

UNIVERSITY OF PARDUBICE	
Directive No. 9/2022	
Subject:	Admission rules to the 1 st year of doctoral study programme P0788D060002 Electrical Engineering and Informatics for the academic year of 2023/2024
Scope of authority:	Faculty of Electrical Engineering and Informatics and doctoral programme applicants
In effect from:	Date of issue
Elaborated and submitted by:	doc. Ing. Frantisek Dusek, CSc., Vice-Dean for Study Affairs
Approved by:	Ing. Zdenek Nemec, PhD., Dean

Dean of the Faculty of Electrical Engineering and Informatics of the University of Pardubice invites applicants for the entrance exam for the first year of Doctoral Programme for the academic year of 2023/2024 in accordance with the Article No. 48, 49, Act No. 111/1998 Coll. on higher education institutions and on the amendment and supplement to some other acts and sections 6, 7, 9 and 10 on the statuses of the University of Pardubice:

P0788D060002 Electrical Engineering and Informatics

**Article 1
Application for studies**

- (1) Applications for study may be submitted electronically at <http://eprihlaska.upce.cz> or on a standard form (SEVT form) to the University of Pardubice, Faculty of Electrical Engineering and Informatics, Studentská 95, 532 10 Pardubice.
- (2) The deadline for submitting applications for the academic year 2023/24, including payment of the administrative fee, is **15 May 2023**.
- 3) A copy of the proof of payment of the fee must be attached to the application on form SEVT. An application on Form SEVT without the enclosed proof of payment will be returned for completion. If the applicant fails to submit the document by the deadline, he/she has not fulfilled the admission requirement and the admission procedure will be terminated by resolution.
- (4) It is not necessary to send a copy of the electronic application form (hereinafter referred to as the "e-application") by post, and it is not necessary to prove payment of the admissions fee (hereinafter referred to as the "fee") by using the correct payment symbols generated at the end of the e-application.
- (5) In addition to the programme of study and the form of study, the application form must list the topic of the dissertation and the name of the supervisor. The list of topics is attached to this Directive.
- (6) Applicants for the PhD study programme P0788D060002 Electrical Engineering and Informatics are obliged to send to the Science and Research Department of the Faculty of Electrical Engineering and Informatics of the University of Pardubice the annexes to the application form in paper form, i.e. a structured CV in English, proof of the level of knowledge of the English language, officially certified proof of a previous master's degree and a copy of the passport (in the case of a foreign national applicant).

(7) Address for sending the application form and mandatory attachments:

University of Pardubice
Faculty of Electrical Engineering and Computer Science
Department for Science and Research
Studentská 95
532 10 Pardubice

(8) If the application for studies does not have the prescribed requirements or suffers from other defects, the applicant will be asked to remove them. If the applicant fails to remedy the defects within the time limit set, he/she will not meet the conditions for the opening of the admission procedure and the procedure will be terminated by resolution.

(9) On the basis of the registered application form, applicants will be invited in writing or electronically to take an entrance examination.

(10) A medical certificate is not required.

Article 2 **Administrative fees**

(1) Administrative fees for the procedure of admission in study programme in English P0788D060002 are:

Application fee: CZK 2000

University Account Name: Univerzita Pardubice

Account number: 37030561/0100

Variable symbol: 6921

Specific symbol: personal university number (generated by e-application)

Banks Name: Komerční banka Pardubice

Bank Address: nám. Republiky 222, 530 78 Pardubice

IBAN: CZ290100000000003703061

SWIFT: KOMBCZPPXX

(2) The fee for the admission procedure is non-refundable.

(3) Fee for the assessment of education in the admissions procedure in accordance with the Directive No. 11/2019 Rules for the assessment of foreign secondary and higher education within the admission procedure at the University of Pardubice:

Recognition fee: CZK 600

University Account Name: Univerzita Pardubice

Account number: 37030561/0100

Variable symbol: 6929

Specific symbol: personal university number (generated by e-application)

Banks Name: Komerční banka Pardubice

Bank Address: nám. Republiky 222, 530 78 Pardubice

IBAN: CZ290100000000003703061

SWIFT: KOMBCZPPXX

(4) The fee for the admission procedure is non-refundable.

Article 3

Conditions for admission to study

1) A candidate who successfully completes the study of a follow-up master's degree programme and successfully passes the entrance examination may be admitted to study. If the applicant does not have a certified copy of the diploma by the date of the entrance examination, he/she shall provide a confirmation of the date of the state final examination. The certified copy of the diploma shall be presented immediately after receipt of the diploma, at the latest at the time of enrolment.

