University of Žilina

Faculty of Electrical Engineering and Information Technology

GUIDE TO DOCTORAL DEGREE STUDY

STUDY PROGRAMME: **Electrotechnologies and Materials**
FIELD OF STUDY: **Electrical and Electronics Engineering**

CHAIRPERSON OF THE WORKING GROUP: **prof. Ing. Dušan Pudiš, Phd.**
GUARANTOR OF THE STUDY PROGRAMME: **prof. Ing. Dušan Pudiš, Phd.**

ŽILINA, 2022

1. DETAILS ON THE STUDY PROGRAMME

1.1 Characteristics of the Study Programme

Name of the study programme:	**Electrotechnologies and Materials**
Name of the field of study:	**Electrical and Electronics Engineering**
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

A graduate of doctoral studies in the field of study Electrotechnologies and Materials (Electrical Technologies and materials) knows scientific methods of evaluating material structures and systems from the point of view of technology processing, structure, service life, reliability, interoperation and output diagnostics and controls, research with the most modern types of materials, work in top-quality laboratories, as well as from the point of view of determining the basic physical properties of the substrate materials and final structures. The comprehensive knowledge obtained in this way will enable the graduate to use it in a wide range of production technologies in electronics and photonics, as in their design, as well as in the organization and optimization of individual technological procedures. The graduate will receive the ability to predict changes in the properties of materials in various conditions of use, as well as from the point of view of the use of various technological procedures to produce electrotechnical elements, structures, systems, and equipment.

The study program of the third degree of Electrotechnologies and Materials leads students to be able to master the scientific methods of evaluating material structures and systems from the point of view processing, structure, lifetime, reliability, interoperation and output technologies, diagnostics, and control, as well as from the point of view of determining basic physical properties substrate materials and final structures. The comprehensive knowledge obtain ed in this way will enable their use in a wide range of production technologies in electronics and photonics, as in their design, as well as in the organization and optimization of individual technological procedures. Materials are the basis of all devices and systems and their development and proper diagnostics modern research. In addition to the mentioned theoretical knowledge, a graduate of the third-degree university studies in the field of Electrotechnology and Materials will receive these supplementary knowledge, abilities, and skills:

He/she knows not only the principles but also the basic properties of materials for modern electronics, optics, photonics and the field of electrotechnology. He/she has deep knowledge of geometric optics, electronics and technologies and can apply them for photonic elements and systems on a chip and on an optical fiber. The graduate can design, modify, and diagnose laser devices and components for telecommunications, medicine, and measurement. It uses and improves the quality and design of fiber optic technology. He/she knows how to introduce new optical or photonic prototypes and devices in various fields of technology. He/she optimizes optical designs by performing design/analysis with extensive use of lighting tools and empirical data as needed. He/she has knowledge of electro-optical and sensory systems. He knows how to use a wide range of ultrasonic and dielectric methods and techniques, under the influence of electric, optical and magnetic fields, when investigating semiconductor structures, polymers, dielectric and insulating materials, ionic glasses or magnetic liquids. It can analyse the measured ultrasonic, dielectric-frequency and conductivity spectra of

electrotechnical materials depending on external parameters and fields. He/she can work with devices and materials used in basic and applied research according to the focus of the study program. The graduate has experience in the use of hi-tech laboratory equipment for surface and material analysis, such as an electron microscope, the technique of vaporization, sputtering of thin layers, and an atomic force microscope. He /she can formulate engineering-physical-technological problems and bring their solutions to practical realizations.

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: Physics, Mathematics, Fiber optics, Photonics, Solid state physics, Physical acoustics, Electrical technologies and materials, Technology, Physical engineering, and measurement technology.

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.

