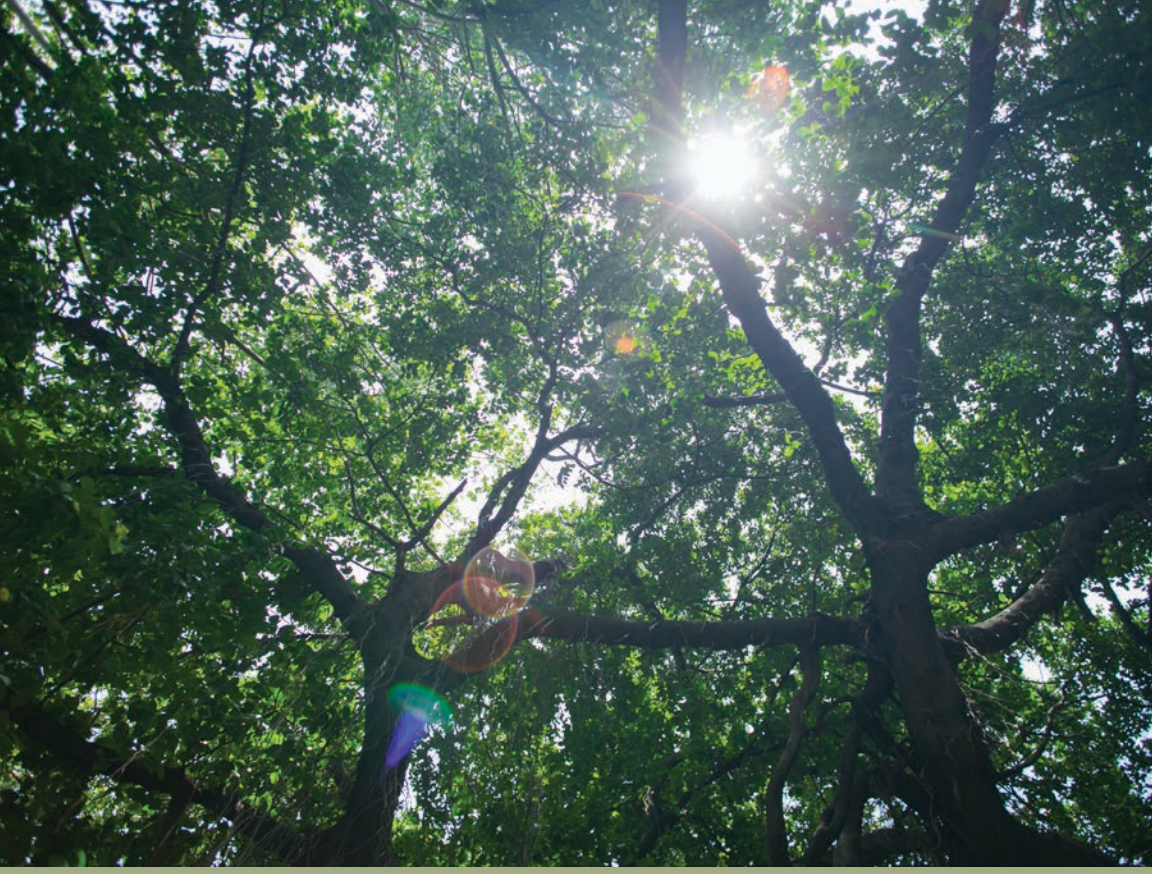

DOCTOR OF PHILOSOPHY PROGRAM IN ENVIRONMENTAL ENGINEERING

- FACULTY OF ENGINEERING

DOCTOR OF PHILOSOPHY PROGRAM IN ENVIRONMENTAL ENGINEERING

The doctoral program in Environmental Engineering is committed to producing capable graduates with a well-rounded set of up-to-date skills. The program's mission emphasizes new integrated knowledge of philosophy, local wisdom, technologies and cutting-edge knowledge, necessary in coping with threatening environmental changes and toxic management on a solid ethical foundation. The faculty houses four research centers in accordance with the program's research focus.

Objectives

Expected outcomes upon graduation are:

- Advanced knowledge and expertise in research and innovation in the area of toxic management.
- Capable of conducting research in environmental engineering at the international standards.
- Professionally ethical.

