

# UNIVERSITY OF PANNONIA



## DOCTORAL SCHOOL OF CHEMISTRY AND ENVIRONMENTAL SCIENCES

### TRAINING PROGRAMME

Responsible for maintaining the document: Faculty of Engineering, Head of DSCES

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### The aim of the training

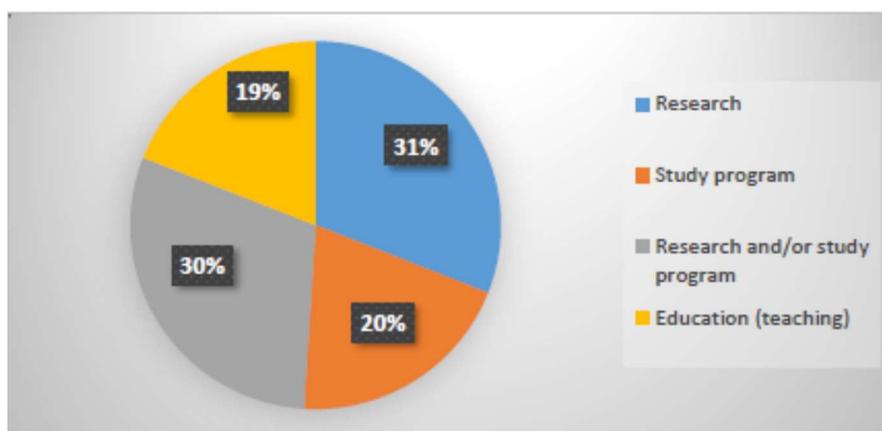
In the Doctoral School of Chemistry and Environmental Sciences (hereinafter referred to as DSCES), doctoral training is the training of a professional who is able to perform creative work based on independent thinking in the key fields of chemistry and environmental science in the requirements of the market economy. The aim of the training is to establish a doctoral degree.

### Main features of the training

The doctoral training is a regular study, research and reporting activity, including the fulfilment of the obligations laid down in the University's Doctoral Code. In the doctoral training of DSCES, the award of doctoral degrees is conditional on the completion of 6 semesters of study obligations for those starting their studies before 1 September 2016, and **8 semesters for those entering after 1 September 2016.**

### Structure of the program

Doctoral courses are divided into three main parts: academic, research and educational activities.



**Figure 1.** The ratio of the three areas in the training.

Educational activity is not a compulsory part of the training, but one of the aims of doctoral training is to provide university teaching supplies. The performance of teaching duties, according to the section (1) in the 16<sup>th</sup> paragraph of the edict 51/2001 (IV.3). However, the doctoral student may be required to work in education equivalent to 20% of the total weekly working time. A maximum of 32 kr can be given for educational activities provided by a doctoral student. At the end of each semester, the educational activity is certified by the PhD student's supervisor(s).

## **The course of doctoral training**

### **1. Fulfilment of the study obligations of organised trainees**

#### **1.1 Admission procedure**

- Applicants apply for research topics published by the DS, which will be published on the DS website by the end of April. Research topics shall be approved by the Disciplinary PhD and Habilitation Council (DPHC) prior to publication. Applications for admission must be submitted to the Directorate of Education (OI) no later than the end of May each year. The website of pannon university/doctoral schools provides information on the documents to be submitted.
- The entrance exam is held by the DS after the final examination (usually at the end of June). Applicants will receive direct information about the date of the exam via email.
- The Selection Committee assesses applicants according to a uniform scoring system.
- Admission sits by the University Doctoral and Habilitation Council (UDHC) by 15 July and notifies applicants within eight working days. The notification also includes the start of the school year and the date of enrolment.
- In the case of cross-semester admissions, the entrance examination is also held by the DS after the university final examination – at the end of January. The deadlines for previous actions will evolve accordingly and the UDHC will take its decision no later than the first week of February.