1.1.2 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
CmpE	Compulsory elective course I	10	2-0-0	SE
CmpE	Compulsory elective course II	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	Compulsory elective course I	10	2-0-0	FSE
Cmp	Foreign Language	10	2-0-0	SE
	Individual and Team Scientific Work	*		C
The second year				
CmpE	Compulsory elective course II	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	Solid State Physics	10	2-0-0	SE
CmpE	Physical Acoustics and Diagnostics	10	2-0-0	SE
CmpE	Laser Technologies	10	2-0-0	SE
CmpE	Materials and Material Structures	10	2-0-0	SE
CmpE	Methods of Material Analysis	10	2-0-0	SE
CmpE	Technologies in Electronics	10	2-0-0	SE
CmpE	Fiber Optics and Optical Sensors	10	2-0-0	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 Electrotechnologies and Materials of the study field Electrical and Electronics Engineering (hereinafter referred to as the field) of the doctoral study for providing and awarding the academic title „Philosophiae doctor" (abbreviation PhD.), the working group Electrotechnologies and Materials of the field committee Electrical and Electronics Engineering 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:

prof. Ing. Dušan Pudiš, PhD.,

prof. Mgr. Ivan Martinček, PhD.,

prof. RNDr. Jozef Kúdelčík, PhD.,

doc. Ing. Daniel Káčik, PhD.,

doc. Ing. Norbert Tarjányi, PhD.

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: 3D0E0E1	**Course name:** Basics of Research Practice (ZVP)
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, winter 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:

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: 3D0E012	**Course name:** Foreign Language (SvJ)
Selectiveness: Compulsory; **Completion**: Examination	
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 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:

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

The person responsible for the course: prof. Ing. Dušan Pudiš, PhD.

Higher education institution: University of Žilina	
Faculty: Faculty of Electrical Engineering and Information Technology	
Course ID: 3D0E012	**Course name:** Solid State Physics (SSP)
Selectiveness: Compulsory; **Completion**: Examination	
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 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	lectures with theoretical input, interactive lectures with discussion, lectures with multimedia support
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:

Students complete an individual project in which they approach and apply the assignment provided by teachers and their supervisors based on dissertation thesis objectives.

Final assessment/evaluation:

Project results will be presented during the oral examination in front of the committee.

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
implemented project	35	Professional knowledge, work with information, independence, presentation skills
portfolio	5	Professional knowledge, work with information
evaluation by the state examination committee	60	Professional knowledge

Education outcomes:

The student is able to explain the basic properties of crystals, describe their parameters and basic graphs and dependencies. The student will be able to use the acquired knowledge to defend the suitability of the use of individual materials and crystals in electrical engineering.

The student can use the knowledge of the basics of crystals in the description of the measured results and can predict the influence of the atomic structure of materials on their properties. The student will gain knowledge on the basis of which he can calculate the specific properties of crystals and correctly apply to his research area.

Based on the information obtained, he will be able to estimate and interpret experimental measurements of the determined properties of materials and form a research report over time.

The student is able to independently present the results of research activities.

Course scheme:

Crystallography, reciprocal grating, diffraction on crystals, Brillouin zone. Lattice oscillations, phonons. Energy band structure, free electron model, effective mass method. Fermi-Dirac distribution, Fermi level. Statistics of charge carriers in the conduction and valence band. Conductivity and valence band, effective mass of electrons and holes. Density of stocks. Ingredients in semiconductors, semiconductor type P N. Homostructure, heterostructure, quantum structures, quantum well, quantum wire, quantum point, phenomena in quantum structures. Charge transport by quantum structures.

Recommended literature:

1. CH.Kittel, Úvod do fyziky tuhých látok (SNTL/ALFA, 1985)
2. K.V.Šalimovová: Fyzika polovodičov (Alfa Bratislava, 1978)
3. J. Singh, Optoelectronics, An Introduction to Materials and Devices (The McGraw-Hill Companies, Inc., 1996)
4. A. Korkin, F. Rosei, Nanoelectronics and Photonics, From Atoms to Materials, Devices, and Architectures (Springer, 2008)
5. G.T. Reed, A. P. Knights, Silicon Photonics, An Introduction (John Wiley & Sons, Ltd. 2004)

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. RNDr. Jozef Kúdelčík, PhD.