2) Applicants for study at the university who have obtained their previous education elsewhere than in the Czech Republic or Slovak Republic are admitted to study in the Czech language under the same conditions as other applicants, provided that

a) their education has been recognised as the education required by law for admission to a doctoral programme

(b) they have complied with the conditions of the admission procedure laid down for other applicants

Applicants' higher education may be recognised for the purposes of the admission procedure in accordance with the Directive No. 11/2019 - Rules for the Assessment of Foreign Higher Education in the Admission Procedure at the University of Pardubice.

(3) Applicants for study at the University with citizenship other than that of the Czech Republic and the Slovak Republic shall be admitted to study in the Czech language under the same conditions as other applicants, provided that

(a) they have demonstrated, no later than on the date of enrolment, linguistic competence for study in a study programme in the Czech language

(b) they have complied with the conditions of the admission procedure laid down for other applicants.

Article 4

Admission procedure

(1) The regular date of the entrance examination is **22 June 2023**.

(2) A condition for admission to study in a doctoral study programme is proper completion of studies in a master's study programme and successful completion of the admission procedure, which includes:

-an oral examination in English,

-an oral professional examination according to the focus of the doctoral study programme.

The English language entrance exam assumes an entry level of B1+ SERR (formerly Intermediate). The exam will take the form of a motivational interview. The candidate will demonstrate the ability to communicate with some degree of independence in oral interaction in a personal and educational areas of language use, using relevant linguistic resources and structures. In terms of topics, the interview will focus primarily on previous study or work experience and motivation for further study and research in the chosen field in the doctoral programme. During the interview, the candidate will also be able to briefly inform about the chosen topic and the aims of his/her dissertation.

The professional examination requires professional knowledge at the level of a completed master's degree programme with a focus on the topic of the doctoral dissertation and the presentation of a thesis on the expected dissertation topic.

(3) In the case of foreign applicants, the Admissions Committee may determine the form and conditions of the entrance examination which do not require the personal presence of the applicant.

(4) If more than one applicant applies for the same doctoral dissertation topic, the committee shall determine the order of the applicants according to the result of the admission procedure. If the next applicants in order successfully pass the entrance examination, the committee shall offer them the unfilled topics or diversify the topic in agreement with the supervisor. In the event that no agreement is reached on the dissertation topic, the candidates will be selected in order of preference.

(5) Absence from the admission procedure will be the subject of a further hearing only if the applicant duly apologises and the faculty announces an alternative date for the admission procedure.

(6) In the event of a change in the form of study within the doctoral study programme Electrical Engineering and Informatics, the candidate will be admitted to the study outside the regular admission procedure and will have the examinations recognised in accordance with the Directive No. 8/2017 of the FEI UPa Rules for Recognition of Completed Courses.

Article 5

Method of deciding on admission

(1) A maximum of 5 applicants will be admitted to study in the order determined during the admission procedure.

(2) The admission decision will be issued within 30 days of the admission examination in accordance with the provisions of Section 50(4) of the Higher Education Act.

(3) The results of the admission procedure will be published on the publicly accessible www server of the University of Pardubice at <https://www.upce.cz/studium/pro-uchazece/prijimacky.html>. The publication of the results will respect the principles of personal data protection.

(4) The faculty delivers the decision to applicants for study itself or through a postal service provider. If the decision grants the applicant's application for admission to study, the decision may be delivered to the applicant via the University's electronic information system if the applicant has agreed to this method of delivery in advance in his/her application; in such a case, the date of delivery and notification of the decision shall be the first day following the date on which the decision is made available to the applicant in the University's electronic information system.

In Pardubice, 12. 12. 2022

Ing. Zdenek Nemecek, PhD., m. p.
Dean

Doctoral Thesis Topics 2023/2024

1.

Supervisor: prof. Ing. Simeon Karamazov, Dr. *Simeon.Karamazov@upce.cz*

Supervisor – specialist: prof. Ing. Pavel Bezoušek, CSc.

Signals and filters optimization in MIMO radars with adaptive pulse compression

The aim of the thesis is optimization of signal modulation and separation filters in MIMO radars with adaptability to various range profiles of radar clutter. A range of optimization methods will be tested and adapted like cyclic approximation methods CAP, CAN, WeCAN, CAD, CMA, majorization-minimization methods (MMM), signal/filter alternation method SWAP, or gradient algorithm LBFGS. Maximum ISL and PSL suppression of clutter coming from range side-lobes while maintaining low peak-to-average-power ratio (PAR) and signal to noise ratio (SNR) loss will be applied as the method quality measures. Minimization of the computation complexity at the design of pulse compression filters will be also one of the dissertation goals. The designed algorithms will be verified in Matlab using a model of the received signal including noise and clutter.

