes:

Course evaluation:

Total number of evaluated students: 0

A	B	C	D	E	FX
0 %	0 %	0 %	0 %	0 %	0 %

Course teachers:

Seminars: doc. Ing. Jozef Hrbček, PhD.
Seminars: doc. Ing. Marián Hruboš, PhD.
Seminars: prof. Ing. Aleš Janota, PhD.
Seminars: doc. Ing. Peter Peniak, PhD.
Seminars: doc. Ing. Rastislav Pirník, PhD.
Seminars: prof. Ing. Karol Rástočný, PhD.
Seminars: doc. Ing. Vojtech Šimák, PhD.
Seminars: doc. Dr. Ing. Peter Vestenický
Seminars: doc. Ing. Juraj Ždánsky, PhD.

Last update: 2022-08-08 15:41:36.377

The person responsible for the course: prof. Ing. Karol Rástočný, PhD.

Higher education institution: University of Žilina

Faculty: Faculty of Electrical Engineering and Information Technology

Course ID: 3D0AE06	**Course name:** Robotic and autonomous systems (RAS)

Selectiveness: Compulsory; **Completion**: Examination

Profile course: Yes ***Core course*****:** Yes

Form, extent, and method of teaching activities:

Number of classes per week in the form of lectures, laboratory exercises, seminars, or clinical practice	Lectures: 0.0 Practical classes 2.0 Lab exercises 0.0
Methods by which the educational activity is delivered	The present form of education
Methods for achieving learning outcomes	Seminars: incentive discussion, explanation, project-based learning, self-study using available resources, experiment, simulations, programming, question-answer method, project work.

Number of credits: 10

Study workload: 300 hours;
2h*13+0h*13+0h*13 (on-site education)
100h (self-study)
174h (project-based learning)

Recommended term of study: 1. year, winter semester

Level of study: 3

Required subsidiary courses:
Prerequisites:
Co-requisites:

Course requirements:

Continuous assessment/evaluation:

Students complete an individual project in which they process selected topics from the course scheme based on the objectives of their dissertation thesis. They will follow the requirements of their supervisors and course teacher/s. Project results will be presented during the oral examination in front of an examination board.

Final assessment/evaluation:

Article 9 of UNIZA Directive no. 110, The Study Regulations for the third degree of university studies at the University of Žilina, specifies the final assessment by the mark.

The minimum score for registration for the exam is not specified.

Forms and methods of assessment	Predetermined weight %	Field of knowledge, skills, and competencies
1 implemented project assignment	35%	Professional knowledge, working with information, independence
1 presentation	15%	Presentation skills

oral examination	50%	Professional knowledge

Education outcomes:

Students can critically assess and select methods suitable for the solution of a problem and tasks defined in the semester assignment.
Students demonstrate the application of selected methods in the design of simulation models and calculations.
Students evaluate obtained results and implement them in the scientific paper.
Students formulate a project text that will be applied within their dissertation theses.
Students can present the output of their works.
Students, based on obtained knowledge, can assess and explain the efficiency of the application of selected methods in terms of their dissertation theses.

Course scheme:

Thematic areas for the semester project:
Concepts of control theory and robotics; learning and adaptation; solution of HW and SW problems resulting in effective fusion of sensors, computers, and problem dynamics into one integrated system; operating technologies; robotic systems focusing on industrial handling and mobile robotics; modeling of robot kinematics and dynamics; robot synchronization and autonomy; optimization of robot's activity, localization and navigation; computer vision; space mapping and SLAM; Kalman filtration; statistical signal and image processing; intelligent tracking and guidance systems; remote-controlled control and autonomous multi-agent control of robotic systems (industrial, social, two-legged humanoids, health care, networking, etc.); selected topics of advanced mathematics.
The preferred thematic areas of the subject are, depending on the topic of the dissertation, more precisely specified in the doctoral student's study plan.