Lectures - prof. Ing. Dušan Pudiš, PhD.

Last update: 2022-04-13 08:30:23.027

The person responsible for the course: prof. Ing. Dušan Pudiš, PhD.

Higher education institution: University of Žilina	
Faculty: Faculty of Electrical Engineering and Information Technology	
Course ID: 3D0E012	**Course name:** Physical Acoustics and Diagnostics (PAD)
Selectiveness: Compulsory; **Completion**: Examination	
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 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	lectures with theoretical input, interactive lectures with discussion, lectures with multimedia support
Number of credits: 10	
Study workload: 300 hours; 2h*13+0h*13+0h*13 (on-site education) + 100h (self-study) + 174h (project based learning) = 300 hours	
Recommended term of study: 1. year, summer semester	
Level of study: 3	
Required subsidiary courses: Prerequisites: Co-requisites:	

Course requirements:

Continuous assessment/evaluation:

Students complete an individual project in which they approach and apply the assignment provided by teachers and their supervisors based on dissertation thesis objectives.

Final assessment/evaluation:

Project results will be presented during the oral examination in front of the committee.

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
implemented project	35	Professional knowledge, work with information, independence, presentation skills
portfolio	5	Professional knowledge, work with information
evaluation by the state examination committee	60	Professional knowledge

Education outcomes:

The student understands the basic principles of diagnostics and applies them to acoustic diagnostics in engineering and physics.

Students are able to interpret the solution of the wave equation for acoustic waves in different environments. Calculates the basic characteristics of different types of waves in a given environment.

Identify the physical principles of generating and detecting acoustic waves.

Study the interactions of acoustic waves with the material environment and apply acoustic methods to investigate the properties of materials and structures.

Using MATLAB and ANSYS programs, the student will be able to analyze: sound propagation in space and damped acoustic systems, analysis of the interaction between fluid and solid structure.

A student prepares a scientific report on a specific topic.

Student is able to develop a solution proposal for environmental diagnostics using acoustics and plan the necessary equipment.

Course scheme:

Defining the scope of physical acoustics. Equations for acoustic waves in different environments. Methods for solving the wave equation. Attenuation and propagation speed of acoustic waves. Basic characteristics of longitudinal, transverse and surface acoustic waves. Basic mechanisms of acoustic wave interaction with solids. Plane waves in crystals (wave equation, anisotropy, piezoactivity). Acoustic waves in semiconductors. Interaction of acoustic waves with deep centers. Methods of acoustic transit spectroscopy. Principles of generation and detection of acoustic waves. Methods of measuring the speed and absorption coefficient of acoustic waves. Basics of acoustic (ultrasonic) diagnostics of the environment and objects (ultrasonic flaw detection, hydrolocation, sonography). Basic principles of acoustic imaging (acoustic microscopy, holography, radiation acoustics, acoustoelectronics).

Recommended literature:

1. A.D. Pierce: Acoustics. An Introduction to Its Physical Principles and Applications, Spinger 1981
2. C. Q. Howard, B. S. Cazzolato: Acoustic Analyses Using MATLAB® and ANSYS®, CRC Press 2015, ISBN: 978-1-4822-2327-9
3. W. P. Mason: Physical Acoustics, Vol. I-XI (vybrané časti)
4. J. L. Davis: Wave Propagation in Solids and Fluids, Springer 1988
5. D. Royer, E. Dieulesaint: Elastic Waves in Solids, I, II, Spinger 2000
6. J. Merhaut a kol.: Základy moderní akustiky, SNTL Praha 1986
7. R. Bálek, M. Košek, O. Tarba, J. Zelenka: Povrchové akustické vlny, ACADEMIA, Praha 1986
8. P. Bury, I. Jamnický: Akustická spektroskopia hlbokých centier v polovodičoch, EDIS 1999

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. RNDr. Jozef Kúdelčík, PhD.

