

UNIVERSITY OF PANNONIA CHEMICAL ENGINEERING AND MATERIAL SCIENCES DOCTORAL SCHOOL TRAINING PROGRAM

Aim of the training

At the Chemical Engineering and Materials Sciences Doctoral School (hereinafter referred to as CEMSDS), doctoral training is the training of a professional who is able to perform creative work based on independent thinking in the most important areas of chemical engineering and material science. The aim of the training is to establish a doctoral degree.

The main features of the training

The doctoral training is a regular study, research and reporting activity, which includes the fulfilment of the obligations stipulated in the Doctoral Regulations of the University. In CEMSDS doctoral training, the award of doctoral degrees is conditional on the completion of 8 semesters of study obligations for those starting after 1 September 2016.

Study points can be obtained by completing subjects, completing a research task and performing an educational task. Taking into account that, the doctoral training requires more individual learning than undergraduate training, it corresponds that 1 lesson (contact hour/week) is equal to 2 study points (TP).

The study score for research activity and research results from research activity was calculated based on the average time spent by a student with average abilities.

Structure of the program

The doctoral program is divided into three main areas: study, research and education. Education (teaching) is optional part of the training.

1. The study program

The aim of the study program is to deepen the classical and modern chemical engineering and material sciences, and to expand knowledge related to the main directions of the Doctoral School (DS).

For those starting their studies after September 1, 2016, the training period is 48 months, which is 24 months from the "training and research phase", and 24 months from the "research and dissertation phase". At least 48 TPs must be completed during the entire training period. Up to 45 TPs can be obtained with teaching. The general rules for the course are as follows:

- In order to deepen the science of DI, the first subject group is provided, from which the doctoral student must fulfil at least 24 TP.
- In connection with the topic of his/her research, PhD students have a minimum of 14 TPs from a range of optional subjects proposed by the specialization (group II).
- Up to 10 TPs can be obtained from the optional subject kit to complete the study program. Optional subjects may be added to the list of subjects in other doctoral schools or other subjects may be accepted as optional subjects.

Summary table subjects accepted in a CEMSDS:

I. DS subjects:

Minimum required: 24 study points

Tárgy neve	Előadó	Óra	TP
The basics of micro and nano detection (in Hungarian: A mikro- és nanoérzékelés alapjai)	István Bársony	3+0+0 K	6
Examination of material structure (in Hungarian: Anyagszerkezeti vizsgálatok)	János Kristóf	3+0+0 K	6
Material Science (in Hungarian: Anyagtudomány)	Kristóf Kovács	3+0+0 K	6
Bio-nanotechnology (in Hungarian: Bio-nanotechnológia)	Ferenc Vonderviszt	3+0+0 K	6
Process Engineering Sciences (in Hungarian: Folyamatmérnöki Tudományok)	János Abonyi, Sándor Németh	3+0+0 K	6
Functional micro- and nanoparticles (in Hungarian: Funkcionális mikro- és nanorészecskék)	Tivadar Feczko	3+0+0 K	6
Modern oil and petrochemical processes (in Hungarian: Korszerű kőolajipari és petrokémiai eljárások)	Jenő Hancsók	3+0+0 K	6
Modern chemical industry operations (in Hungarian: Korszerű vegyipari műveletek)	Dóra Pethő	3+0+0 K	6
Environmental Engineering (in Hungarian: Környezetmérnöki Ismeretek)	Endre Domokos	3+0+0 K	6
Special materials for mechatronic systems (in Hungarian: Mechatronikai rendszerek speciális anyagai)	István Szalai	3+0+0 K	6
Technical biotechnology (in Hungarian: Műszaki biotechnológia)	Katalin Bélafiné Bakó Nándor Nemestóthy	3+0+0 K	6
Radioisotopic techniques and their application (in Hungarian: Radioizotopos technikák és alkalmazásuk)	Tibor Kovács	3+0+0 K	6
Selected organic chemical technologies (in Hungarian: Válogatott szerves vegyipari technológiák)	Szilárd Törös	3+0+0 K	6

II. Optional subjects recommended by specialization: Minimum required: 14 study points

VM-1: Materials Testing Methods and Surface Chemistry

Tárgy neve	Előadó	Óra	TP
IR and Raman Spectroscopy (in Hungarian: IR és Raman spektroszkópia)	Erzsébet Horváth	2+0+0 K	4
Modern surface analysis methods (in Hungarian: Modern felületanalitikai módszerek)	János Kristóf	2+0+0 K	4
Nuclear measurement technology (in Hungarian: Nukleáris mérés technika)	Tibor Kovács	2+0+0 K	4
Rheological studies (in Hungarian: Reológiai vizsgálatok)	László Bartha, Roland Nagy	2+0+0 K	4
X-ray diffraction (in Hungarian: Röntgendiffrakció)	Éva Kristófné Makó	1+0+1 K	4
Computer microscopy (in Hungarian: Számítógépes mikroszkópia)	Kristóf Kovács	1+0+1 K	4
Determination of mechanical properties of solid bodies (in Hungarian: Szilárd testek mechanikai jellemzőinek meghatározása)	Imre Timár	2+1+0 K	6
Thermal analysis (in Hungarian: Termikus analízis)	János Kristóf	2+0+0 K	4