Recommended literature:

Specific recommended references depend on the selected range of topics according to the focus of the dissertation project.
Generally:
[1] Weisong Shi, Liangkai Liu: Computing Systems for Autonomous Driving. Springer, 2021
[2] Cyber-Physical, IoT, and Autonomous Systems in Industry 4.0. (Bali V. et al, Eds.), CRC Press, 2022
[3] Alain Cardon, Mhamed Itmi: New Autonomous Systems. Wiley, 2016
[4] Blockchain and Robotic Process Automation. (Koschmider A. and Schulte S., Eds.), Springer, 2021
[5] Sebbane Y.B.: A First Course in Aerial Robots and Drones. CRC Press, 2022
[6] Waldron K.J., Kinzel G. L., Agraval S.K.:Kinematoics, Dynamics, and Design. Wiley, 2016
[7] Wittenburg, J.: Kinematics. Theory and Applications. Springer, 2016
[8] SLAM Techniques Application for Mobile Robot in Rough Terrain. (Kudriashov A. et al, Eds.), Springer, 2020
[9] Digital Twin technology. (Chaudhary G. et al, Eds.), CRC Press, 2022
[10] Syeliski R.: Computer Vision. Algorithms and Applications. Second Edition, Springer, 2022

Instruction language: English

Notes:

Course evaluation:

Total number of evaluated students: 0

A	B	C	D	E	FX
0 %	0 %	0 %	0 %	0 %	0 %

Course teachers:

Seminars: doc. Ing. Jozef Hrbček, PhD.
Seminars: doc. Ing. Marián Hruboš, PhD.
Seminars: prof. Ing. Aleš Janota, PhD.
Seminars: doc. Ing. Peter Peniak, PhD.
Seminars: doc. Ing. Rastislav Pirník, PhD.
Seminars: prof. Ing. Karol Rástočný, PhD.
Seminars: doc. Ing. Vojtech Šimák, PhD.
Seminars: doc. Dr. Ing. Peter Vestenický

Seminars: doc. Ing. Juraj Ždánsky, PhD.
Last update: 2022-08-08 15:41:36.377
The person responsible for the course: doc. Ing. Rastislav Pirník, PhD.

Higher education institution: University of Žilina	
Faculty: Faculty of Electrical Engineering and Information Technology	
Course ID: 3D00E05	**Course name:** University pedagogy (UP)
Selectiveness: Compulsory; **Completion**: Examination	
Profile course: Yes ***Core course*****:** Yes	
Form, extent, and method of teaching activities:	
Number of classes per week in the form of lectures, laboratory exercises, seminars, or clinical practice	Lectures: 0.0 Practical classes 2.0 Lab exercises 0.0
Methods by which the educational activity is delivered	The present form of education
Methods for achieving learning outcomes	Teaching is carried out in blocks - in the total range of 20 hours: interactive lectures with discussion and problem interpretation; solving authentic problems, case studies; role-playing; cooperative/collaborative teaching; peer learning; skills training; workplace learning, providing feedback; activating strategies, methods, and techniques of higher education, self-evaluation
Number of credits: 2	
Study workload: 60 hours; 20h full-time + 20h preparation, implementation, and self-assessment of activating teaching of the assigned course + 20h self-study = 60 hours	
Recommended term of study: 1. year, winter semester	
Level of study: 3	
Required subsidiary courses: Prerequisites: Co-requisites:	
Course requirements: **Continuous assessment/evaluation:** **Final assessment/evaluation:** During the training at the seminars, doctoral students will solve authentic problems, case studies, and, in the role of students, they will gradually create their methodological portfolio of applications in the course they teach. They will independently design activating teaching. After consulting with the teacher, they implement it and then reflect on their pedagogical activities. Article 9 of UNIZA Directive no. 110, The Study Regulations for the third degree of university studies at the University of Žilina, specifies the final assessment by the mark. **The minimum score for registration for the exam is not specified.**	

