



DOCTOR OF PHILOSOPHY IN CHEMISTRY

■ FACULTY OF SCIENCE

DOCTOR OF PHILOSOPHY IN CHEMISTRY

Chemistry is a permeating basic science, a platform where scientific inquiries arise. Our doctoral program aspires to nurture and train outstanding scientists in Chemistry at international standards. The process highlights intensive research activities, building the “how to” and “problem solutions.” Diverse research topics span advanced basic scientific discoveries to applied research made practical in short periods of time. Our faculty and staff are competent with experiences. With the up-to-date facilities, tools, and research funds available for our faculty and their graduate students, including some scholarships, our accomplishments are soaring high in the area. Additionally, cooperation with scholars at home and abroad enables international research and research networking as well as international conferences to enrich our students.



Objectives

Desirable attributes of graduates are as follows:

- Excellent in knowledge and understanding of Chemistry.
- Well-rounded in world affairs with morality and professional ethics.
- Competent in R&D in Chemistry. Able to make innovative contributions, to develop research skills and to apply holistically in knowledge and research advancement of Chemistry.

Admission

In accordance with the Graduate School Rules and Regulations. The program committee reserves the rights to require more qualifications as deemed appropriate.

Medium of Instruction

Thai and English

Research Focus

- Conjugated polymers for organic light emitting diode, plastic solar cells and sensors
- Magnetic nanoparticles and related materials for drug delivery
- Natural products for medical and cosmetic applications
- Biomaterial and applications
- Flow-based analysis and applications
- Advanced material synthesis and applications
- Bioorganic and bioinorganic synthesis and applications

Requirement for Graduation

In accordance with the university Graduate School Rules and Regulations.



Doctor of Philosophy in Chemistry

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Structure of the Program

1. Credit Requirements. *

Requirements	Type 1.1	Type 2.1	Type 2.2
Coursework	-	12	24
Core Courses	-	3	12
Electives	-	9	12
Required Non-credit Courses	3	3	7
Dissertation	48	36	48
Total	48	48	72

* Minimum credits required.

2. Core Courses

Requirements	Type 1.1		Type 2.1		Type 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Spectroscopic Method for Chemical Analysis	-	-	-	-	256552	3
Sample Preparations and Separation Techniques for Chemical Analysis	-	-	-	-	256557	3
Advanced Techniques for Structural Analysis	-	-	-	-	256561	3
Innovation in Chemistry	-	-	256661	3	256661	3
Total	0	0	1	3	4	12

3. Electives

Requirements	Type 1.1		Type 2.1		Type 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Organic Chemistry Module						
Natural Products Chemistry	-	-	256621	3	256621	3
Chemistry of Aromatic Macromolecule and Supramolecule	-	-	256622	3	256622	3
Advanced Organic Reaction Mechanism	-	-	256623	3	256623	3
Advanced Research Topics in Organic Chemistry	-	-	256624	3	256624	3
Energy Chemistry	-	-	256662	3	256662	3
Inorganic Chemistry Module						
Integrated Inorganic Chemistry	-	-	256631	3	256631	3
Novel Inorganic Material	-	-	256632	3	256632	3
Molecular Devices and Machines	-	-	256633	3	256633	3
Inorganic Catalyst	-	-	256634	3	256634	3
X-ray Crystallography of Inorganic Materials	-	-	256635	3	256635	3
Advanced Research Topics in Inorganic Chemistry	-	-	256636	3	256636	3
Physical Chemistry Module						
Fluorescence Spectroscopy	-	-	256641	3	256641	3
Physical Chemistry of Solids	-	-	256642	3	256642	3
Electron Microscopy in Chemistry	-	-	256643	3	256643	3
Computational Structure Analysis	-	-	256644	3	256644	3