Lectures - prof. RNDr. Peter Bury, CSc.

Last update: 2022-04-13 08:30:23.027

The person responsible for the course: prof. Ing. Dušan Pudiš, PhD.

Higher education institution: University of Žilina	
Faculty: Faculty of Electrical Engineering and Information Technology	
Course ID: 3D0E012	**Course name:** Technologies (LT)
Selectiveness: Compulsory; **Completion**: Examination	
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 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	lectures with theoretical input, interactive lectures with discussion, lectures with multimedia support
Number of credits: 10	
Study workload: 300 hours; 2h*13+0h*13+0h*13 (on-site education) + 100h (self-study) + 174h (project based learning) = 300 hours	
Recommended term of study: 1. year, summer semester	
Level of study: 3	
Required subsidiary courses: Prerequisites: Co-requisites:	

Course requirements:

Continuous assessment/evaluation:

Students complete an individual project in which they approach and apply the assignment provided by teachers and their supervisors based on dissertation thesis objectives.

Final assessment/evaluation:

Project results will be presented during the oral examination in front of the committee.

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
implemented project	35	Professional knowledge, work with information, independence, presentation skills
portfolio	5	Professional knowledge, work with information
evaluation by the state examination committee	60	Professional knowledge

Education outcomes:

The student is able to explain the principles of laser operation from basic to complex types. Can describe their parameters and properties in terms of field shape, spectrum, etc. The student will be able to use the acquired knowledge to defend the suitability of the use of individual lassographic equipment for various technologies and their interaction with materials.

The student applies knowledge of lasers for technological processes in electrical engineering as well as other fields. The student is able to predict the interaction of the laser with the material and to design the right lasers for the given material and technology.

Based on the information obtained, he will be able to estimate and interpret the use of laser technology for the quality of materials processing.

The student is able to independently present the results of research activities.

Course scheme:

Theoretical principle of laser operation and properties of laser radiation. Basic types of technological lasers. Interaction of laser radiation with the environment. Laser technological processes. Laser technologies in optoelectronics (optical data writing and reading, laser printing). Laser technologies in industry (industrial laser marking, welding, cutting, engraving, surface heat treatment, etc.). Laser measuring methods and instruments. Laser holography and interferometry.

Recommended literature:

1. M. Vrbová, H. Jelínková, P. Gavrilov: Úvod do laserové techniky, ČVUT, Praha 1998
2. M. von Almen: Laser Beam Interactions with Materials. Springer-Verlag, Berlin 1995
3. E. Webb, J.D.C. Jones: Handbook of Laser Technology and Applications (Three- Volume Set), Taylor & Francis, 2003
4. Literature from portal http://www.sciencedirect.com

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. Dušan Pudiš, PhD.
Lectures - doc. Ing. Ľuboš Šušlik, PhD.
Lectures - doc. Ing. Norbert Tarjányi, PhD.

Last update: 2022-04-13 08:30:23.027

The person responsible for the course: prof. Ing. Dušan Pudiš, PhD.

Higher education institution: University of Žilina	
Faculty: Faculty of Electrical Engineering and Information Technology	
Course ID: 3D0E012	**Course name:** Materials and Material Structures (MMS)
Selectiveness: Compulsory; **Completion**: Examination	
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 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	lectures with theoretical input, interactive lectures with discussion, lectures with multimedia support
Number of credits: 10	
Study workload: 300 hours; 2h*13+0h*13+0h*13 (on-site education) + 100h (self-study) + 174h (project based learning) = 300 hours;	
Recommended term of study: 1. year, summer semester	
Level of study: 3	
Required subsidiary courses: Prerequisites: Co-requisites:	

Course requirements:

Continuous assessment/evaluation:

Final assessment/evaluation:

Students complete an individual project in which they approach and apply the assignment provided by teachers and their supervisors based on dissertation thesis objectives.