In the case of trainings started after 1<sup>st</sup> of September 2016, a complex examination shall be carried out at the end of the fourth semester, concluding the first phase of training and research and as a condition for the start of the research and dissertation phase, which shall measure and evaluate the progress of the study and research.

- In the case of individual preparers, they can be admitted to the second stage (research and dissertation phase) – by fulfilling the conditions for obtaining a degree and by applying for the complex examination. The complex examination will take place before the beginning of the first semester of the research and dissertation phase.

#### **1.2. The work plan**

The students' work plan should be prepared during the first semester of the organised course with the help of the supervisor(s). The work plan shall be approved by the DPHC.

The work plan must include the subjects that the student intends to take. Any subject can be recorded, which is promulgated by the Doctoral School of Chemistry and Environmental Sciences of the University of Pannonia (UP) or by any other doctoral school accredited in Hungary. A subject in a related field (science) or PhD course can also be included, with the support of the supervisor(s) and approved by the DPHC. Subjects at foreign universities are also permitted (moreover, recommended). For each subject, the name (title), lecturer (lecturer who is responsible for the subject), place of promulgation (university, doctoral school or course), content and number of hours of the course must be provided.

The list of subjects promulgated at the Doctoral School of Chemistry and Environmental Sciences is shown in the table on pages 10-11.

The work plan must be submitted

- electronically to the DS's e-mail address (rososa@almos.uni-pannon.hu) and
- in a printed version - signed by the student and the supervisor(s) – to the Directorate of Education.

The work plan shall be approved by the DPHC no later than the start of the student's second semester of study.

### **1.3. Fulfilment of study obligations**

The student picks up the subjects recorded in her/his work plan. Teachers can choose to attend regular classes, give lectures in blocks, or give the student an individual assignment. The performance of the subject shall be certified by the instructor by registration in the NEPTUN system.

Subjects as set out in the work plan may be derogated from during studies. The new subjects must be selected as specified in the original work plan. The change may be requested by submitting an application to the TPHC, amending the original work plan. The modification of the work plan shall be approved by the TDHT no later than the commencement of the semester of study following the submission of the student application. In the case of trainings started after 1 January 2016, a work plan shall be drawn up separately for each 24-month phase. Only the work plan for the first phase will contain study plan. The work plan for the second phase is part of the complex examination.

In addition to the subjects that can be taken at the University of Pannonia, we encourage the participation of students in other intensive scientific schools organized by domestic and foreign institutions. For the successful completion of these subjects, DPHC determines the credits that can be granted on a case-by-case basis.

### **1.4. Research work, reports**

The most important activity of the doctoral student is scientific research. The student conducts the research with the direction and assistance of the supervisor(s), but independently. She/he presents her/his results at the relevant field conferences and publishes them in high-quality journals with as much autonomy as possible. The credits for publications and lectures are given in the table at the end of the Training Plan.

The doctoral student shall give an oral report on her/his work once a year. The reporting forum may be a DPHC meeting, a DS forum, a research center professional community, an academic, or other professional forum (if the DPHC accepts it, it will be a national or foreign conference). Annual accounts are worth 20 credits. (Within a phase, the second one is a final report.)

An electronic summary of 6 to 10 pages of 10 working days before the final report shall be submitted to the secretary of the DS. The accepted final report is worth 20 credits. The deadline for final reports by graduate students is 31 July.

### **1.5. Final (pre-degree) certificate**

In the case of trainings started after 1<sup>st</sup> of September 2016, the acquisition of the final (pre-degree) certificate shall be subject to the successful completion of the final report of the second phase (research and dissertation) and the acquisition of at least 240 credits in accordance with the requirements and the fulfilment of the language conditions for obtaining a degree. The student prepares a statement of his or her credits, as verified by his or her subject. In order to obtain the final (pre-degree) certificate, an application must be made

- electronically to the DS's e-mail address (rososa@almos.uni-pannon.hu) and
- in a printed version - signed by the student and the supervisor(s) – to the Directorate of Education.