Requirements	Type 1.1		Type 2.1		Type 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Analytical Chemistry Module						
Applied Analytical Chemistry for Research	-	-	256651	3	256651	3
Application of Advanced Elucidation Techniques	-	-	256652	3	256652	3
Electronic for Chemical Analysis	-	-	256653	3	256653	3
Environmental of Chemistry and Pollutant Analysis	-	-	256654	3	256654	3
Advanced Research Topics in Analytical Chemistry	-	-	256655	3	256655	3
Industrial Chemistry Module						
Advanced Physical Ceramics	-	-	277621	3	277621	3
Composite Materials	-	-	277622	3	277622	3
Material Surface Analysis	-	-	277651	3	277651	3
Advanced Polymer Physics	-	-	277652	3	277652	3
Total	0	0	≥3	≥9	≥4	≥12

4. Required Non-credit Courses.

Requirements	Type 1.1		Type 2.1		Type 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Seminar I	256691	1	256691	1	256691	1
Seminar II	256692	1	256692	1	256692	1
Seminar III	256693	1	256693	1	256693	1
Seminar IV	-	-	-	-	256694	1
Research Methodology in Science and Technology	-	-	-	-	256511	3
Total	3	3	3	3	5	7

5. Dissertation Credit Requirements.

Requirements	Type 1.1		Type 2.1		Type 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Dissertation I, Type 1.1	256695	6	-	-	-	-
Dissertation II, Type 1.1	256696	6	-	-	-	-
Dissertation III, Type 1.1	256697	6	-	-	-	-
Dissertation IV, Type 1.1	256698	9	-	-	-	-
Dissertation V, Type 1.1	256699	9	-	-	-	-
Dissertation VI, Type 1.1	256791	12	-	-	-	-
Dissertation I, Type 2.1	-	-	256792	6	-	-
Dissertation II, Type 2.1	-	-	256793	6	-	-
Dissertation III, Type 2.1	-	-	256794	6	-	-
Dissertation IV, Type 2.1	-	-	256795	9	-	-
Dissertation V, Type 2.1	-	-	256796	9	-	-
Dissertation I, Type 2.2	-	-	-	-	256891	6
Dissertation II, Type 2.2	-	-	-	-	256892	6
Dissertation III, Type 2.2	-	-	-	-	256893	6
Dissertation IV, Type 2.2	-	-	-	-	256894	9
Dissertation V, Type 2.2	-	-	-	-	256895	9
Dissertation VI, Type 2.2	-	-	-	-	256896	12
Total	6	48	5	36	6	48

Course Descriptions

256511 Research Methodology in Science and Technology 3(3-0-6)

Definitions, characteristics and goals of research, research methodologies, types of research, variables and hypothesis, data collection, data analysis, research proposal and research report writing, research applications, ethics in research, and advanced research techniques in science and technology.

256552 Spectroscopic Method for Chemical Analysis 3(2-2-5)

Principles and applications of spectroanalysis chemistry, such as ultraviolet-visible spectroscopy, infrared spectroscopy, Raman spectroscopy, nuclear magnetic resonance spectroscopy, mass spectroscopy, and electron spin resonance.

256557 Sample Preparations and Separation Techniques for Chemical Analysis 3(2-2-5)

Advanced principles and applications of sample pretreatments and separation techniques prior to chemical analysis using modern digestion techniques, such as ultrasound-assisted extraction, microwave-assisted extraction and analyte separation from the sample matrices, including solid phase extraction, microextraction, and superficial fluid extraction.

256561 Advanced Techniques for Structural Analysis 3(2-2-5)

Analysis of various types of techniques in structural analysis, such as x-ray and neutron scattering, scanning probe microscopy and solid-state nuclear magnetic resonance spectroscopy (SSNMR).

256621 Natural Products Chemistry 3(3-0-6)

Chemistry of natural products, bioactive compounds, synthesis of natural products with complex structures, and structural identification with spectroscopic techniques.