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

- Environmental Toxic Substance Removal: CeTox
- Air Pollution
- Energy for the Environment
- Climate Change, Natural Resources, and Disaster Research Unit

Requirement for Graduation

In accordance with the Graduate School Rules and Regulations.

Doctor of Philosophy Program in **Environmental Engineering**

■ FACULTY OF ENGINEERING

Structure of the Program

1. Credit Requirements. *

Requirements	Option 1.1	Option 1.2	Option 2.1	Option 2.2
Coursework	-	-	12	24
Core Courses	-	-	6	12
Electives	-	-	6	12
Required Non-credit Courses	3	6	3	6
Dissertation	48	72	36	48
Total	**48**	**72**	**48**	**72**

* Minimum credits required.

2. Core Courses

Requirements	Option 1.1		Option 1.2		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits	Course No.	Credits
Environmental Contaminant Removal	-	-	-	-	307601	3	-	-
Environmental Toxic Substances and Removal Technology	-	-	-	-	307602	3	-	-
Physico-Chemical-Biological Processes and Reaction Kinetics	-	-	-	-	-	-	307502	3

Requirements	Option 1.1		Option 1.2		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits	Course No.	Credits
Environmental Fate and Transport of Pollutants	-	-	-	-	-	-	307503	3
Environmental Contaminant Removal	-	-	-	-	-	-	307601	3
Environmental Toxic Substances and Removal Technology	-	-	-	-	-	-	307602	3
Total	**0**	**0**	**0**	**0**	**2**	**6**	**4**	**12**

3. Electives

Requirements	Option 1.1		Option 1.2		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits	Course No.	Credits
Environmental Toxicology	-	-	-	-	307631	3	-	-
Environmental Nanotechnology	-	-	-	-	307632	3	-	-
Aquatic Chemistry	-	-	-	-	307641	3	-	-
Environmental Organic and Inorganic Chemistry	-	-	-	-	307642	3	-	-
Air Pollution and Control	-	-	-	-	-	-	307511	3
Design of Air Pollution and Control System for Industry	-	-	-	-	-	-	307512	3

Requirements	Option 1.1		Option 1.2		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits	Course No.	Credits
Advanced Wastewater Treatment Process	-	-	-	-	-	-	307521	3
Advanced Water Supply Technology	-	-	-	-	-	-	307522	3
Integrated Municipal Solid Waste Engineering and Management	-	-	-	-	-	-	307531	3
Advanced Hazardous Waste Management	-	-	-	-	-	-	307532	3
Site Remediation	-	-	-	-	-	-	307534	3
Environmental and Health Risk Assessment	-	-	-	-	-	-	307536	3
Climate Change and Ecosystem	-	-	-	-	-	-	307611	3
Natural Treatment Engineering	-	-	-	-	-	-	307621	3
Environmental Toxicology	-	-	-	-	-	-	307631	3
Environmental Nanotechnology	-	-	-	-	-	-	307632	3
Aquatic Chemistry	-	-	-	-	-	-	307641	3
Environmental Organic and Inorganic Chemistry	-	-	-	-	-	-	307642	3
Total	**0**	**0**	**0**	**0**	**4**	**≥6**	**14**	**≥12**

4. Required Non-credit Courses.

Requirements	Option 1.1		Option 1.2		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits	Course No.	Credits
Seminar 1	307650	1	307650	1	307650	1	307650	1
Seminar 2	307651	1	307651	1	307651	1	307651	1
Seminar 3	307652	1	307652	1	307652	1	307652	1
Research Methodology in Science and Technology	-	-	307581	3	-	-	307581	3
Total	**3**	**3**	**4**	**6**	**3**	**3**	**4**	**6**

5. Dissertation Credit Requirements.

Requirements	Option 1.1		Option 1.2		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits	Course No.	Credits
Dissertation 1, Type 1.1	307661	6	-	-	-	-	-	-
Dissertation 2, Type 1.1	307662	6	-	-	-	-	-	-
Dissertation 3, Type 1.1	307663	9	-	-	-	-	-	-
Dissertation 4, Type 1.1	307664	9	-	-	-	-	-	-
Dissertation 5, Type 1.1	307665	9	-	-	-	-	-	-
Dissertation 6, Type 1.1	307666	9	-	-	-	-	-	-
Dissertation 1, Type 1.2	-	-	307671	3	-	-	-	-
Dissertation 2, Type 1.2	-	-	307672	6	-	-	-	-
Dissertation 3, Type 1.2	-	-	307673	9	-	-	-	-
Dissertation 4, Type 1.2	-	-	307674	9	-	-	-	-
Dissertation 5, Type 1.2	-	-	307675	9	-	-	-	-
Dissertation 6, Type 1.2	-	-	307676	12	-	-	-	-
Dissertation 7, Type 1.2	-	-	307677	12	-	-	-	-
Dissertation 8, Type 1.2	-	-	307678	12	-	-	-	-
Dissertation 1, Type 2.1	-	-	-	-	307681	3	-	-
Dissertation 2, Type 2.1	-	-	-	-	307682	6	-	-