2.

Supervisor: doc. Ing. Jan Mareš, Ph.D. *Jan.Mares@upce.cz*

Supervisor - specialist: Mohsen Shayestegan Ph.D.

Modern machine learning methods in biomedical data analysis

The aim of the dissertation is the design and implementation of a complex system for the analysis of biomedical data. Data for analysis will be provided/measured at the University Hospital of Královské Vinohrady Prague and the Hospital of the Pardubice Region. The system will (i) serve as an auxiliary tool for the specialist (MD) in the objective assessment of the patient's current condition, (ii) enable the analysis of one- and multi-dimensional data (mainly ECG, heart rate, movement data, possibly CT and NMR). The methodology used for the analysis will be based on classical statistical methods (OLR, RF, etc.) and will also use deep learning methods.

3.

Supervisor: doc. Mgr. Jiří Tuček, Ph.D. *Jiri.Tucek@upce.cz*

Supervisor - specialist: Mgr. Jaroslav Marek, Ph.D.

Image Analysis of Size and Morphology of Nanoparticle Systems

Nanosystems exhibit physicochemical properties diametrically opposed to their counterparts in the macroworld. These properties are known to be governed by both finite particle size and surface phenomena. It turns out that every physical process is controlled by a certain critical length; if the dimension of an object in one dimension is smaller than this critical length (usually below 100 nm), new material properties can be expected. It is therefore important to accurately describe the size and shape of such nanosystems. In particular, parameterization is crucial for the analysis of nanoparticles from electron microscope images. This is associated with several fundamental challenges. Finding the boundaries of the nanoparticles and describing them using appropriate curves or surfaces is necessary. Image processing methods are available to address this task. A nanoparticle can be approximated by an ellipsoid and its boundaries in an image can therefore be described by an ellipse. Methods based on orthogonal least squares or evolutionary algorithms have been proposed to approximate the data by conics. After studying the relevant methods, it is expected to design an algorithm that allows the determination of the number of nanoparticles. The most important goal is then to estimate

the unknown distribution functions of the nanoparticle dimensions and the distribution functions of their rotations. The proposed models will be tested in a programmed application. The involvement of various statistical methods is foreseen. The proposed algorithm and its modifications will also be used to analyse real electron microscope images of nanoparticle systems. One of the outputs is expected to be a software application with some degree of autonomy in describing the shape of individual nanoparticles and determining their sizes with distribution functions.

4.

Supervisor: doc. Mgr. Pavel Tuček, Ph.D. *Pavel.Tucek@upce.cz*

Supervisor - specialist: Mgr. Jaroslav Marek, Ph.D.

Statistical Acceptance Plan and Its Connection to Process Regulation

Statistical acceptance plans are used to decide whether the deliveries of certain products from the supplier meet the requirements of the customer, who is interested in the quality of the delivery or the proportion of defective products in the delivery. This can also be freely used in the case where the role of customer and supplier is represented by individual downstream production processes. In each acceptance, acceptance quality control is carried out, which is divided into 100 % and selective according to the scope. The work will therefore be devoted to such methods of monitoring the quality of processes and ensuring the required characteristics of product quality and verifying their eligibility. First of all, the author will carry out a thorough research of the current methods used in the field of statistical quality acceptance with an emphasis on the methods of multiple selections. Furthermore, the author will propose new approaches for calculating the price aspects of the acquisition plan. After studying and designing new methods, it is expected that the author will create an application that will enable statistical control of the process, calculation of capability indices, calculation of Hotelling statistics for several characters, and construction of a loss function following the performed statistical acceptance. In particular, the application will measure the total cost of quality. Depending on the chosen application, a feedback system will also be designed to transmit detected errors in process parameters that could lead to correction.

5.

Supervisor: doc. Mgr. Pavel Tuček, Ph.D. *Pavel.Tucek@upce.cz*

Supervisor - specialist: doc. Mgr. Jiří Tuček, Ph.D.

Modeling of Diffraction Optical Systems

Diffraction, or bending, is a phenomenon in which the wave behind an obstacle bends away from its original direction and enters the geometric shadow region of the obstacle. This process can be observed in all types of waves. However, the subject of study in this dissertation will be mainly diffraction in light and its use for lighting design. In the research part, the author will make a thorough review of diffraction theory and its application for lighting engineering, review the current state of the art of sw solutions for modelling light diffraction (Z-MAX, ANSYS, etc.). The aim is to propose a methodology for the automated design of an optical system consisting of a light source (LED), optical components with diffractive elements and a projection plane, whose parameters meet the requirements for real applications. It is important to find the optimal parameters of the system and to simulate the diffraction phenomena.