256622 Chemistry of Aromatic Macromolecule and Supramolecule 3(3-0-6)

Study of advanced organic chemistry; conjugation alkadienes and allylic systems; arenes; macro aromaticity and annulene system together with the reaction of arene; alkynyl benzene and other functional group chemistry with emphasis on aromatic and carbonyl containing molecules and selected topics, such as macro heterocyclic compounds, macromolecules, supramolecular molecules, and biomolecules.

256623 Advanced Organic Reaction Mechanism 3(3-0-6)

Principles and purposes of various reaction mechanisms in organic chemistry including basic theories to describe the reaction in terms of mechanistic study, experimental designs and investigations of the reaction mechanisms, structural factors that affect reactions, and recent topics of reaction mechanisms.

256624 Advanced Research Topics in Organic Chemistry 3(2-2-5)

Recent research topics in organic chemistry, advanced methods in organic synthesis, special characterization protocols, and advanced applications in organic chemistry.

256631 Integrated Inorganic Chemistry 3(2-2-5)

Advanced inorganic chemistry related and applied to organic chemistry, physical chemistry, biological chemistry, and other related fields.

256632 Novel Inorganic Material 3(2-2-5)

Bonding, structures, spectroscopy, and synthesis and characterizations of inorganic chemistry for new inorganic materials.

256633 Molecular Devices and Machines 3(2-2-5)

Supramolecular chemistry, general concepts for devices and machines at the molecular level, devices for processing electrons and electronic energy, memories, logic gates and related systems, and molecular-scale machines.

256634 Inorganic Catalyst 3(2-2-5)

Types, preparations and characterization of inorganic catalysts, and reaction mechanisms and their applications.

256635 X-ray Crystallography of Inorganic Materials 3(2-2-5)

Extensive study of single crystal growth, point groups, space groups, X-ray diffraction, and inorganic structure refinement.

256636 Advanced Research Topics in Inorganic Chemistry 3(2-2-5)

Rational designs and synthesis of inorganic based materials, advanced characterization techniques, and smart-advanced and multifunctional material applications.

256641 Fluorescence Spectroscopy 3(3-0-6)

Adsorption of UV-visible lights, energy transfer processes of molecules, characteristics of light emissions, effects of excimer/excimer formation on the emission processes, effects of solvent on emissions, and principles and techniques of steady spectroscopy in advanced research.

256642 Physical Chemistry of Solids 3(3-0-6)

Applications of physical and solid state chemistry to the structures and properties of solids as used in solid state devices, ceramics, and metallurgy; equilibrium and free energy of heterogeneous systems; thermodynamics of solutions; chemical kinetics; diffusion; and solid state transformations.

256643 Electron Microscopy in Chemistry**3(3-0-6)**

Theories of electron optics and principles of transmission electron microscopy including dynamical theory of electron diffraction and image contrast; applications to material analysis including defects, boundaries, and phase analysis; and analysis of electron microscopy including convergent beam diffraction, energy dispersive x-ray analysis, and energy loss spectroscopy.

256644 Computational Structure Analysis**3(3-0-6)**

Principles and theories of quantum chemistry to calculate the possible structures using commercial computer software, such as Gaussian03; and useful data that support IR and NMR data.

256651 Applied Analytical Chemistry in Research**3(2-2-5)**

Aspects of theories underlying modern analytical chemistry for research application, methods development in research in analytical chemistry and applications of analytical techniques to actual problems in research, and instrument development for laboratory settings, experimental designs and optimization, uses of statistics for analysis and treatment of data, and quality control and assurance of developed analytical techniques with emphasis on application to analysis of real samples.

256652 Application of Advanced Elucidation Techniques**3(2-2-5)**

Application of advanced techniques, such as 1-D and 2-D nuclear magnetic resonance, spectroscopy, scanning electron microscopy, transmitted electron microscopy, differential elucidation, X-ray diffractometer, energy dispersive spectroscopy for structural elucidation, determination of physical and chemical properties of organic and inorganic compounds, and exploitation of various techniques for research.