The issue of final (pre-degree) certificate shall be decided by the TDPHC no later than one month after the application has been submitted.

## **2. Acts to obtain a PhD**

In the case of the trainings started before 1<sup>st</sup> of September 2016, a doctorate can be obtained by means of a separate degree-acquisition procedure. The person involved in the doctoral degree-taking process is the doctoral candidate. Applications for the degree-acquisition procedure may be submitted within three years of the final (pre-degree) certificate's issue. If the doctoral student begins the course of her/his degree within the training period, she/ he is also a doctoral candidate in addition to his or her status as a student. Before 1<sup>st</sup> of September 2016, she/he was also a doctoral candidate who did not participate in doctoral training but was individually prepared to obtain a degree. The status of doctoral candidate shall cease to exist at the conclusion of the degree-acquisition procedure or if the doctoral candidate has not submitted her/his doctoral thesis or her/his doctoral thesis within two years of the date for the beginning of her/his status of doctoral candidate, or she/he has not obtained a doctorate within three years.

In the case of the trainings started after 1<sup>st</sup> of September 2016 as well as for individual preparations, no doctoral candidate status exists; the doctoral student must then submit the dissertation within three years of the successful complex examination.

### **2.1. Doctoral comprehensive examination**

For doctoral candidates involved in trainings started before 1<sup>st</sup> of September 2016 as well as for individual doctoral candidates commenced before this date, doctoral comprehensive examination is part of the procedure for obtaining a doctorate, which is a summary and overview form of accountability of the person involved in the doctoral degree process.

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Entry for the doctoral comprehensive examination is subject to:

- acquisition of final (pre-degree) certificate (i.e. successful completion of their studies) for PhD students in organised training;
- admission to DS for individually prepared students;
- submission of a doctoral application for a doctorate.

The doctoral comprehensive examination must be laid out from a principal and a side subject.

Any elective subject of the DS which is related to the research area and theme of the doctoral candidate can be chosen as principal or side subject.

The student may, expediently, apply for the comprehensive examination at the same time with the acquisition of the final (pre-degree) certificate (or after it) in the official request submitted.

The application shall indicate the principal and secondary subjects chosen by the student. The application must be submitted

- electronically to the DI's e-mail address (rososa@almos.uni-pannon.hu) and
- in a printed version - signed by the student and the supervisor(s) – to the Directorate of Education.

The DPHC shall decide on the request no later than one month after the application has been submitted.

The organization of comprehensive examination will be carried out in the following steps:

- Approval of a request including the suggested Committee of the Comprehensive Examination. The Committee shall be composed of a chairman, two examiners and two other members. At least one third of the Committee shall be qualified external experts. In the proposal for examiners, the DPHC shall seek the opinion of the supervisor(s). The chairman of the Committee ought to be an active or emeritus professor of the UP. The candidate's supervisor shall not be a member of the Committee. The composition of the Committee shall be approved by the DPHC, if necessary by electronic voting. It shall inform the student, her/his supervisor(s) and the Dean's Secretariat about its decision.

- Selection of the material for the examination. The student contacts her/his examiners to select the subject matter and begins to prepare.

- Appointment: The Administrator of the Dean's Secretariat (of the Faculty of Engineering) shall make an appointment in advance with the members of the Committee and then notify them, the candidate and the supervisor(s) by e-mail of the agreed date of the examination.

- Technical organisation of the examination The Dean's Secretariat organises the comprehensive examination (hall, official notification of the members of the committee, travel expenses, examination fees, publication of the invitation to the examination on the UP website). The secretary of the DS will also publish the invitation to the examination on the DS's website.