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
implemented project	25	Professional knowledge, work with information, independence, presentation skills
portfolio	5	Professional knowledge, work with information
evaluation by the state examination committee	70	Professional knowledge

Education outcomes:

Students can explain basic material properties; describe their parameters, dimensions, and material structures. Students will be able to defend the suitability of the application of individual materials and structures in electrical engineering.

Students apply knowledge covering material basics in the description of measured results and they can predict impacts of material structure on their properties. Students obtain knowledge in order to calculate specific material properties and implement them into their research area.

Based on the obtained information, students will be able to assess and interpret experimental measurements of prescribed material properties and create the research report within the team.

Students can present the outcomes of their own research projects.

Course scheme:

Atoms, molecules, and chemical bonds characteristics. Structure and arrangement of atoms in materials. Crystalline and non-crystalline structures. Structure and internal interactions in polymers. Micro and macro

composites. Mechanical and thermal properties of materials. Band theory of material conductivity. Insulators and dielectrics. Dielectric polarization and electrical conductivity. Electrical strength of materials. Semi-conductors and their electronic structure. Basic structures in semi-conductors. Charge transport and optical transitions of semi-conductors. Conductors and superconductors. Magnetic materials and their characteristics. Hard and soft magnetic materials. Materials in sensors.

Recommended literature:

1. CH.Kittel, Úvod do fyziky tuhých látok (SNTL/ALFA, 1985)
2. Drápala, J., Kursa, M.: Elektrotechnické materiály, VŠB – Technická univerzita Ostrava, 2012, ISBN 978-80-248-2570-0.
3. W.D. Callister, D.G. Rethwisch: Materials Science and Engineering An Introduction, John Wiley&Sons 2009.
4. R.W. Kelsall, W. Hamley, M. Geoghegan: Nanoscale Science and Technology (John Wiley&Sons, Chichester, 2005)
5. S. R. Elliott: The physics and chemistry of solids, (John Wiley&Sons, Chichester, 1998)
6. J. Singh, Optoelectronics, An Introduction to Materials and Devices (The McGraw-Hill Companies, Inc., 1996)

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. RNDr. Jozef Kúdelčík, PhD.

Last update: 2022-04-13 08:30:23.027

The person responsible for the course: prof. Ing. Dušan Pudiš, PhD.

Higher education institution: University of Žilina	
Faculty: Faculty of Electrical Engineering and Information Technology	
Course ID: 3D0E012	**Course name:** Methods of Material Analysis (MMA)
Selectiveness: Compulsory; **Completion**: Examination	
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 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	lectures with theoretical input, interactive lectures with discussion, lectures with multimedia support
Number of credits: 10	
Study workload: 300 hours; 2h*13+0h*13+0h*13 (on-site education) + 100h (self-study) + 174h (project based learning) = 300 hours;	
Recommended term of study: 1. year, summer semester	
Level of study: 3	
Required subsidiary courses: Prerequisites: Co-requisites:	

Course requirements:

Continuous assessment/evaluation:

Students complete an individual project in which they approach and apply the assignment provided by teachers and their supervisors based on dissertation thesis objectives.

Final assessment/evaluation:

Project results will be presented during the oral examination in front of the committee.

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
implemented project	35	Professional knowledge, work with information, independence, presentation skills
portfolio	5	Professional knowledge, work with information
evaluation by the state examination committee	60	Professional knowledge

Education outcomes:

The student is able to explain the basic properties and distribution of diganostic methods of materials, can describe their parameters and possibilities. The student will be able to use the acquired knowledge to defend the suitability of the use of individual analytical methods and tools for elemental analysis of structures as well as surface analysis of structures in electrical engineering.

The student applies the knowledge of diagnostic methods for their use for specific materials and surfaces and can predict the capabilities of the method with an estimate of the required output. Based on the information obtained, he will be able to estimate and interpret experimental measurements of given methods for specific types of materials used in electrical engineering and photonics and form a research report in the team.

The student is able to independently present the results of research activities.