Forms and methods of assessment	Predetermined weight %	Field of knowledge, skills, and competencies
methodological portfolio	20%	professional knowledge, peer learning, working with information, independent creative activity and decision-making
2 self-reflective sheets	10%	work with information, independence, reflection of own activity
activating teaching	70%	professional knowledge, creativity, self-reflection, presentation skills, competence: psycho-didactic, communicative, organizational, managerial and diagnostic

Education outcomes:

The doctoral student will explain the basic principles of effective planning, preparation, implementation, and evaluation of student-oriented higher education.
He/She actively trains the employment of students in simulated situations resulting from team university teaching.
In a group discussion, he/she makes suggestions, uses examples to illustrate and argue their specific use in teaching.
He/She creatively designs and, with the support of the teacher, implements activating teaching based on predetermined requirements.
He/She demonstrates the ability to apply the acquired knowledge, skills, and competencies in education.
He/She justifies the suitability of using individual activating strategies, teaching methods, and techniques concerning activating students in teaching.
During the self-reflection, he/she will describe his/her pedagogical activity in activating teaching and suggests further possibilities of improvement.

Course scheme:

Basic principles of effective planning, preparation, implementation, and evaluation of full-time and online teaching at the university. The personality of a university student, the personality of a doctoral student, and his/her pedagogical activity. Effective learning and motivation of university students. Learning objectives, choice of teaching methods, and evaluation of learning outcomes. Activating higher education strategies.

Recommended literature:

[1] Bajtoš, J. (2013). Didaktika vysokej školy. Bratislava: IURA EDITION.
[2] Mužík, J. Mužík, J. (2004). Androdidaktika. Praha: ASPI.
[3] Plamínek, J. (2014). Vzdělávání dospělých. Praha: Grada.
[4] Sirotová, M. (2014). Vysokoškolský učiteľ v edukačnom procese. Trnava: UCM FF.
[5] Slavík, M., et al. (2012). Vysokoškolská pedagogika. Praha: Grada.
[6] Turek, I. (2006). Základy didaktiky vysokej školy. Bratislava: STU.
[7] Vašašová, Z., et al. (2016). Psychológia učenia dospelých. Banská Bystrica: UMB.

Instruction language: English

Notes:

Course evaluation:

Total number of evaluated students: 0

A	B	C	D	E	FX
0 %	0 %	0 %	0 %	0 %	0 %

Course teachers:

Seminars: Mgr. Gabriela Chalupianská
Seminars: PaedDr. Lenka Môcová, PhD.
Seminars: Mgr. Jana Trabalíková, PhD.

Last update: 2022-08-08 15:41:36.377

The person responsible for the course: Mgr. Jana Trabalíková, PhD.

Higher education institution: University of Žilina

Faculty: Faculty of Electrical Engineering and Information Technology

Course ID: 3D0AE05	**Course name:** Written work for the dissertation exam and defence of the written work for the dissertation exam (DED)

Selectiveness: Compulsory; **Completion**: Examination

Profile course: Yes ***Core course*:** Yes

Form, extent, and method of teaching activities:

Number of classes per week in the form of lectures, laboratory exercises, seminars, or clinical practice	Lectures: 0.0 Practical classes 0.0 Lab exercises 0.0
Methods by which the educational activity is delivered	The present form of education

Methods for achieving learning outcomes	consultations, individual work with professional literature, observation, simulation, programming, modelling, preparation of experiments, self-study, formulation of conclusions

Number of credits: 2

Study workload: 300 hours;
100h (consultations + exam)
200 h (self-study)

Recommended term of study: 2. year, winter semester

Level of study: 3

Required subsidiary courses:
Prerequisites:
World language, Basics of research practice, Process control and automation, one of the compulsory-optional courses according to the focus of the dissertation
Co-requisites:

Course requirements:

Continuous assessment/evaluation:
During the semester, the student will elaborate a project of his/her dissertation, in which he/she will work on the state-of-art of literature and selected topics in connection with the focus of his/her dissertation. In doing so, he/she will follow the instructions of his/her supervisor. The student presents the results of his/her written project during the oral defense of the project in front of the examination board.