VM-2: Process Engineering Sciences

Tárgy neve	Előadó	Óra	TP
Data Modeling Methods (in Hungarian: Adatmodellezési módszerek)	János Abonyi s	2+0+0 K	4
Process Synthesis and Optimization (in Hungarian: Folyamatszintézis és optimalizálás)	Béla Lakatos	2+0+0 K	4
Management/Control algorithms (in Hungarian: Irányítási algoritmusok)	Lajos Nagy	2+0+0 K	4
Modern technology development (in Hungarian: Korszerű technológiafejlesztés)	Tibor Chován	2+0+0 K	4
Modeling and Simulation (Integrated Course) (in Hungarian: Modellezés és szimuláció (integrált tantárgy))	Sándor Németh	3+0+0 K	6

VM-3: Intelligent Materials and Technologies

Tárgy neve	Előadó	Óra	TP
Engineering applications of HIL / SIL technologies (in Hungarian: HIL/SIL technológiák mérnöki alkalmazásai)	Dénes Fodor	2+0+0 K	4
Soft intelligent materials and their applications (in Hungarian: Lágy intelligens anyagok és alkalmazásaik)	István Szalai	2+0+0 K	4
Micro-electromechanical systems (in Hungarian: Mikro-elektromechanikus rendszerek)	Dénes Fodor	2+0+0 K	4
Optimal scaling of technology systems (material, energy and cost saving) (in Hungarian: Technológiai rendszerek optimális (anyag-, energia- és költségtakarékos) méretezése)	Imre Timár	2+0+0 K	4

VM-4: Material Systems and Procedures of Ceramic Industry

Tárgy neve	Előadó	Óra	TP
Composite materials (in Hungarian: Kompozit anyagok)	Kristóf Kovács	2+0+0 K	4
Modern technical ceramics (in Hungarian: Korszerű műszaki kerámiák)	Kristóf Kovács	3+0+0 K	6
Modern technical glasses (in Hungarian: Korszerű műszaki üvegek)	Tamás Korim	2+0+0 K	4
Nanostructured metals, ceramics, plastics (in Hungarian: Nanoszerkezetű fémek, kerámiák, műanyagok)	János Szépvölgyi	3+0+0 K	6

Silicate chemistry (in Hungarian: Szilikátkémia)	Margit Eniszné Bódogh	2+0+0 K	4
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VM-5: Modern chemical operations

Tárgy neve	Előadó	Óra	TP
Energetics (in Hungarian: Energetika)	Zoltán Hodai	2+0+0 K	4
Modern liquid separation operations (in Hungarian: Korszerű folyadékszeparációs műveletek)	László Hanák	2+0+0 K	4
Reaction Technique (in Hungarian: Reakciótechnika)	Róbert Bocsi	2+0+0 K	4
Transport Theory (in Hungarian: Transzportelmélet)	Dóra Pethő	2+0+0 K	4

VM-6: Environmental Engineering and Technology Systems

Tárgy neve	Előadó	Óra	TP
Life cycle analysis (in Hungarian: Életciklus elemzés)	Endre Domokos	0+2+0 Gy	4
Pharmaceutical chemistry and syntheses (in Hungarian: Gyógyszerkémia és –szintézisek)	Szilárd Törös	3+0+0 K	6
Homogeneous catalytic technological processes (in Hungarian: Homogénkatalitikus technológiai eljárások)	Szilárd Törös	2+0+0 K	4
Waste management (in Hungarian: Hulladékgazdálkodás)	Róbert Kurdi	2+0+0 K	4
Industrial organic chemistry (in Hungarian: Ipari szerves kémia)	Szilárd Törös	2+0+0 K	4
Catalysis (in Hungarian: Katalízis)	Tatjana Juzsakova,	2+0+0 K	4
Environmental impact assessment, auditing (in Hungarian: Környezetállapot értékelés, auditálás)	Tatjana Juzsakova,	2+0+0 Gy	4
Environmental management systems (in Hungarian: Környezetmenedzsment rendszerek)	Viola Somogyi	2+0+0 K	4
Air quality protection (in Hungarian: Levegőtisztaság-védelem)	Tatjana Juzsakova,	2+0+0 K	4
Membrane separation processes in environmental protection (in Hungarian: Membránszeparációs eljárások a környezetvédelemben)	Katalin Bélafiné Bakó	2+0+0 K	4
Ecological risk assessment (in Hungarian: Ökológiai kockázatbecslés)	Nóra Kováts	2+0+0 K	4
Radioecology (in Hungarian: Radioökológia)	Anita Csordás	2+0+0 K	4
Wastewater treatment technologies (in Hungarian: Szennyvízkezelési technológiák)	Árpád Kárpáti	2+0+0 K	4
Soil contamination, damage prevention (in Hungarian: Talajszennyezések, kárelhárítás)	Balázs Zsirka	2+0+0 K	4
GIS applications (in Hungarian: Térinformatikai alkalmazások)	Endre Domokos	0+2+0 Gy	4