Requirements	Option 1.1		Option 1.2		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits	Course No.	Credits
Dissertation 3, Type 2.1	-	-	-	-	307683	9	-	-
Dissertation 4, Type 2.1	-	-	-	-	307684	9	-	-
Dissertation 5, Type 2.1	-	-	-	-	307685	9	-	-
Dissertation 1, Type 2.2	-	-	-	-	-	-	307691	6
Dissertation 2, Type 2.2	-	-	-	-	-	-	307692	6
Dissertation 3, Type 2.2	-	-	-	-	-	-	307693	9
Dissertation 4, Type 2.2	-	-	-	-	-	-	307694	9
Dissertation 5, Type 2.2	-	-	-	-	-	-	307695	9
Dissertation 6, Type 2.2	-	-	-	-	-	-	307696	9
Total	**6**	**48**	**8**	**72**	**5**	**36**	**6**	**48**

Course Descriptions

307502 Physico-Chemical-Biological Processes and Reaction Kinetics 3(2-2-5)

Physico-chemical-biological unit processes and reactions, derivation of a mathematical equation for the expression of reaction rate, kinetics of microorganism growth, interpretation of data from a reaction kinetic experiment, mass transfer via diffusion and advection, mass transfer across phases, and mass transfer coupled with chemical reactions.

307503 Environmental Fate and Transport of Pollutants 3(2-2-5)

Chemical properties and applied principles of chemical fate and transport in atmospheric, aquatic, and subsurface environments and biodata; partitioning coefficient; solubility; absorption into soil and sediment; vaporisation; biodegration; hydrolysis; and development and hands-on experience of using mathematical modeling tools for predicting fate and transport of pollutants in the environment.

307511 Air Pollution and Control 3(2-2-5)

Introduction to air pollution, air pollutants and sources, effects of air pollution, air pollution meteorology, pollutant and gas control, and laws and regulations.

307512 Design of Air Pollution Control Systems for Industry 3(2-2-5)

Principles and design of air pollution control units for particulates and gases for industry, gravity setters, incinerators, cyclone, electrostatic precipitators, fabric filters, wet scrubbers, absorption, ventilation systems design for industry, and operation and maintenance.

307521 Advanced Wastewater Treatment Processes 3(2-2-5)

Advanced technologies and processes for the treatment of recalcitrant compounds in wastewater, processes for industrial wastewater re-use, advanced oxidation, absorption, ion exchange, membrane filtration, biological wastewater treatment for toxic substances, and emerging technologies.

307522 Advanced Water Supply Technology 3(2-2-5)

Applied principles of water equilibrium; quality of natural water, portable water, and wastewater; aquatic pollutants and toxic compounds; theories and advanced processes for producing portable water; drinking water and industrial water; water recycling and re-use; and management of water for cooling systems.

307531 Integrated Municipal Solid Waste Engineering and Management 3(2-2-5)

Regulatory and hierarchical aspects of integrated solid waste management; characterisation properties of MSW; collection, transfer, and transport of solid waste; separation, processing, and recycling of waste material; solid waste disposal by combustion processes and incineration; landfill design for solid waste disposal; compositing of solid waste; public participation; and innovative approaches, suchas waste-to-energy processes.

307532 Advanced Hazardous Waste Management 3(2-2-5)

Classification and characterisation of hazardous waste, physico-chemical and biological properties of hazardous waste, fate and transport of hazardous waste in the environment, toxicology and risk assessment, hazardous waste treatment and disposal technology, and site remediation.

307534 Site Remediation 3(2-2-5)

Environmental and health impacts due to contamination by hazardous compounds, monitoring, site investigation and characterization, risk assessment, selection of remedial technologies, and evaluation of site remediation efficiency.