256653 Electronic Chemical Analysis**3(2-2-5)**

Application of electronics involving chemical processes, principles of measurement and control systems, design of analog circuits and digital circuits, electric signal analysis of chemical processes, system analysis of chemical instrumental designs, chemtronics, and cheminformatics.

256654 Environmental Chemistry and Pollutant Analysis**3(2-2-5)**

Study of chemical pollutants contaminating the environment including water, atmosphere, and soil; mechanism of contamination and chemical reaction of pollutant transformation in the environment; chemical equilibrium and thermodynamics concerning mechanism of transformations and contaminations; and case studies of pollutant contamination.

256655 Advanced Research Topics in Analytical Chemistry**3(2-2-5)**

Advanced research protocols in analytical chemistry emphasizing current topics and applications of advanced instrumentations and techniques in analytical chemistry research.

256661 Innovation in Chemistry**3(2-2-5)**

Innovative processes in chemistry, IP searching, IP mapping, writing IP in chemistry; and processes and approaches for creation of innovation in chemistry from industrial and private sectors.

256662 Energy Chemistry**3(2-2-5)**

Storage energy in chemical form, fossil energy, alternative energy, renewable energy, and chemical energy transformation; formation of renewable energy synthesis of absorption material for storage energy; application of quantum calculations of biodiesel formations; structural identifications of starting materials; intermediate energy level; and analysis of products and production of biomass via electrophoresis.

256691 Seminar I**1(0-2-1)**

Discussion and presentation of research topics in chemistry with emphasis on researching and criticizing information from research and articles.

256692 Seminar I**1(0-2-1)**

Discussion and presentation of theories and recent topics in respective branches of chemistry for increasing experience in writing the dissertation.

256693 Seminar III**1(0-2-1)**

Discussion and presentation of theories and experiments of current topics related to the dissertation.

256694 Seminar IV**1(0-2-1)**

Discussion and presentation of theories and progress of the topic of the dissertation.

256695 Dissertation I, Option 1.1**6 credits**

Literature search on interesting topics from various databases, submission of an executive summary of the literature review with new ideas/concepts, and submission of a report to the dissertation advisors and the supervisory committee.

256696 Dissertation II, Option 1.1**6 credits**

Examination of new ideas/concepts obtained from previous literature search, conducting multiple and repeated experiments, submitting an executive summary of experimental results performed during the semester with additional and new ideas/concepts, and submitting a report to the dissertation advisors and the dissertation supervisory committee.

256697 Dissertation III, Option 1.1**6 credits**

Detailed analysis of the results obtained from previous experiments possibly involving comparison with related theories, results of data analysis important for further experimental plans, and submitting the completed dissertation proposal examined by the dissertation supervisory committee.

256698 Dissertation IV, Option 1.1**9 credits**

Extensive experimental work closely following the experimental plans in the dissertation proposal with nearly completed results examined by the dissertation supervisory committee, and submitting and presenting an executive summary of the experimental results performed during the semester to the dissertation advisors or the supervisory committee.

256699 Dissertation V, Option 1.1**9 credits**

Detailed analysis of experimental results, conducting additional experiments if necessary, using experimental results and data analysis in writing a research article and dissertation, and producing one full length draft of an international article and one full length draft of either an international or national article.

256791 Dissertation VI, Option 1.1**12 credits**

Writing a research article and dissertation for examination, passing the dissertation defense with the dissertation supervisory committee, correcting and submitting the completed dissertation to the Graduate School, and producing one full length draft of an international article and one full length draft of either an international or national article.

256792 Dissertation I, Option 2.1**6 credits**

Literature search on interesting topics from various databases, submission of an executive summary of the literature review with new ideas/concepts, and submission of a report to the dissertation advisors and the supervisory committee.

256793 Dissertation II, Option 2.1**6 credits**

Examination of new ideas/concepts obtained from the previous literature search, conducting multiple and repeated experiments, submitting an executive summary of experimental results performed during the semester with additional and new ideas/concepts, and submitting a report to the dissertation advisors and the dissertation supervisory committee.