VM-7: Petroleum industrial and petrochemical processes and products

Tárgy neve	Előadó	Óra	TP
Chemistry and technology of lubricants (in Hungarian: Kenőanyagok kémiája és technológiája)	Roland Nagy	2+0+0 K	4
Modern engine and jet engine fuels (in Hungarian: Korszerű motor- és sugárhajtómű üzemanyagok)	Jenő Hancsók	2+0+0 K	4
Petroleum industry equipment and scaling (in Hungarian: Kőolajipari berendezések és méretezésük)	Zoltán Varga	2+0+0 K	4
Polymer chemistry and technology (in Hungarian: Polimerek kémiája és technológiája)	Norbert Miskolczi	2+0+0 K	4
Hydrocarbon industrial catalytic processes (in Hungarian: Szénhidrogénipari katalitikus eljárások)	Jenő Hancsók	2+0+0 K	4

VM-8: Molecular and Nanotechnologies

Tárgy neve	Előadó	Óra	TP
Analytical system biology (in Hungarian: Analitikai rendszerbiológia)	András Guttman	2+0+0 K	4
Fundamentals of materials (in Hungarian: Anyagszerkezeti ismeretek)	István Bársony	2+0+0 K	4
Bioellipsometry (in Hungarian: Bioellipszometria)	Péter Petrik	2+0+0 K	4
Structure and function of biological macromolecules (in Hungarian: Biológiai makromolekulák szerkezete és működése)	Ferenc Vonderviszt	2+0+0 K	4
Electronmicroscopy in materials science (in Hungarian: Elektronmikroszkópia az anyagtudományban)	Béla Pécz	2+0+0 K	4
Controlled release of drug: theories and applications (in Hungarian: Ellenőrzött gyógyszerkioldás elmélete és gyakorlata)	Endre Nagy	2+0+0 K	4
Surface chemistry in biosensors (in Hungarian: Felületkémia a bioszenzorokban)	Sándor Kurunczi	2+0+0 K	4
Glycomics (in Hungarian: Glikomika)	András Guttman	2+0+0 K	4
Integrated microsystems (in Hungarian: Integrált mikrorendszerek)	István Bársony	2+0+0 K	4
Ion beam characterization and material modifications (in Hungarian: Ionsugaras anyagvizsgálat és anyagmódosítás)	Miklós Fried	2+0+0 K	4
Label-free optical biosensors and their applications (in Hungarian: Jelölésmentes optikai bioszenzorok és alkalmazásaik)	Róbert Horváth	2+0+0 K	4
Up-to-date separation methods in biotechnology (in Hungarian: Korszerű elválasztási módszerek a biotechnológiában)	Endre Nagy	2+0+0 K	4
Quantum chemistry I. (in Hungarian: Kvantumkémia I.)	György Lendvay	2+0+0 K	4
Quantum chemistry II. (in Hungarian: Kvantumkémia II.)	György Lendvay	2+0+0 K	4
Nanoscale physics (in Hungarian: Nanoszerkezetek fizikája)	Miklós Fried	2+0+0 K	4
Particulate systems of controlled release (in Hungarian: Szabályozott hatóanyagleadású részecskerendszerek)	Tivadar Feczkó	2+0+0 K	4

VM-9: Technical Biotechnology

Tárgy neve	Előadó	Óra	TP
Bioreactors (in Hungarian: Bioreaktorok)	Bélafiné Bakó Katalin	2+0+0 K	4
Enzymatic catalysis in non-conventional media (in Hungarian: Enzimkatalitikus reakciók nem-konvencionális közegben)	Gubicza László	2+0+0 K	4
Integrated systems in biotechnology (in Hungarian: Integrált rendszerek a biotechnológiában)	Bélafiné Bakó Katalin	2+0+0 K	4
Kinetics of complex enzymatic reactions (in Hungarian: Komplex enzimes reakciók kinetikája)	Bélafiné Bakó Katalin	2+0+0 K	4