307536 Environmental and Health Risk Assessment 3(2-2-5)

Systems analysis, methods for environmental risk management, exposure-response relationships, quantitative risk assessment, concepts of health impact assessments and methods, and applications and implementation.

307581 Research Methodology in Science and Technology 3(3-0-6)

Research definition, characteristics, and goals; research process types; research problem determination; variables and hypotheses; data collection and analysis; research proposal and report writing; research evaluation; research application; ethics for researchers; and research techniques in science and technology.

307601 Environmental Contaminant Removal 3(2-2-5)

Contaminant removal using physical and chemical processes and methods, chemical reaction, mathematical equations for the expression of reaction rates, mechanism and kinetics, interpretation and data from a reaction kinetic experiment, mass transfer via diffusion and advection, mass transfer across phases, mass transfer coupled with chemical reactions, contaminant removal by biological processes, microorganism growth, and kinetics of microorganism growth and applications.

307602 Environmental Toxic Substances and Removal Technology 3(2-2-5)

Environmental toxic substances, such as pesticides, persistent pollutants, polycyclic aromatic hydrocarbons, radionuclides and heavy metals; fundamental chemistry of toxic substances; contamination; fate and transport in water and soil; toxicity; and treatment technologies of toxic substances in the environment.

307611 Climate Change and Ecosystems 3(2-2-5)

Overview of climate change; greenhouse effects and global warming; natural causes of climate change; solar and terrestrial causes; the assessment of climate change induced by anthropogenic causes; changes, sources, and sinks of greenhouse gases in ecosystems; the impact of climate change on the biodiversity of ecosystems; adaptation and vulnerability of ecosystems; and climate change and potential impacts on Thailand.

307621 Natural Treatment Engineering 3(2-2-5)

The use of indigenous microbes for the removal of toxic substances; nutrient re-use; principles and types of natural treatments; soil reclamation; treatment via aquatic plants; algae ponds; stabilising ponds, wetlands; and phytoremediation and other technologies using natural treatment principles.

307631 Environmental Toxicology 3(2-2-5)

Basic principles of toxicology; types of pollutants in environments including naturally originated and anthropogenic substances; health effects of pollutants in environments; legal control of pollutants; toxicity of chemically contaminated food, water, and air; toxicity of heavy metals and trace organic compounds; and risk assessment of environmental and public health.

307632 Environmental Nontechnology 3(2-2-5)

Fundamentals of nanotechnology, types of pollutants treatable by nano materials, titanium dioxide, nano scale zerovalent iron, magnetic nanoparticles, nano-sorbent technology, selection of nano-scaled reactions for pollutant removal, treatment efficiency and reaction by-product and intermediates from nano-enabled treatment technologies, and health and safety of nano material utilization.

307641 Aquatic Chemistry 3(2-2-5)

Chemical behavior of water and contaminants in natural water, wastewater, and treated water; kinetic chemistry; chemical equilibrium; acid-based equilibrium; ion complexation, precipitation, and dissolution; oxidation reduction; surface complexation on solid surfaces; applications of advanced theory for the prediction or estimation of fate and transport of pollutants in natural and engineered systems; and sophisticated instrumentation for pollutant characterisation.

307642 Environmental Organic and Inorganic Chemistry 3(2-2-5)

Physical and chemical transformations affecting the fate of organic and inorganic contaminants in natural and treated waters; environmental factors that govern the processes determining the fate of organic chemicals in natural and engineered systems; environmental behavior of organic materials including solubility, vapour pressure, air-water exchange, sorbtion, abiotic and biotic reactions, and photodegredation.

307643 Seminar 1 1(0-2-1)

Practicing how to search, read, critically analyse and present research or articles of current interest in environmental engineering.

307651 Seminar 2 1(0-2-1)

Presenting and discussing current research in environmental engineering which is relevant to a proposed dissertation research project.

307652 Seminar 3 1(0-2-1)

Practicing how to write and present research in environmental engineering.

307661 Dissertation 1, Option 1.1 6Credits

Undertaking a literature review of basic knowledge and research relevant to the topic, creating guidelines and hypotheses for the proposed research, and submitting a summary research and progress report.

307662 Dissertation 2 Option1.1 6Credits

Undertaking a further literature review and intensive study of basic knowledge and research relevant to the topic, reviewing frameworks and guidelines, and submitting a summary report of the research and progress.

