



### (A) GENERAL DATA

<b>Title</b>	Doctoral School of Chemistry
<b>Degree</b>	PhD in Chemistry
<b>Type</b>	Full degree program
<b>Level</b>	Doctoral level
<b>Accreditation number</b>	OH-FRKP/406-3/2007.
<b>Faculty</b>	Faculty of Science
<b>Institute</b>	Institute of Chemistry
<b>Department(s)</b>	Doctoral School of Chemistry
<b>Language</b>	English
<b>Duration</b>	4 + 4 semesters
<b>ECTS credits</b>	240
<b>Place</b>	ELTE Lágymányos Campus
<b>Minimum number of new students</b>	2
<b>Maximum number of new students</b>	20



## **(B) PROGRAM CONTENT**

### **Short description:**

The Doctoral School of Chemistry of Eötvös Loránd University was founded in 1993. The topics covered by the PhD program include practically the whole spectrum of chemistry, *i.e.*, inorganic chemistry, physical chemistry, analytical chemistry, environmental chemistry, theoretical chemistry, organic and biochemistry, electrochemistry, structural chemistry, and polymer chemistry. The program is research oriented, the students start to work on their chosen topic in the respective laboratory under the guidance of a project leader. The students must take selected courses and complete 8 exams. By the end of the 8-semester long program most of the PhD students obtain results which are published (or accepted for publication) at internationally renowned journals. At least two such papers are necessary to obtain the degree. The students report about their research progress during their study at yearly conferences organized by the School.

### **Strength of the program:**

The Institute of Chemistry has 25 full professors and many further teacher-researchers working in various fields of chemistry. The Advisory Board of the Doctoral School of Chemistry consists of internationally renowned experts of their fields. The research advisors of the Doctoral School of Chemistry of Eötvös Loránd University collaborate with several research institutes and universities both in and outside of Hungary, and regularly have visitors from abroad doing research or giving courses.



## (C) STRUCTURE

The lecture courses can be chosen from the following topics, depending on the research interest of the student:

KÉM/201	Computational statistical mechanics
KÉM/206	Ring transformations in heterocyclic chemistry
KÉM/207	Quantum chemistry and structural determinations, advanced
KÉM/208	Quantum mechanics of molecular motions II.
KÉM/209	Stability of Colloidal Drug Delivery Systems
KÉM/210	Interfacial behaviour of macromolecules
KÉM/211	Electromigration methods
KÉM/212	Quantum chemical molecular modeling
KÉM/213	Liquid Crystals
KÉM/214	Computational Chemistry
KÉM/215	Electrostatic interactions in colloid systems
KÉM/216	Self-association of surfactants in solution
KÉM/218	Heteroaromatic Chemistry
KÉM/221	Green Chemistry
KÉM/222	The chemistry of cyclodextrins
KÉM/223	Bioconjugates
KÉM/224	Selected chapters of peptide and protein chemistry
KÉM/225	History of Electrochemistry
KÉM/226	Theoretical electrochemistry
KÉM/227	Basics of macromolecular technology
KÉM/228	Principles of molecular engineering of macromolecules
KÉM/229	Advanced organic chemistry
KÉM/230	Chromatographic separation of enantiomers
KÉM/231	New trends in X-ray crystallography
KÉM/232	Basic Neurochemistry
KÉM/233	Methods of applied statistics
KÉM/234	Modern reaction Kinetics
KÉM/235	Surface chemistry of biomaterials
KÉM/236	Solid/liquid interfacial phenomena – nanolayers
KÉM/239	Organometallic compounds in the organic synthesis
KÉM/240	Modern synthetic methods
KÉM/241	Theoretical background of experimental electrochemistry