III. Optional subjects: Maximum achievable: 10 study points

Subject set of specialisations + subjects accepted by other doctoral schools

Tárgy neve	Előadó	Óra	TP
Fundamentals of genetic engineering and protein engineering (in Hungarian: A génszélesztés és fehérjemérnökség alapjai)	Hajnalka Jankovics	2+0+0 K	4
Modern instrumental analytical methods for environmental protection (in Hungarian: A környezetvédelem korszerű műszeres analitikai módszerei)	János Kristóf	2+0+0 K	4
Adsorption and drying (in Hungarian: Adszorpció és szárítás)	Róbert Bocsi	2+0+0 K	4
Functional materials for alternative energy sources (in Hungarian: Alternatív energiaforrások funkcionális anyagai)	Kristóf Kovács	2+0+0 K	4
Material transformations and syntheses under special circumstances (in Hungarian: Anyagátalakítások és szintézisek különleges körülmények között)	János Szépvölgyi	2+0+0 K	4

Nuclear Energetics applications (in Hungarian: Atomenergetika)	Edit Tóth-Bodrogi	2+0+0 K	4
Bioseparation operations (in Hungarian: Bioszeparációs műveletek)	László Hanák	2+0+0 K	4
Digital manufacturing (in Hungarian: Digitális gyártás)	István Gábor Gyurika	2+0+0 K	4
Digital filters and estimators (in Hungarian: Digitális szűrők és becslők)	Dénes Fodor	2+0+0 K	4
Separation methods (in Hungarian: Elválasztási módszerek)	Krisztián Horváth	2+0+0 K	4
Protein production; extracellular protein synthesis (in Hungarian: Fehérjék termelése, alkalmazása; sejten kívüli fehérjeszintézis)	Endre Nagy	2+0+0 K	4
Investigation of surfaces and thin films with polarized light (in Hungarian: Felületek és vékonyrétegek vizsgálata polarizált fénnel)	Miklós Fried	2+0+0 K	4
Capillary electrophoresis (in Hungarian: Kapilláris elektroforézis)	Gábor Járvas	2+0+2 K	8
Techniques for repairing damage (in Hungarian: Kárelhárítás műszaki módszerei)	Erzsébet Horváth	2+0+0 K	4
Chemometrics (in Hungarian: Kemometria)	Tamás Pap	2+0+0 K	4
Ceramic technology (in Hungarian: Kerámia technológia)	Tamás Korim	2+0+0 K	4
Combined operations (in Hungarian: Kombinált műveletek)	Zoltán Hodai	2+0+0 K	4
Technology of binders (in Hungarian: Kötőanyagok technológiája)	Tamás Korim	2+0+0 K	4
Special machining procedures (in Hungarian: Különleges megmunkálási eljárások)	István Gábor Gyurika	2+0+0 K	4
Mechanochemical Processes (in Hungarian: Mechanokémiai folyamatok)	Éva Kristófné Makó	2+0+0 K	4
Microfluidics (in Hungarian: Mikrofluidika)	Gábor Járvas	2+0+2 K	8
Highly selective organochemical syntheses (in Hungarian: Nagyszelektivitású szerveskémiai szintézisek)	Szilárd Törös	2+0+0 K	4
Preparative liquid chromatography (in Hungarian: Preparatív folyadékkromatográfia)	László Hanák	2+0+0 K	4
Sintering Processes (in Hungarian: Szinterelési folyamatok)	Margit Eniszné Bódogh	2+0+0 K	4
New Analytical Trends in Glycomics (in Hungarian: Új analitikai trendek a glikomikában)	András Guttman	2+0+0 K	4
Glass Chemistry (in Hungarian: Üvegekémia)	Margit Eniszné Bódogh	2+0+0 K	4
Glass Technology (in Hungarian: Üvegtechnológia)	Tamás Korim	2+0+0 K	4
Korszerű röntgenfluoreszcens spektrometria és alkalmazása	Kristófné Makó Éva	2+0+0 K	4
Az ipari biotechnológia molekuláris biológiai eszközei	Jankovics Hajnalka	2+0+0 K	4
Public speaking and behavior (in Hungarian: Nyilvános beszéd és magatartás)	Georgina Tóth-Nagy	2+0+0 K	4

By completing the subjects, you must complete a minimum of 48 study points.

2. Research program

Conducting scientific research for the preparation of the doctoral dissertation under the supervision of the supervisor of the research program and its continuous examination. During the research work, the doctoral student must adapt the application of scientific methods, obtain valuable scientific results and testify in the form of scientific publications, scientific presentations, i.e. the student must prove that he/she is able to solve a scientific task independently.

- The doctoral student must report the research work done at least every six months.
- An important part of the research program is the encouragement of proper documentation of research results; therefore, a special study point can be given for this activity.