Final assessment/evaluation:
The courses is a state exam. The external evaluation of the written work for the dissertation examination and the defense of the written work for the dissertation examination will be performed by the state examination board, taking into account the opinion of the opponent of the written work for the dissertation examination. The examination board makes decision on the result of the examination in a closed session.
The final evaluation of the source is governed by the Art. 9 Directive no. 110 Study Regulations for the Third Degree of University Studies at the University of Žilina in Žilina.
The minimum score for registration for the exam is not specified.

Forms and methods of assessment	Predetermined weight %	Field of knowledge, skills, and competencies
External evaluation by the state examination board	100%	professional knowledge; creative problem solving; knowledge integration; formulation of own decisions; presentation skills; work with information; independence

Education outcomes:
The student can explain and present a deep systematic understanding of the field of study of cybernetics, corresponding to the 3rd study degree, in English, with a focus on process control. He/She can present the acquired skills and methods of scientific research associated with the field, and present the current state-of-art of knowledge in the field of cybernetics with a focus on the area related to the topic of the dissertation.
The postgraduate has extensive professional knowledge from several areas of the field, which serves as a basis for research and development and the creation of new knowledge in traditional fields such as methods of modeling and process control, design of robotic and mechatronic systems, new software, and communication systems for management of complex systems. The postgraduate has professional and methodological knowledge of an interdisciplinary nature, based on which he/she can profile himself/herself in the penetration areas of artificial intelligence, cognition, adaptation, communication, connectivity, biosystems, social systems, and the like.
Based on the developed skills, the student can educate himself/herself and continue further self-study.

Course scheme:
The content focus of the course is individually focused on the issues that the student will address in his/her dissertation. Obtaining data from information sources, introduction to theoretical and experimental elaboration of selected parts of the dissertation takes place throughout the first part of the study. The course is organized in the form of individual consultations aimed at solving work issues and ongoing control of work solutions. After the elaboration and submission of the written work for the dissertation examination, the opponent of the written work for the dissertation examination will prepare a review. During the state exam, the student will present his / her written work for the dissertation exam, respond to the opponent's comments

and the comments made by the members of the examination board during the discussion. The examination board will also specify the objectives of the dissertation to the student.

Recommended literature:
Literature recommended during the study of professional courses.

Instruction language: English

Notes:

Course evaluation:
Total number of evaluated students: 0

A	B	C	D	E	FX
0 %	0 %	0 %	0 %	0 %	0 %

Course teachers:

Last update: 2022-08-08 16:18:47.323

The person responsible for the course: prof. Ing. Aleš Janota, PhD.

Higher education institution: University of Žilina

Faculty: Faculty of Electrical Engineering and Information Technology

Course ID: 3D0AE05	**Course name:** Dissertation thesis and defence of the dissertation thesis (DTD)

Selectiveness: Compulsory; **Completion**: Examination

Profile course: Yes ***Core course*****:** Yes

Form, extent, and method of teaching activities:

Number of classes per week in the form of lectures, laboratory exercises, seminars, or clinical practice	Lectures: 0.0 Practical classes 0.0 Lab exercises 0.0
Methods by which the educational activity is delivered	The present form of education
Methods for achieving learning outcomes	consultations, independent work with professional literature, observation, simulation, programming, model creation, preparation of experiments, experimental independent and team work in the laboratory, processing and analysis of research data, problem solving, self-study, formulation of conclusions

Number of credits: 2

Study workload: 900 hours;
200h (consultations + exam) and 700 h (self-study)

Recommended term of study: 3. year, summer semester

Level of study: 3

Required subsidiary courses:
Prerequisites:
Written work for the dissertation exam and defence of the written work for the dissertation exam
Co-requisites:

Course requirements:

Continuous assessment/evaluation:

Final assessment/evaluation:
The course is a state exam. The external evaluation of the dissertation and its defense will be performed by the dissertation defense board, taking into account the reviews of the dissertation opponents. The examination board makes decision on the result of the examination in a closed session.
The final evaluation of the subject is governed by the Art. 15 Directive no. 110 Study Regulations for the Third Degree of University Studies at the University of Žilina in Žilina. 3
The minimum score for registration for the exam is not specified.