In the case of trainings started after 1<sup>st</sup> of September 2016 and in the case of individual preparations, there is no need of comprehensive examination because the complex examination ensures that the doctoral student is theoretically prepared. The two subjects in the complex

examination, similarly to the comprehensive examination, are selected from the compulsory (elective) subjects of the DS in such a way as to relate to the research area and theme of the doctoral student. To pass the complex exam, the doctoral student must have at least 90 credits, which involve a minimum of 48 study credits. At least 50 credits must be provided when applying for the examination.

Application for the complex exam is made in the Neptun study system (electronically) and also on a printed application form (submission of the filled application document to the Doctoral Affairs' Administrator of the Faculty of Engineering and an electronic copy to the DSCES's Secretary) **until the last day of the academic term.**

## **2.2 The complex exam**

- The complex exam consists of two parts:

(a) the theoretical part in which the doctoral student proves her/his knowledge of the relevant discipline literature, and his current theoretical and methodological knowledge, and

(b) reporting on her/his scientific progress.

- The doctoral student may repeat the unsuccessful complex exam once during the same exam period.

- A report of the complex examination must be taken. The results of the examination shall be published on the day of the last part of the examination. The assessment (rating) of the complex examination may be qualified or inadequate.

## **2.3. Preparation of the doctoral thesis**

In the case of trainings started before 1<sup>st</sup> of September 2016, and in the case of individual preparations started before this date, the doctoral candidate must submit a doctoral thesis together with the submission of the request of becoming doctoral candidate or within two years after its acceptance

In the case of trainings started after 1<sup>st</sup> of September 2016, and in the case of individual preparations started after this date, the doctoral student must submit a doctoral thesis within three years after the complex exam. This deadline may be extended by no more than one year, as decided by the DPHC, in cases of particular appreciation, provided that the student is unable to meet her/his obligations under the student relationship due to childbirth, accident, illness or other unexpected reasons, but not through her/his own fault.

The dissertation may be submitted in a foreign language at the request of the author with the consent of the DPHC. The main results of the doctoral dissertation should be summarised in thesis statements, also in the form of a thesis booklet.

### **2.3.1. Preliminary professional/workplace debate (pre-defense) of the doctoral thesis**

In order to support the author, the dissertation should be debated in a professionally competent forum before it is finally completed.

Prior to the public debate, the of the workplace (institute director) invites two external evaluators to comment on the thesis, based on a proposal of the supervisor(s). The chairman who will lead the debate is also asked by the institute director. It is the responsibility of the student and/or the supervisor(s) to coordinate and organise the date of the professional debate.

The author shall consider the objections raised in the evaluations and during the debate, at the discretion of the author, when preparing the final version of the dissertation. A minutes and a attendance record shall be kept on the presentation, the debate and the author's statements.

#### **2.4. Defending of the thesis**

In the case doctoral candidates connected to trainings started before 1<sup>st</sup> of September 2016, and in the case of individual preparations started before this date, the application for defending shall be conditional on the preparation and submission of the dissertation and thesis booklet with the necessary other documents (copies of language examination certificates, special imprints of articles, etc.) at the Dean's Secretariat). The defending of the dissertation can only be carried out after the comprehensive examination has been successfully laid down.

In the case of trainings started before 1<sup>st</sup> of September 2016, and in the case of individual preparations started before this date, there is no need for copies of the language examination certificates and a successful comprehensive examination when applying for the defending of the dissertation, as they have been fulfilled by the completion of the complex examination and the acquisition of final (pre-degree) certificate.

**The minimum publication requirements for the submission of the dissertation are involved in the Rules of Procedure of the Doctoral School of Chemistry and Environmental Sciences.**

The defending of the dissertation is organised and conducted in the following steps:

- Submission of application for defending together with the English and Hungarian versions of the thesis booklet to the Doctoral School.
- The application will be considered by the head of the Doctoral School, proposing the composition of the Committee for the defending (chairman, referees, additional members), to which he shall seek the opinion of the supervisor(s). Both referees must be external qualified specialists. The chair of the committee is a professor or emeritus professor at the UP. Nobody in the committee can be the author of a joint publication with the candidate.
- The examination of the application, the proposal for the Committee shall be approved by the DPHC, if necessary by electronic voting. The secretary of the DS shall notify the candidate, the supervisor(s) and the Dean's Secretariate of the decision and the composition of the Committee. The secretary of the DS shall, on behalf of the head of the DS, request the members of the Committee in advance and notify them of the expected date of protection.
- The dissertation, in consultation with the secretary of the DS, is sent by Dean's Secretariate to the appointed referees for review with a letter of request signed by the head of the DS.