In the research program, a study point (TP) can be given for each performance:

Lecture notes, tutorial	15 TP/pcs* participants share
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Article in Referenced International Journal (1st author)	30 TP/pcs
Article in Referenced International Journal (co-author)	25 TP/pcs
Article in foreign language non-referenced journal (1st author)	15 TP/pcs
Article in foreign language non-referenced journal (co-author)	10 TP/pcs
Article in a Hungarian language journal	8 TP/pcs
Poster in Hungarian	2 TP/pcs
Presentation in Hungarian with full text presentation	5 TP/pcs
Presentation in Hungarian with abstract appearance	3 TP/pcs
Poszter idegen nyelven	5 TP/pcs
Presentation in a foreign language with full text presentation	15 TP/pcs
Presentation in a foreign language with an abstract appearance	10 TP/pcs
Patent	20 TP/pcs * participants share
Semester report (accepted with written material and evaluation)	10 TP/pcs
Final report	10 TP
Research report, participation in a study	6 TP/pcs * participants share

A minimum of 75 study points to be completed in the research program.

3. Educational program

One of the aims of doctoral training is to provide university instructor recruitment. Carrying out the teaching duties - 51/2001. (IV.3) Korm. § 16 (1) - may not form part of the doctoral student's study obligations, however, a student participating in doctoral training may be required to perform 20% of the weekly full-time work. A maximum of 45 TP can be awarded for the educational activity provided by the doctoral student. In the education program, doctoral students - based on a contract with the student - take part in seminars and laboratory exercises. Keeping 1 contact hour a week, or a total of 14 contact hours / semester, means completing 2 study points. Educational activity is certified by the supervisor of the PhD student.

Study and Exam Order in CEMSDS

- (1) The duration of the study obligations stipulated in the Doctoral Regulations and the payment of the doctoral scholarship is 4 years (48 months).
- (2) The interruption of study time may be interrupted twice, for a maximum of two semesters. The application must be accepted for the first time. No state scholarship can be paid during the interruption of student status.
- (3) Participants in organized training may continue their studies in CEMSDS for scholarships or for reimbursement.
- (4) In the first month of the course, the doctoral student who has been admitted shall prepare his / her study and research plan in agreement with the supervisor and submit it to the TDHT for approval. The plan should be prepared according to the guidance in Annex 4 to the Doctoral Regulation.
- (5) The doctoral candidate who has been admitted is enrolled in a manner published before each semester according to the administration.
- (6) The doctoral student enrolls in the semester the subjects announced in the semester according to his/her study plan. Subjects are mandatory and optional.
- (7) In accordance with the subject matter of the curriculum, the advertised items will be delivered at the beginning of the semester as specified in the announcement issued by CEMSDS. The announcement should include the individual learning aids, the date of the consultations and the topic of the consultation, the conditions of fulfilment (written examination, individual assignment to be given, etc.) and the way of the examination.
- (8) The doctoral student may also participate in foreign part-time training. The doctoral student may participate in the part-time training based on a work program approved by the supervisor, which ensures the validity of the given study period. The duration of foreign part-time training is counted in the duration of the doctoral training, and the student status is not interrupted. The head of the DS may authorize the acceptance of the study trip as part-time training on the proposal of the supervisor.
- (9) The head of the DS shall decide on the acceptance of an optional subject of another doctoral school based on an application.
- (10) The doctoral student is required to take an examination of the subjects taken.
- (11) Qualification of the exam: excellent, passed, failed.

- (12) An attempt to repate an unsuccessful exam can be made once.
- (13) Passing of exams and the fulfilment of researcher requirements should be justified.
- (14) The start of the next semester may only be based on the closure of the previous semester.
- (15) During the 48-month study period 240 TP must be completed
- (16) The completion of the doctoral training is indicated by the final certificate (absolutorium), which certifies that the doctoral student has fulfilled all his/her study and examination obligations prescribed in CEMSDS's doctoral training.

Procedure for doctoral studies

1. The fulfilment of the study obligations of students in organised training

1.1. Work plan

The students' work plan must be drawn up in the first semester of the programme, with the help of the supervisor. The work plan is approved by the TDHT. The work plan must include the subjects, according to the study programme, which the student intends to take.

The work plan must be submitted

- electronically to the DS Secretary,
- in written - validated by the student's signature and the supporting signature of the subject leader - to the Directorate of Education.

The work plan is approved by the TDHT no later than the start of the student's second semester of study.

1.2. Fulfilment of study obligations

The student must consult the lecturer of the course about the admission to the course, and after the course has been announced, the student will take it. The lecturer certifies the fulfilment of the course by registering it in the NEPTUN system.

Subjects can be changed from the subjects is registered in the work plan during the studies. The new subjects must be selected in the same way as in the original work plan. A change can be requested by submitting an application to TDHT, modifying the original work plan. The TDHT will approve the change to the work plan no later than the beginning of the academic semester following the submission of the student's application.