256794 Dissertation III, Option 2.1**6 credits**

Detailed analysis of experimental results, conducting additional experiments if necessary, using experimental results and data analysis in writing a research article and dissertation, and producing one full length draft of an international article and one full length draft of either an international or national article.

256795 Dissertation IV, Option 2.1**9 credits**

Detailed analysis of experimental results, conducting additional experiments if necessary, using experimental results and data analysis in writing a research article and dissertation, and producing one full length draft of an international article and one full length draft of either an international or national article.

256796 Dissertation V, Option 2.1**9 credits**

Writing a research article and dissertation for examination, passing the dissertation defense with the dissertation supervisory committee, correcting and submitting the completed dissertation to the Graduate School, and producing one full length draft of an international article and one full length draft of either an international or national article.

256891 Dissertation I, Option 2.2**6 credits**

Literature search on interesting topics from various databases, submission of an executive summary of the literature review with new ideas/concepts, and submission of a report to the dissertation advisors and the supervisory committee.

256892 Dissertation II, Option 2.2**6 credits**

Examination of new ideas/concepts obtained from previous literature search, conducting multiple and repeated experiments, submitting an executive summary of experimental results performed during the semester with additional and new ideas/concepts, and submitting a report to dissertation advisors and the dissertation supervisory committee.

256893 Dissertation III, Option 2.2**6 credits**

Detailed analysis of the results obtained from previous experiments possibly involving comparison with related theories, results of data analysis important for further experimental plans, and submitting the completed dissertation proposal examined by the dissertation supervisory committee.

256894 Dissertation IV, Option 2.2**9 credits**

Extensive experimental work closely following the experimental plans in the dissertation proposal with nearly completed results examined by the dissertation supervisory committee, and submitting and presenting an executive summary of the experimental results performed during the semester to the dissertation advisors or the dissertation supervisory committee.

256895 Dissertation V, Option 2.2**9 credits**

Detailed analysis of experimental results, conducting additional experiments if necessary, using experimental results and data analysis in writing a research article and dissertation, and producing one full length draft of an international article and one full length draft of either an international or national article.

256896 Dissertation VI, Option 2.2**12 credits**

Writing a research article and dissertation for examination, passing the dissertation defense with the dissertation supervisory committee, correcting and submitting the completed dissertation to the Graduate School, and producing one full length draft of an international article and one full length draft of either an international or national article.

277621 Advanced Physical Ceramics**3(3-0-6)**

Characteristics of vitreous and crystalline inorganic nonmetallic materials; and applications and discussions of effects of composition and microstructure on thermal, mechanical, optical, electrical, and magnetic properties of ceramic products.

277622 Composite Materials**3(3-0-6)**

Application of the fundamental concepts of mechanics, elasticity, and plasticity to multiphase and composite materials; constitutive equations for the mechanical and physical properties of metal, ceramic, and polymeric matrix composites; and the role of processing and microstructure on properties.

277651 Material Surface Analysis**3(3-0-6)**

Surface analytical techniques for polymers, ceramics, metals, and alloys, such as X-ray photoelectron spectroscopy (XPS), scanning tunneling microscopy (STM), atomic force microscopy (AFM), auger electron spectroscopy (AES), and other techniques.

277652 Advanced Polymer Physics**3(3-0-6)**

Mechanical, optical, and transport properties of polymers; physical chemistry of polymers in melt solution and solid state; conformation and molecular dimensions of polymer chains in solutions, melts, blends, and block copolymers; and thermodynamics of polymer solutions, blends, crystallization, and relationship between structures and properties of polymers.

277653 Advanced Research Topics in Materials and Polymers 3(2-2-5)

Interesting topics in materials and polymers, special characterization protocol, recent and modern processes, and advanced applications in materials and polymers.