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- After receiving the referee's reports, the administrator of the Dean's Secretariate shall make an appointment in advance with the members of the Committee and then notify them, the candidate and the supervisor(s) by e-mail of the agreed date of the defending.
- After that, the technical organisation of the defending (hall, performance tools, formal notification of the members of the committee, travel expenses, fees, publication of the defending on the website of UP) is the responsibility of the Dean's Secretariate. The secretary of the DS shall ensure that the dissertation, the referee's reports and the responses are posted on the websites of the DS and the National Doctoral Council.
- The secretary of the DS electronically sends the invitation to the defending and the Hungarian thesis booklet to all members of the DS, as well as to the mailing list provided by the candidate.

Following the defending, the University Doctoral and Habilitation Council, acting on a proposal from the Committee, will decide on the issue of a doctoral (PhD) degree.

### 3. Cooperation agreements

The doctoral school may initiate and assist the establishment of cooperation agreements at university level with appropriate research institutes and centers, both with a view to involving external supervisors, teachers and improving research conditions, with a view to strengthening its training. Pending the update of the agreements previously concluded, if this is necessary as a result of the reorganisation and re-name of the partner institutions, the previous agreement will be considered valid with the partner's successor.

## PROGRAMME OF THE DSCES

Research group/ Head of research group	Supervisors, teachers	Research topics	Depart ment/in stitute
<b>1. Atmospheric Chemistry</b> András Gelencsér	András Gelencsér, Gyula Kiss, András Hoffer, Ágnes Molnár, Kornélia Imre, Ágnes Rostási	<ul style="list-style-type: none"><li>• Study of cloud processes leading to the formation of atmospheric organic aerosols</li><li>• Determination of the contribution of aerosol sources to the mass concentration of atmospheric aerosol in different environments</li><li>• Role of the physico-chemical properties of atmospheric aerosol in the condensation of water vapour</li><li>• Condensation of atmospheric water vapour: precipitation, fog, dew and deed formation</li><li>• Particle formation processes</li><li>• Effect of water content of aerosol particles on PM10 concentrations and limit values</li></ul>	ACRG

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<p><b>2. Environmental Mineralogy</b></p> <p>Mihály Pósfai</p>	<p>Mihály Pósfai</p>	<ul style="list-style-type: none"> <li>• Crystalchemical characteristics, formation, geological and paleomagnetic significance of iron oxide and iron sulfide minerals of biogenic (bacterial) origin</li> <li>• Study of the mixing status and properties of individual aerosol particles by microscopic methods</li> <li>• Regulation of the crystal size and morphology of synthetic nanocrystalline iron oxides</li> <li>• Production of one-dimensional magnetic nanostructures with biomimetic synthesis</li> <li>• Examination and experimental modelling of lake carbonate separation</li> </ul>	<p>EMRG</p>
<p><b>3. Limnology</b></p> <p>Judit Padisák</p>	<p>Judit Padisák, Csilla Stenger-Kovács, Géza B. Selmeczy, Edina Lengyel</p>	<p>Phytoplankton of Hungary's small waters</p> <ul style="list-style-type: none"> <li>• Long-term changes in the phytoplankton of Lake Balaton</li> <li>• Phytoplankton ecology</li> <li>• The diatoms flora of Hungary's streams and its hydrogeological, anthropogenic and water chemistry determinants</li> <li>• Impact of global climate change on lake ecosystems</li> <li>• Examination of the functionality of small water courses: production and demolition</li> <li>• Algae ecophysiology</li> <li>• Metacommunity analysis</li> <li>• Character-based ecological studies</li> <li>• Soil productivity testing using algae</li> <li>• Study of the effect of endocrine disruptors and other drug residues on aquatic organisms</li> <li>• Ecological application of environmental DNA-based methods</li> <li>• Chemical and biological characteristics of surface and aquatic waters</li> </ul>	<p>RGL</p>
<p><b>4. Ecotoxicology</b></p> <p>Nóra Kovács</p>	<p>Nóra Kovács</p>	<ul style="list-style-type: none"> <li>• Testing of ecotoxicity of aerosol, sediment and soil samples with new types of tests</li> <li>• Analysis of genotoxicity of environmental samples</li> </ul>	<p>RGE</p>