For two-phase training courses started after 1 September 2016, a work plan must be prepared for each phase (24-24 months) of which only the first phase containing a study plan. The work plan for the second phase is part of the complex examination.

In addition to the courses offered at the University of Pannonia, we encourage students to participate in scientific schools organised by other institutions in Hungary and abroad. The TDHT will determine the number of credits to be granted for the successful completion of the DI subjects covered by the DS topic.

1.3. Research activity, reports

The main activity of a doctoral student is scientific research. Students carry out their research independently, under the guidance and with the help of their supervisor. Students

will present his/her results at conferences in the relevant field and publish as independently as possible in high quality journals. Credit points for publications and presentations are given in the table in the Training Plan.

The doctoral student gives an oral report on his/her work twice a year. Semi-annual reports are worth 10 academic points.

Every semester, the doctoral student fills in an evaluation form, recording the academic points obtained in the course of study, research and teaching activities.

The evaluation form must be submitted

- electronically with the necessary annexes to the DI Secretary,
- in written - validated by the student's signature and the attesting signature of the subject leader - to the DS Secretary and then, after the supporting signature of the DS Head, to the Directorate of Education.

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1.4. Pre-degree certificate (Absolutorium)

For students who started their studies after 1 September 2016, the degree is conditional on the successful completion of the final report of the second stage (research and dissertation) and the acquisition of at least 240 credits, as well as the language requirements for the degree.

An application for the Pre-degree certificate must be submitted:

- electronically to the DS Secretary,
- in written, signed by the student, the supervisor and the supporting signatures of the DS Head, to the Directorate of Education.

2. Activities for the obtaining of a PhD degree

There is no doctoral candidate status for study programs and individual preparations started after 1 September 2016; in this case, the doctoral candidate must submit the dissertation within three years of passing the complex examination.

2.1 Complex exam

The two subjects included in the complex examination will be selected from the obligatory or compulsory elective subjects of the DI (one major and one minor) in such a way that they are related to the doctoral student's research field and topic. To pass the complex examination, a minimum of 90 credits must be obtained, of which at least 48 must be study credits. At the time of application for the examination, a minimum of 50 credits must be obtained.

To apply for the complex exam:

- The application form and the proposal of exam committee must be sent electronically and on paper to the DS Secretary (validated by the student's signature and the supporting signatures of the subject leader and the DS Head)
- The application must also be submitted in Neptun.

The complex exam consists of two parts:

- theoretical part, in which the doctoral candidate demonstrates his/her knowledge of the literature in the relevant discipline, his/her current theoretical and methodological knowledge, and
- dissertation part, in which the candidate shall report on his/her scientific progress.

The examination board will grade the theoretical and dissertation parts separately. The complex examination is successful if both parts are passed. A failed theoretical examination may be repeated once in the examination period for the subject not passed. The dissertation part of the examination may not be repeated in the event of failure. A record of the complex examination shall be kept. The result of the examination shall be announced on the day of the last part of the examination. The complex examination shall be marked in two grades, pass or fail. Successful completion of the complex examination is a condition for entry to the second stage, but the result does not count in the final grade.

2.2 Preparation of the doctoral thesis

In the case of programs started after 1 September 2016 or individual preparations started after 1 September 2016, the doctoral student must submit the doctoral thesis within three years of the complex examination. This deadline may be extended by up to one year, at the discretion of the TDHT, in cases of special circumstances, if the student is unable to fulfil the obligations arising from the student's status as a student through no fault of his/her own, due to childbirth, accident, illness or other unforeseen circumstances.

The thesis may also be submitted in a foreign language at the author's request and with the consent of the TDHT. The main results of the doctoral thesis must be summarised in a thesis.

2.3 Preliminary workplace discussion of the doctoral thesis

In order to support the author, the thesis should be submitted for discussion in a competent professional forum before it is finalised.

Prior to the public discussion, the PhD student's supervisor will invite two external referees to comment on the thesis, on the basis of a proposal from the thesis supervisor. The workplace supervisor will also request the chairperson of the discussion. It is the responsibility of the student and/or the supervisor to arrange and organise the date of the peer review.

Objections raised in the reviews and during the debate will be considered at the discretion of the author when preparing the final version of the thesis. Minutes and a record of attendance shall be kept of the presentation, discussion and the author's position.

2.5 Doctoral defense

For programs started after September 1, 2016, or for individual preparations started after September 1, 2016, the prerequisite for the application for the thesis is: the thesis and the thesis booklet must be prepared and submitted with the necessary other documents (publication list, copies of articles, etc.) to the Doctoral Office (Dean's Office).

The minimum publication requirements for the submission of a thesis are specified in the VMADI Rules of Procedure.

The doctoral defence is organised and managed in the following steps:

- Submission of the Application for defence and the Hungarian and English version of thesis booklet to the DS.