Course scheme:

Division of materials analysis methods according to the principle of activities and used signals. Methods using X-rays - structural X-ray analysis, XPS, mass spectroscopy. Electron beam methods - SEM and TEM. Atomic

force spectroscopy method - AFM. Methods using magnetic properties of atoms - EPR, APR and NMR. Methods using electrical properties of materials - conductivity and dielectric spectroscopy, DLTS. Methods using acoustic waves - acoustic spectroscopy. Methods of optical diagnostics.

Recommended literature:

1. CH.Kittel, Úvod do fyziky tuhých látok (SNTL/ALFA, 1985)
2. Drápala, J., Kursa, M.: Elektrotechnické materiály, VŠB – Technická univerzita Ostrava, 2012, ISBN 978-80-248-2570-0.
3. W.D. Callister, D.G. Rethwisch: Materials Science and Engineering an Introduction, John Wiley&Sons 2009.
4. R.W. Kelsall, W. Hamley, M. Geoghegan: Nanoscale Science and Technology (John Wiley&Sons, Chichester, 2005)
5. S. R. Elliott: The physics and chemistry of solids, (John Wiley&Sons, Chichester, 1998)
6. J. Singh, Optoelectronics, An Introduction to AMaterials and Devices (The McGraw-Hill Companies, Inc., 1996)

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. RNDr. Jozef Kúdelčík, PhD.

Lectures - prof. Ing. Dušan Pudiš, PhD.

Last update: 2022-04-13 08:30:23.027

The person responsible for the course: prof. Ing. Dušan Pudiš, PhD.

Higher education institution: University of Žilina	
Faculty: Faculty of Electrical Engineering and Information Technology	
Course ID: 3D0E012	**Course name:** Technologies in Electronics (TE)
Selectiveness: Compulsory; **Completion**: Examination	
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 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	lectures with theoretical input, interactive lectures with discussion, lectures with multimedia support
Number of credits: 10	
Study workload: 300 hours; 2h*13+0h*13+0h*13 (on-site education) + 100h (self-study) + 174h (project based learning) = 300 hours;	
Recommended term of study: 1. year, summer semester	
Level of study: 3	
Required subsidiary courses: Prerequisites: Co-requisites:	

Course requirements:

Continuous assessment/evaluation:

Students complete an individual project in which they approach and apply the assignment provided by teachers and their supervisors based on dissertation thesis objectives.

Final assessment/evaluation:

Project results will be presented during the oral examination in front of the committee.

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
implemented project	35	Professional knowledge, work with information, independence, presentation skills
portfolio	5	Professional knowledge, work with information
evaluation by the state examination committee	60	Professional knowledge

Education outcomes:

The student is able to explain the basic properties of optical and electrical properties of semiconductor and dielectric materials for electrical engineering. The student will be able to use the acquired knowledge to defend the suitability of the use of organic materials and structures in electrical engineering as well as polymers and liquid crystals.

The student applies knowledge of the basics of growth and production technologies of optoelectronic materials and can predict the impact of technology on the properties of materials, surfaces and layers. The student will gain knowledge on the basis of which he can calculate the specific properties of materials achieved by given technologies and correctly apply to his research area.

Based on the information obtained, he will be able to estimate and interpret the determined properties of materials prepared by given technologies and will create a research report in the team.

The student is able to independently present the results of research activities.

Course scheme:

Optical and electrical properties of semiconductor and dielectric materials for electrical engineering. Materials for organic optoelectronics. Polymers and liquid crystals. Photoluminescence and electroluminescence. Growth and technology of optoelectronic materials production. Vacuum and plasma technologies, photochemical deposition. Epitaxial growth, interface and transition manufacturing technologies. Quantum structures in optoelectronics. Forbidden bandwidth engineering. Post-deposition technologies (photolithography, contacting, annealing). Integrated optoelectronics technology.