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<p><b>5. Behavioral Ecology</b></p> <p>András Liker</p>	<p>András Liker, Gábor Seress</p>	<ul style="list-style-type: none"> <li>• Ecological impact of climate change and urbanisation on the structure and repleitivity of wildlife populations</li> <li>• Evolution of reproductive systems in vertebrate animals</li> <li>• Genetic bases of behavioral adaptations in animal populations</li> </ul>	<p>BERG</p>
<p><b>6. Analytical Chemistry-Separation Sciences</b></p> <p>Krisztián Horváth</p>	<p>Krisztián Horváth</p>	<ul style="list-style-type: none"> <li>• Examination of the physico-chemical basis of ion and liquid chromatography</li> <li>• Development of retention theories and their use in the development of analytical methods</li> <li>• Development of chromatography methods for the monitoring of biotechnological and molecular biological processes</li> <li>• Development and optimisation of two-dimensional liquid chromatography separations for analysis of complex samples</li> </ul>	<p>RGAC</p>
<p><b>7. Radiochemistry</b></p> <p>Tibor Kovács</p>	<p>Tibor Kovács Edit Tóth-Bodrogi</p>	<ul style="list-style-type: none"> <li>• Contamination-decontamination and corrosion research and development in nuclear power plants</li> <li>• Combined radiochemical and electrochemical testing of sorption and transport processes</li> </ul>	<p>RRI</p>
<p><b>8. Radioecology</b></p> <p>Edit Tóth-Bodrogi</p>	<p>János Somlai, Tibor Kovács, Edit Tóth-Bodrogi</p>	<ul style="list-style-type: none"> <li>• Determination of parameters affecting radon transport and the balance between radon and its products under different environmental conditions</li> <li>• Determination of movement and absorption of <math>^{210}\text{Po}</math>, <math>^{210}\text{Pb}</math> isotopes</li> </ul>	<p>RRI</p>
<p><b>9. Organic Chemistry – Synthesis and Catalysis</b></p> <p>Rita Skoda-Földes</p>	<p>József Bakos, Gergely Farkas, Rita Skoda-Földes</p>	<ul style="list-style-type: none"> <li>• Green chemistry (development of environmentally friendly syntheses, ionic liquids)</li> <li>• Organic, metal organic and coordination chemistry</li> <li>• Design and synthesis of new chiral modifiers</li> <li>• Homogeneous catalysis (selective synthesis of organic chemical and pharmaceutical intermediates, functioning of steroids)</li> </ul>	<p>RGOC</p>
<p><b>10. Bioinorganic and Biocoordination Chemistry</b></p>	<p>József Kaizer</p>	<ul style="list-style-type: none"> <li>• Examination of stoichiometric and catalytic oxidation/oxygenation reactions of transient metal complexes.</li> <li>• Biomimicing reactions (homogeneous catalysis)</li> </ul>	<p>RGOC</p>