KÉM/242	Theory of the kinetics of elementary reactions
KÉM/243	Selected topics in quantumchemistry
KÉM/244	Advanced bioorganic chemistry
KÉM/246	Shape, similarity and complementarity of molecules
KÉM/247	Preparation of cyclo- and oligopeptides
KÉM/248	Colloid Chemistry of network structures
KÉM/249	Molecular modelling
KÉM/250	Oscillation and other dynamic phenomena in chemistry
KÉM/251	Structure elucidation of peptides and proteins by NMR
KÉM/252	Bio-NMR pulse-sequences
KÉM/253	GC and HPLC in the analysis of organic compounds
KÉM/254	Methods of Quantum Chemistry
KÉM/255	Modern Methods of Quantum Chemistry
KÉM/256	Disorder in condensed phases
KÉM/257	Organofluorine Chemistry
KÉM/258	Methods of surface examination
KÉM/259	NMR spectroscopy of solids and solutions
KÉM/260	Phisycal organic chemistry
KÉM/261	Instrumental Nuclear Methods Applied in Environmental Analysis
KÉM/265	Theoretical study of protein structures
KÉM/266	Applied NMR spectroscopy
KÉM/267	Basics of NMR spectroscopy
KÉM/268	Mathematical methods in quantum chemistry I.
KÉM/269	Mathematical methods in quantum chemistry II.
KÉM/270	Peptidomimetics
KÉM/272	Modern methods of quantum chemistry
KÉM/273	Spectroscopic application of molecular dynamics
KÉM/274	Application of photoionization spectroscopy
KÉM/275	Organometallic chemistry II.
KÉM/277	Investigation of metal corrosion by electrochemical methods
KÉM/278	Asymmetric Synthesis
KÉM/279	Applied gas chromatography
KÉM/280	Sepaartion techniques in organic chemistry
KÉM/281	Environmental and health effects of energy production
KÉM/282	Combustion chemistry and physics



KÉM/283	Investigation of reaction mechanisms
KÉM/284	Applied computer simulations
KÉM/285	Elementary reaction dynamics
KÉM/286	Mass spectrometry II.
KÉM/287	Nuclear Techniques in Material Science
KÉM/288	Analytical application of plasma spectroscopy
KÉM/289	Environmental analysis
KÉM/290	Enrichment methods in atomspectroscopy
KÉM/291	Density functional methods for the description of electronic structures
KÉM/292	Vacuum Technique
KÉM/293	Basic and applied quantum chemistry
KÉM/294	Proteome Analysis and Protein Structure
KÉM/295	Applied electrochemistry
KÉM/296	Photophysics and photochemical kinetics
KÉM/298	Cyclodextrins in nanotechnology
KÉM/299	Computer-aided drug design
KÉM/301	Mass spectrometry of biomolecules
KÉM/302	Theory of NMR techniques
KÉM/303	NMR spectroscopy of solids and solutions
KÉM/304	Protein Crystallography
KÉM/305	Organosilicon chemistry
KÉM/306	Theoretical organic chemistry II
KÉM/307	Advances in organic and biomolecular chemistry
KÉM/308	Chemistry of Protein Biosynthesis
KÉM/309	Thermal decomposition of organic macromolecules
KÉM/311	Theoretical background of experimental electrochemistry II
KÉM/312	Monte Carlo method
KÉM/113	Molecular recognition
KÉM/314	Carbohydrate chemistry
KÉM/316	Nanoparticles and nanosystems
KÉM/317	Biomolecular mass spectrometry
KÉM/318	Optimization of drug substances
KÉM/320	Analysis of protein drugs
KÉM/321	Electrochemical metal deposition
KÉM/324	Hyphenated techniques for elemental speciation



## **(D) CAREER**

### **Career opportunities:**

Many of the former students of our Doctoral School obtained postdoctoral positions throughout the world ranging all the way from the US to Japan, often at leading universities of the world (just to name a few, Cambridge, UK; University of Tokyo; ETH Zürich). A large portion of the graduates gets tenure or tenure track positions at universities and research institutions inside and outside of Hungary. Some of our students have been pursuing their research career in a non-academic environment of large international research institutions and firms, including major pharma companies.

### **Job examples:**

university professor, research associate, research scientist, entrepreneur, synthetic organic chemist, analytical chemist, computational chemist, program developer



## (E) ADMISSIONS FOR THE ACADEMIC YEAR 2017/2018

### TUITION AND OTHER FEES

	EU/EEA students	non-EU/EEA students
Tuition fee/semester	1910 (EUR)*	2500 – 4500 (EUR) depending on the research topic
Application fee	160 (EUR)	160 (EUR)
Registration fee	60 (EUR)	60 (EUR)

\* Reduced fee: 350 EUR, if you research not in the University territory.

Offered for the academic year 2017/2018?	YES
Deadline for applications – September intake	01 May 2017
Is there a February intake?	NO

#### Admission requirements – Language requirements:

A master's degree in chemistry (or in a related field) is a requirement. A reasonable command of English language is also needed.

Criteria for ranking at the admission audition shall include:

1. previous university achievement (examinations, comprehensive examinations, qualification of degree),
2. achievements related to previous research work (awards obtained in students' academic circles, publications in the particular professional area),
3. the feasibility of the research program.