Forms and methods of assessment	Predetermined weight %	Field of knowledge, skills, and competencies

External evaluation by the state examination board	100%	professional knowledge; creative problem solving; knowledge integration; formulation of own decisions; presentation skills; work with information; independence

Education outcomes:

The student is able to explain and present a deep systematic understanding of the field of cybernetics, on the level of the 3rd study degree, in English, with a focus on the process control. He/She can present the skills and methods of scientific research associated with the field, and is familiar with the current state-of-art of knowledge in the field of cybernetics with a focus on the area related to the topic of the dissertation.

He/She has the expertise to use appropriate methods for modelling and process control, design of control of robotic and mechatronic systems, new software and communication systems used to control complex systems. He/She has professional and methodological knowledge of an interdisciplinary nature, on the basis of which he/she can profile himself/herself in the penetration areas of artificial intelligence, cognition, adaptation, communication, connectivity, biosystems, social systems and the like. He/She is able to solve research problems relevant to the field of cybernetics, masters and can choose specific scientific methods of basic and applied research in one of the areas of cybernetics, automation and mechatronics. He/She is capable of critical analysis, abstraction, evaluation and generalization of the issue and synthesis of new and complex concepts. He/She demonstrates the ability to design, construct, implement and modify a substantial part of research with scientific integrity. He/She applies and implements his/her own findings of the theoretical analysis and complex scientific research in solving problems. Through the original research, he/she contributes to broadening the boundaries of scientific knowledge and is able to interpret the results of his/her research at various levels. He/She will prove that at least some of his/her original scientific works are accepted for publication after review, and at least one of them in a scientific journal. He/She is characterized by independent, critical and analytical thinking, applicable in changing conditions. He/She can present his / her scientific research as a rigorous process of acquiring new scientific knowledge, i.e. expanding the boundaries of human knowledge, demonstrating how he/she himself/herself carried out a substantial part of the research, designed, constructed, implemented, optimized his/her solutions, all in an ethically clean way. He/She is able to communicate his/her field of expertise to colleagues, the wider scientific community and the general public, and to independently and professionally present the results of research and development at home and abroad. It takes into account social, scientific and ethical aspects when formulating research intentions and interpreting research results. He/She can determine the focus of research and coordinate the team in the relevant scientific field. In an academic and professional context, his/her ability to support technological, social or cultural progress in a knowledge-based society is expected.

Course scheme:

The content focus of the course is individually focused on the issues that the student addresses in his/her dissertation. Obtaining data from information sources, theoretical and experimental elaboration of individual parts of the work takes place throughout the study. The course is organized in the form of individual consultations focused on the solution of the dissertation and continuous supervision of the dissertation solution. After the elaboration and submission of the dissertation, the student's supervisor and the opponents of the dissertation will prepare their reports/reviews. During the state exam, the student will present his / her dissertation, respond to the comments of the supervisor and opponents of the dissertation and the comments made during the discussion over the dissertation.

Recommended literature:

Literature recommended during the study of professional courses.

Instruction language: English

Notes:

Course evaluation:

Total number of evaluated students: 0

A	B	C	D	E	FX
0 %	0 %	0 %	0 %	0 %	0 %

Course teachers:

Last update: 2022-08-08 16:18:47.323

The person responsible for the course: prof. Ing. Aleš Janota, PhD.