307623 Dissertation 3, Option 1.1 9Credits

Setting up research hypotheses, conducting research within guidelines and frameworks, and presenting a summary report of the research and progress.

307664 Dissertation 4, Option 1.1 9Credits

Preparing a dissertation proposal; conducting the research following the defined methodology, frameworks, and guidelines; and submitting a progress report.

307665 Dissertation 5, Type 1.1 9Credits

Reviewing and summarising the preliminary research results, preparing an articles(s) suitable for publication in national or international mathematical journals, and submitting a summary research and progress report.

307666 Dissertation 6, Option 1.1 9Credits

Completing the research results, writing up the complete dissertation, passing the dissertation defense, making any required corrections to the dissertation, and submitting a copy of the completed dissertation to the Graduate School.

307671 Dissertation 1, Option 1.2 3Credits

Conduct a literature review of relevant journals, data bases, and research articles on fundamental knowledge of topics of interest; creating foundations and guidelines for the establishment of hypotheses for proposed dissertation research; and submitting a summary report of the research and progress.

307672 Dissertation 2 Option1.1 6Credits

Undertaking a further literature review and intensive study of basic knowledge and research relevant to the topic, reviewing the frameworks and guidelines, and submitting a summary report of the research and progress.

307673 Dissertation 3, Option 1.2 9Credits

Undertaking a literature review of basic knowledge and research relevant to the topic, creating possible guidelines and hypotheses for the proposed research, and submitting a summary report of the research progress.

307674 Dissertation 4, Option1.2 9Credits

Conducting preliminary research within the established guidelines and frameworks, and submitting a summary research progress report.

307675 Dissertation 5, Option 1.2 9Credits

Conducting in-depth research within allocated frameworks and guidelines, presenting a dissertation proposal, and submitting a summary report of the research and progress.

307676 Dissertation 6, Option 1.2 12 Credits

Conducting in-depth research within the allocated guidelines and frameworks, and presenting a summary research and progress report.

307677 Dissertation 7, Option 1.2 12 Credits

Conducting a review of the research, making any improvements or modifications to the research articles based on expert opinions, and presenting a summary of the research and progress.

307678 Dissertation 8, Option 1.2 12 Credits

Passing the dissertation defense, making any required corrections to the dissertation based on the examiners comments and recommendations, and submitting a copy of the completed dissertation to the Graduate School.

307681 Dissertation 1, Option 2.1 3 Credits

Undertaking a literature review of various databases on the basic knowledge and research relevant to the topic, creating guidelines and frameworks for setting up hypotheses for a proposed research project, and submitting a summary research and progress report.

307682 Dissertation 2, Option 2.1 6 Credits

Researching and compiling further information relevant to the research and within the frameworks and guidelines, and submitting a summary research and progress report.

307683 Dissertation 3, Option 2.1 9 Credits

Setting up research hypotheses, conducting research within guidelines and frameworks, and submitting a summary report of the research and progress.

307684 Dissertation 4, Option 2.1 9Credits

Reviewing the research making any improvements or modifications necessary based on expert opinions and submitting a summary report of the research and a progress report.

307685 Dissertation 5, Option 2.1 9Credits

Passing the dissertation defense, making any corrections necessary according to comments from the examiners, and submitting the final dissertation to the Graduate School.

307691 Dissertation 1, Option 2.2 6Credits

Conducting a literature review in various databases and research articles on fundamental knowledge on topics of interest, creating guidelines for hypotheses establishment, and submitting a report on research and progress.

307692 Dissertation 2, Option 2.2 6Credits

Conducting further research, compiling further information, guidelines and frameworks, and submitting a summary research and progress report.

307693 Dissertation 3, Option 2.2 9Credits

Setting up research hypotheses, conducting research within the frameworks and guidelines, and submitting a summary research and progress report.

307694 Dissertation 4, Option 2.2 9Credits

Conducting research within allocated guidelines and frameworks, presenting a dissertation proposal and a summary report of the research findings.

307695 Dissertation 5, Option 2.2 **9 Credits**

Reviewing the research making any improvements or modifications necessary based on expert opinions and submitting a summary report of the research and a progress report.

307696 Dissertation 6, Option 2.2 **9 Credits**

Passing the dissertation defense, making any corrections necessary according to comments from the examiners, and submitting a final dissertation to the Graduate School.