#### Admission requirements – Documents to submit with application:

- ✓ Master-level degree
- ✓ Transcript of records
- ✓ CV
- ✓ Motivation letter
- ✓ Essay
- ✓ Research plan
- ✓ Letter of recommendation
- ✓ Application form
- ✓ Copy of the main pages of the passport (needs to be valid)
- ✓ Passport photo



- ✓ Medical certificate
- ✓ Certificate of clean criminal records
- ✓ Copy of application fee transfer
- ✓ Entrance exam fee
- ✓ Reference work

#### Application procedure:

The application can be done by sending a letter with a short CV, copy of the degree certificate, transcript of results, and a language examination certificate. Details can be found at [http://www.doktori.hu/index.php?menuid=191&di\\_ID=57&lang=EN](http://www.doktori.hu/index.php?menuid=191&di_ID=57&lang=EN).

#### Procedure of the entrance examination:

**Applicants should agree on their exact research topic with the relevant supervisor, and should make a research plan approved by her/him. Concerning the details and other documents to be submitted, please contact the international coordinator of the faculty well before the application deadline. For the thesis topics visit the following website:**

<http://www.doktori.hu/index.php?menuid=116&lang=EN&lid=116&lang=EN&tol=0&sb=2&sd=1>

The application package is reviewed by an admission committee. Then the applicant is expected to take an oral entrance examination. If a personal meeting is impossible, the interview is held through Skype or telephone. The decision on admission or rejection is made at the earliest date possible.

Selected research topics offered (please, check the current list at <http://ttk.elte.hu/node/815>)

Surján, Péter	Many-electron theory and its application to molecular systems
Surján, Péter	Research in material science: theory of conjugated pi-electron systems
Salma, Imre	Interaction of aerosol particles with water vapour in urban environments
Salma, Imre	Formation, properties and environmental effects of carbonaceous aerosol
Császár, Attila	The fourth age of quantum chemistry: Molecules in motion
Császár, Attila	Small molecules as complex systems
Császár, Attila	Exotic chemical phenomena: Tunneling and resonances
Rábai, József	Synthesis of Organofluorine Compounds and Study of Their Molecular and Macroscopic Properties
Kiss, Éva	Surface biocompatibility of polymeric biomaterials
Kiss, Éva	Preparation of membrane model systems and their interaction with bioactive molecules
Kiss, Éva	Development of complex nanostructured drug delivery systems
Mészáros, Róbert	Association between oppositely charged macromolecules and surfactants
Inzelt, György	Preparation and characterization of conducting polymers and composites
Inzelt, György	Electrochemical nanogravimetric studies of microparticles
Szalay, Péter	Spectroscopy of the building blocks of DNA
Szalay, Péter	Adiabatic and non-adiabatic interactions in ozone molecule: electronic structure





	calculations serving spectroscopy
Szalay, Péter	Electronic structure calculations in grid and parallel environments: development of methods and programs
Baranyai, András	Molecular dynamics studies of water, ice and aqueous solutions
Keszei, Ernő	Study of ultrafast laser kinetic mechanisms
Szabados, Ágnes	Approximate many-body methods for describing electron correlation in molecules
Sinkó, Katalin	Synthesis and structure investigation of macro-, meso- and microporous materials
Turányi, Tamás	Development of detailed chemical kinetic mechanisms for combustion processes
Szalai, István	Pattern formation in reaction-diffusion systems
Orbán, Miklós – Kurin, Krisztina	Design, produce and study the mechanism of the chemical oscillatory processes
Orbán, Miklós – Kurin, Krisztina	Application of pH-oscillators to induce periodic changes in chemical, physical or biochemical equilibria
Túri, László	Quantum molecular dynamics simulations: theory and applications for condensed phase problems
Láng, Győző	Investigation of electroactive intermediates in electrochemical processes by dual voltammetry
Láng, Győző	Investigation of the electrochemical stability of conducting polymer films and thin metal layers
Novák, Zoltán	Examination of transition metal catalyzed oxidative coupling reactions
Novák, Zoltán	Examination of transition metal catalyzed cross-coupling reactions
Mező, Gábor	Development of bioconjugates for selective drug targeting
Farkas, Viktor	Synthesis and conformational studies of peptides, peptidomimetics and proteins
Visy, Júlia	Investigation of ligand binding properties of biological macromolecules using spectroscopic and separation techniques
Túrós, György	Continuous flow synthesis of novel heterocycles with druglike properties
Hajós, György	Nucleophilic carbenes with fused pyridine skeleton
Bencs, László	Synthesis and characterization of polycrystalline scintillator materials
Pápai, Imre	Chemistry of Frustrated Lewis Pairs
Pápai, Imre	Design of Organocatalysts



**(F) CONTACT**

***Program leader***

Name: Prof. Attila G. Császár PhD.

***Program coordinator***

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