- The Head of the Doctoral School evaluates the application, proposes the referees and the members of the Committee together with the supervisor. Both reviewers must be external qualified experts with at least 3 years experience. The chairperson of the committee shall be a professor or professor emeritus of the University of Pannonia. The members of the Committee must not be co-authors of publications with the candidate.
- The TDHT approves the application, the proposal for the reviewers and the members of the Committee, if necessary by electronic vote. The Secretary of the DS will notify the candidate, his/her supervisor and the Doctoral Office (Dean's Office) of the decision and the composition of the Committee.
- The administrator of Doctoral Office (Dean's Office) in consultation with the DS Secretary, sends the thesis to the designated referees for refereeing.
- The administrator of Doctoral Office (Dean's Office) will organize and schedule the defence and inform the members of the committee.
- Afterwards, the technical organisation of the defence (room, equipment, official notification of the members of the committee, travel expenses, honorarium, announcement of the examination on the University of Pannonia website) is the responsibility of the Doctoral Office (Dean's Office). The Secretary of the DS will ensure that the thesis, the thesis booklets, the referees' comments and the replies to the thesis are posted on the ODT website.
- Following the defence, the University Doctoral and Habilitation Council decides on the award of the doctorate (PhD) on the basis of a recommendation from the Committee.

CHEMICAL ENGINEERING AND MATERIAL SCIENCES DOCTORAL SCHOOL SUBJECT LIST

MAIN SUBJECTS:

- The basics of micro and nano detection (*in Hungarian: A mikro- és nanoérzékelés alapjai*)
- Examination of material structure (*in Hungarian: Anyagszerkezeti vizsgálatok*)
- Material Science (*in Hungarian: Anyagtudomány*)
- Bio-nanotechnology (*in Hungarian: Bio-nanotechnológia*)
- Process Engineering Sciences (*in Hungarian: Folyamatmérnöki Tudományok*)
- Functional micro- and nanoparticles (*in Hungarian: Funkcionális mikro- és nanorészecskék*)
- Modern oil and petrochemical processes (*in Hungarian: Korszerű kőolajipari és petrolkémiai eljárások*)
- Modern chemical industry operations (*in Hungarian: Korszerű vegyipari műveletek*)
- Environmental Engineering (*in Hungarian: Környezetmérnöki Ismeretek*)
- Special materials for mechatronic systems (*in Hungarian: Mechatronikai rendszerek speciális anyagai*)
- Technical biotechnology (*in Hungarian: Műszaki biotechnológia*)
- Radioisotopic techniques and their application (*in Hungarian: Radioizotopos technikák és alkalmazásuk*)
- Selected organic chemical technologies (*in Hungarian: Válogatott szerves vegyipari technológiák*)

MINOR SUBJECTS ACCORDING TO THE MAIN LINES OF RESEARCH:

Materials Testing Methods and Surface Chemistry

- IR and Raman Spectroscopy (*in Hungarian: IR és Raman spektroszkópia*)
- Modern surface analysis methods (*in Hungarian: Modern felületanalitikai módszerek*)
- Nuclear measurement technology (*in Hungarian: Nukleáris mérés-technika*)
- Rheological studies (*in Hungarian: Reológiai vizsgálatok*)
- X-ray diffraction (*in Hungarian: Röntgendiffrakció*)
- Computer microscopy (*in Hungarian: Számítógépes mikroszkópia*)
- Determination of mechanical properties of solid bodies (*in Hungarian: Szilárd testek mechanikai jellemzőinek meghatározása*)
- Thermal analysis (*in Hungarian: Termikus analízis*)

Process Engineering Sciences

- Data Modeling Methods (*in Hungarian: Adatmodellezési módszerek*)
- Process Synthesis and Optimization (*in Hungarian: Folyamatszintézis és optimalizálás*)
- Management/Control algorithms (*in Hungarian: Irányítási algoritmusok*)
- Modern technology development (*in Hungarian: Korszerű technológiafejlesztés*)
- Modeling and Simulation (Integrated Course) (*in Hungarian: Modellezés és szimuláció (integrált tantárgy)*)

Intelligent Materials and Technologies

- Engineering applications of HIL / SIL technologies (*in Hungarian: HIL/SIL technológiák mérnöki alkalmazásai*)
- Soft intelligent materials and their applications (*in Hungarian: Lágy intelligens anyagok és alkalmazásaik*)
- Micro-electromechanical systems (*in Hungarian: Mikro-elektromechanikus rendszerek*)
- Optimal scaling of technology systems (material, energy and cost saving) (*in Hungarian: Technológiai rendszerek optimális (anyag-, energia- és költségtakarékos) méretezése*)