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József Kaizer		<ul style="list-style-type: none"> <li>• Structural and functional enzyme models</li> <li>• Testing oxidative stress reactions (ROS particles, antioxidants)</li> </ul>	
<b>11. Modeling and Simulation of Complex Molecular Systems</b> <a href="https://mcsms.uni-pannon.hu/">(https://mcsms.uni-pannon.hu/)</a>  Dezső Boda	Dezső Boda, András Dallos, Tamás Kristóf, Mónika Valiskó, Szabolcs Varga, Péter Gurin, Zoltán Ható	<ul style="list-style-type: none"> <li>• Thermodynamic properties of array-phase molecular systems (e.g. electrolyte activity, properties of fuel components)</li> <li>• Structural and phase-in behaviour of complex molecular systems (e.g. liquid crystals)</li> <li>• Testing of inhomogeneous molecular systems (e.g. electrical double layers, clay minerals, surface energy, corrosion research)</li> <li>• Testing of transport properties of nanosystems (e.g. clay minerals, nanopores, ion channels, membranes)</li> </ul>	RGMS
<b>12. Environmental and Inorganic Photochemistry</b>  Ottó Horváth	Ottó Horváth, Erzsébet Szabó-Bárdos, Zsolt Valicsek	<ul style="list-style-type: none"> <li>• Photoinduced properties of complex compounds and photoactive inorganic semiconductors in homogeneous and (micro)heterogeneous systems</li> <li>• Environmental photochemistry; photocatalytic degradation of pollutants and solar energy utilization</li> </ul>	RGEIP

*ACRG: Atmospheric Chemistry Research Group; BERG: Behavioral Ecology Research Group; EMRG: Environmental Mineralogy Research Group, RGAC: Research Group of Analytical Chemistry; RGE: Research Group of Ecotoxicology; RGEIP: Research Group of Environmental and Inorganic Photochemistry; RGL: Research Group of Limnology; RGMS: Research Group of Modeling and Simulation of Complex Molecular Systems, RGOC: Research Group of Organic Chemistry – Synthesis and Catalysis; RRI: Institute of Radiochemistry and Radioecology*

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<b>MANDATORY (ELECTIVE) SUBJECTS</b>		
<b>Subject name</b>	<b>Lecturer</b>	<b>Credits</b>
Nuclear energetics	Edit Tóth-Bodrogi	4
Bioanalytical methods	András Guttman	4
Biochemistry II.	Rita Skoda-Földes	8
Chemistry of biocoordination	József Kaizer	8
Theoretical inorganic chemistry	Margit Kovács	8
Theoretical organic chemistry	József Kaizer	8
Separation methods in analytical chemistry	Horváth Krisztián	8
Metalloorganic chemistry	József Kaizer	8
Physical chemistry I.	Dezső Boda	8
Physical chemistry II.	Dezső Boda	8
Statistical thermodynamics of fluids	István Szalai	8
Computer simulation of liquids	Tamás Kristóf	8
Hydrobiology	Judit Padisák	8
Hydrogeology	Ádám Tóth	4
Interpretive spectroscopy I.	Rita Skoda-Földes	8
Interpretive spectroscopy II.	Rita Skoda-Földes	8
Experimental photochemistry steady state methods	Ottó Horváth	8
Time resolved methods	Lajos Fodor	8
Coordination chemistry	Lajos Fodor	4
Environmental mineralogy	Mihály Pósfai	8
Environmental photochemistry	Ottó Horváth	8
Environmental chemistry	Ottó Horváth	8
Environmental DNA	Kálmán Tapolczai	6
Research report (1.year) I.		20
Research report (2.year) II.		20
Research report (3.year) III.		20
Quantum chemistry I.	György Lendvay	4
Quantum chemistry II.	György Lendvay	4
Atmospheric science	Molnár Ágnes	8
Atmospheric chemistry	András Gelencsér	8
Limnology	Judit Padisák	8
Nuclear and particle physics	Péter Gurin	8
Nuclear metrology	Tibor Kovács	4
Ecology	Judit Padisák	8
Polimer chemistry	József Kaizer	8
Radioisotope applications	Tibor Kovács	4
Radioecology	Edit Tóth-Bodrogi	6
Vibrational and electronic spectroscopy	Zsolt Valicsek	8
Stereochemistry of Organic Compounds	Gergely Farkas	8
Inorganic photochemistry	Lajos Fodor	8
Natural and artificial radiations	Edit Tóth-Bodrogi	4
Toxicology	Nóra Kovács	8