Recommended literature:

1. P. Bhattacharya: Semiconductor Optoelectronic Devices, (Prentice Hall Englewood Cliffs, N.J, 1994)
2. S.D. Smith: Optoelectronic Devices, (Prentice Hall Europe, 1995)
3. S. O. Kasap, P. Capper: Springer Handbook of Electronic and Photonic Materials. (Springer-Verlag, New York 2006)
4. A. Moliton: Optoelectronics of Molecules and Polymers. (Springer Series in Optical Sciences, Vol. 104, 2006, XXXII)

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. RNDr. Jozef Kúdelčík, PhD.
Lectures - prof. Ing. Dušan Pudiš, PhD.

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The person responsible for the course: prof. Ing. Dušan Pudiš, PhD.

Higher education institution: University of Žilina	
Faculty: Faculty of Electrical Engineering and Information Technology	
Course ID: 3D0E012	**Course name:** Fiber Optics and Optical Sensors (FOOS)
Selectiveness: Compulsory; **Completion**: Examination	
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 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	lectures with theoretical input, interactive lectures with discussion, lectures with multimedia support
Number of credits: 10	
Study workload: 300 hours; 2h*13+0h*13+0h*13 (on-site education) + 100h (self-study) + 174h (project based learning) = 300 hours;	
Recommended term of study: 1. year, summer semester	
Level of study: 3	
Required subsidiary courses: Prerequisites: Co-requisites:	

Course requirements:

Continuous assessment/evaluation:

Final assessment/evaluation:

Students complete an individual project in which they approach and apply the assignment provided by teachers and their supervisors based on dissertation thesis objectives.

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
implemented project	35	Professional knowledge, work with information, independence, presentation skills
portfolio	5	Professional knowledge, work with information
evaluation by the state examination committee	60	Professional knowledge

Education outcomes:

The student is able to explain the propagation of electromagnetic radiation through dielectric waveguides and different types of optical fibers. The student will be able to use the acquired knowledge to defend the suitability of the use of the fibers for various transmission and experimental uses.

The student will use the knowledge of the basics of optical fibers in the description of the measured results and can predict the effect of radiation on the propagation in the fibers. The student will gain knowledge on the basis of which he can determine the specific properties of fibers and output electromagnetic radiation.

On the basis of the obtained information, he will be able to define materials and technologies of optical fibers, material, structural and transmission characteristics of quartz, polymer, optofluid, polarization, microstructural production, capillary and Bragg fibers, narrowed optical fibers and optical fiber spikes.

The student is able to independently present the results of research activities.

Course scheme:

Wave equation of dielectric waveguide and its solution for different types of optical fibers. Losses in optical fibers and their measurement, dispersion properties of optical fibers and their measurement, limit wavelength of optical fibers and its measurement, diameter of mode of optical fibers and its measurement, materials and production technologies of optical fibers, material, structural and transmission characteristics of quartz, polymer, optofluid, polarizing, microstructural, capillary and Bragg fibers, narrowed optical fibers and optical fiber spikes.

Recommended literature:

1. A.W.Snyder, J.D.Love: Optical waveguide theory (Chapman and Hall, 1983)
2. M.Dado, I.Turek, J.Štelina a kol.: Kapitoly z optiky pre technikov, (EDIS -Žilinská univerzita, Žilina, 1998)
3. I. Martinček, D. Pudiš: Optické vlákna pre špeciálne aplikácie (EDIS -Žilinská univerzita, Žilina, skriptá na CD, 2013)
4. I. Martinček, I. Turek, D. Káčik, D. Pudiš: Netradičné metódy vyšetrovania optických vlákien a polovodičových laserových diód, (EDIS-Žilinská univerzita, Žilina, monografia na CD, 2006)
5. C.-L. Chen: Elements of optoelectronics and fiber optics (IRWIN, 1996)
6. A. Méndez, T. F. Morse: Specialty optical fibers handbook (Academic Press, 2007)

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. Daniel Káčik, PhD.

Lectures - prof. Mgr. Ivan Martinček, PhD.

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The person responsible for the course: prof. Ing. Dušan Pudiš, PhD.