Material Systems and Procedures of Ceramic Industry

- Composite materials (*in Hungarian: Kompozit anyagok*)
- Modern technical ceramics (*in Hungarian: Korszerű műszaki kerámiák*)
- Modern technical glasses (*in Hungarian: Korszerű műszaki üvegek*)
- Nanostructured metals, ceramics, plastics (*in Hungarian: Nanoszerkezetű fémek, kerámiák, műanyagok*)
- Silicate chemistry (*in Hungarian: Szilikátkémia*)

Modern chemical operations

- Energetics (*in Hungarian: Energetika*)
- Modern liquid separation operations (*in Hungarian: Korszerű folyadékszeparációs műveletek*)
- Reaction Technique (*in Hungarian: Reakciótechnika*)
- Transport Theory (*in Hungarian: Transzportelmélet*)
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Environmental Engineering and Technology Systems

- Life cycle analysis (*in Hungarian: Életciklus elemzés*)
- Pharmaceutical chemistry and syntheses (*in Hungarian: Gyógyszerkémia és –szintézisek*)
- Homogeneous catalytic technological processes (*in Hungarian: Homogénkatalitikus technológiai eljárások*)
- Waste management (*in Hungarian: Hulladékgazdálkodás*)
- Industrial organic chemistry (*in Hungarian: Ipari szerves kémia*)
- Catalysis (*in Hungarian: Katalízis*)
- Environmental impact assessment, auditing (*in Hungarian: Környezetállapot értékelés, auditálás*)
- Environmental management systems (*in Hungarian: Környezetmenedzsment rendszerek*)
- Air quality protection (*in Hungarian: Levegőtisztaság-védelem*)
- Membrane separation processes in environmental protection (*in Hungarian: Membránszeparációs eljárások a környezetvédelemben*)
- Ecological risk assessment (*in Hungarian: Ökológiai kockázatbecslés*)
- Radioecology (*in Hungarian: Radioökológia*)
- Wastewater treatment technologies (*in Hungarian: Szennyvízkezelési technológiák*)
- Soil contamination, damage prevention (*in Hungarian: Talajszennyezések, kárelhárítás*)
- GIS applications (*in Hungarian: Térinformatikai alkalmazások*)

Petroleum industrial and petrochemical processes and products

- Chemistry and technology of lubricants (*in Hungarian: Kenőanyagok kémiai és technológiája*)
- Modern engine and jet engine fuels (*in Hungarian: Korszerű motor- és sugárhajtómű üzemanyagok*)
- Petroleum industry equipment and scaling (*in Hungarian: Kőolajipari berendezések és méretezésük*)
- Polymer chemistry and technology (*in Hungarian: Polimerek kémiai és technológiája*)
- Hydrocarbon industrial catalytic processes (*in Hungarian: Szénhidrogénipari katalitikus eljárások*)

Molecular and Nanotechnologies

- Analytical system biology (*in Hungarian: Analitikai rendszerbiológia*)
- Fundamentals of materials (*in Hungarian: Anyagszerkezeti ismeretek*)
- Bioellipsometry (*in Hungarian: Bioellipszometria*)
- Structure and function of biological macromolecules (*in Hungarian: Biológiai makromolekulák szerkezete és működése*)
- Electronmicroscopy in materials science (*in Hungarian: Elektronmikroszkópia az anyagtudományban*)
- Controlled release of drug: theories and applications (*in Hungarian: Ellenőrzött gyógyszerkioldás elmélete és gyakorlata*)
- Surface chemistry in biosensors (*in Hungarian: Felületkémia a bioszenzorokban*)
- Glycomics (*in Hungarian: Glikomika*)
- Integrated microsystems (*in Hungarian: Integrált mikrorendszerek*)
- Ion beam characterization and material modifications (*in Hungarian: Ionsugaras anyagvizsgálat és anyagmódosítás*)
- Label-free optical biosensors and their applications (*in Hungarian: Jelölésmentes optikai bioszenzorok és alkalmazásaik*)
- Up-to-date separation methods in biotechnology (*in Hungarian: Korszerű elválasztási módszerek a biotechnológiában*)
- Quantum chemistry I. (*in Hungarian: Kvantumkémia I.*)
- Quantum chemistry II. (*in Hungarian: Kvantumkémia II.*)
- Nanoscale physics (*in Hungarian: Nanoszerkezetek fizikája*)
- Particulate systems of controlled release (*in Hungarian: Szabályozott hatóanyagleadású részecskerendezetek*)

Technical Biotechnology

- Bioreactors (*in Hungarian: Bioreaktorok*)
- Enzymatic catalysis in non-conventional media (*in Hungarian: Enzimkatalitikus reakciók nem-konvencionális közegben*)
- Integrated systems in biotechnology (*in Hungarian: Integrált rendszerek a biotechnológiában*)
- Kinetics of complex enzymatic reactions (*in Hungarian: Komplex enzimes reakciók kinetikája*)