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Transmission electron microscopy	Mihály Pósfai	6
Transition metals and their compounds	Zsolt Valicsek	8
Biogeochemical cycles	Ottó Horváth	8
Theoretical inorganic chemistry	Margit Kovács	8
Behavioral ecology	András Liker	6
Final report I.		20

<b>OPTIONAL SUBJECTS</b>		
<b>Subject name</b>	<b>Lecturer</b>	<b>Credits</b>
Origin of colours	Ottó Horváth	4
IR and Raman spectroscopy	János Kristóf	6
NMR spectroscopy	Gábor Szalontai	6
Biindication	Csilla Stenger-Kovács	4
Structure and function of biological macromolecules	Ferenc Vonderviszt	6
Biostatistics	András Liker	6
Physics and chemistry of liquid crystals	Szabolcs Varga	4
Dielectric properties of liquids	Mónika Valiskó	4
Photoinduced processes in microheterogeneous systems	Ottó Horváth	4
Photochemistry of main group metals	Ottó Horváth	4
Chemometrics	Tamás Pap	6
Quantum mechanics	Péter Gurin	4
Fieldwork	Géza B. Selmeczy	8
Science theory and communication in science	Judit Padisák	8
Water chemistry laboratory practice I.	Katalin Hubai	8
Water chemistry laboratory practice II.	Katalin Hubai	8

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**Credits (cr) for each performance in the research programme:**

In the case of trainings started after 1<sup>st</sup> of September 2016, at least 240 credits ought to be completed as follows:

<b>Condition for requesting pre-degree</b>	
<b>min. 180 cr in the case of trainings started before 1st of September 2016 min. 240 cr in the case of trainings started after 1st of September 2016</b>	
Study obligations min. 48 cr	
Educational activity (optional) max. 32 cr	
4 credit/14 contact hours (no maximum per semester limit)	
<b>Publication activity (min. 50 cr in the case of trainings started before 1st of September 2016, min. 75 cr in the case of trainings started after 1st of September 2016)</b>	
Lecture note, educational aid	15 credits/pc *participants share
Article appeared or accepted in a peer-reviewed international journal (1 <sup>st</sup> author)	impact factor*26 credits/pc, but at most 45 credits/pc
Article appeared or accepted in a peer-reviewed international journal (coauthor)	impact factor*14 credits/pc, but at most 35 credits/pc
Article in (non-peer-reviewed) international journal	8 credits/pc
Article in Hungarian journal	8 credits/pc
Book chapter	1 credit/15 pages
Poster (Hungarian): with abstract publication	2 credits /pc
Poster (Hungarian): with full-text publication	3 credits /pc
Oral presentation (Hungarian) with abstract publication	3 credits /pc
Oral presentation (Hungarian) with full-text publication	6 credits /pc
Poster in foreign language with full-text publication	6 credits /pc
Poster in foreign language with abstract publication	5 credits /pc
Oral presentation in foreign language with full-text publication	11 credits /pc
Oral presentation in foreign language with abstract publication	8 credits /pc
Patent	20 credits/pc *participants share
Annual report*	20 credits
Final report*	20 credits
Report on research project, participation in scientific study	6 credits/pc *participants share

\*Credits for annual reports are not included in the credits to be completed by publication activities.

Approved by the Council of the Doctoral School of Chemistry and Environmental Sciences on 31<sup>th</sup> of August 2021.