Doctor of Philosophy Program in Pharmaceutical Engineering
(International Program/Revised Program 2018)
Department of Pharmaceutical Technology

Name of the Program

Thai	หลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาวิศวเภสัชกรรม (หลักสูตรนานาชาติ)
English	Doctor of Philosophy Program in Pharmaceutical Engineering (International Program)

Title of the Degree

Thai	ปรัชญาดุษฎีบัณฑิต (วิศวเภสัชกรรม) ปร.ด. (วิศวเภสัชกรรม)
English	Doctor of Philosophy (Pharmaceutical Engineering) Ph.D. (Pharmaceutical Engineering)

Study Venue

Faculty of Pharmacy, Silpakorn University, Sanam Chandra Palace Campus, Nakhon Pathom

Collaboration with other institutes

This curriculum is in collaboration with the Graduate School of Pharmaceutical Sciences of Chiba University (Japan) under the Double Doctoral Degree Program. The program provides graduate students the opportunities to study and do research at Chiba University. Student who partakes in the double degree program can receive two Doctoral's degrees from Silpakorn University and Chiba University.

Degree Awarded

Student(s) enrolling the Double Doctoral Degree Program will receive a Doctor of Philosophy (Pharmaceutical Engineering) from Silpakorn University and a Doctor of Philosophy (Pharmaceutical Sciences) from the Graduate School of Pharmaceutical Sciences of Chiba University. However, students who do not participate in the program will receive only a Doctor of Philosophy (Pharmaceutical Engineering) from Silpakorn University.

Objectives

1. To produce professionals who can advance research in pharmaceutical engineering, and bring about self developments in discipline, moral, and code of conduct.
2. To create new knowledge, theory, technology based on interdisciplinary integration that will support sustainable domestic industries, and also international industries

Qualifications of Applicants

1. Graduates of a Bachelor degree in pharmacy, health sciences, sciences, or engineering program with a "very good" level of GPA

2. Graduates of a Master degree in pharmacy, health sciences, sciences, or engineering program with a "very good" or "good" level of GPA

3. English examination result according to the committee of Higher Education council or to the announcement of Silpakorn University as of standard English proficiency test for the admission of doctorate study

4. Accordance with Silpakorn University's 2007 Regulations on Graduate Study and/or later revision and/or updated amendment

5. Graduates of a Bachelor or Master degree in pharmacy, health sciences, sciences, or engineering program with qualifications as required by Royal Golden Jubilee Ph.D. Program.

6. Other qualifications may also apply as reviewed by Committee of Faculty of Pharmacy

Curriculum Structure

1. Type 1.1

Core courses (non-credit)	7	credits
Thesis (equivalent to)	48	credits
Credits earned from entire program	48	credits

2. Type 1.2

Core courses (non-credit)	7	credits
Thesis (equivalent to)	72	credits
Credits earned from entire program	72	credits

3. Type 2.1

Core courses	7	credits
Elective courses not less than	5	credits
Thesis (equivalent to)	36	credits
Minimum credits earned from entire program	48	credits

4. Type 2.2

Core courses	13	credits
Elective courses not less than	11	credits
Thesis (equivalent to)	48	credits
Minimum credits earned from entire program	72	credits

Course List

Remedial Courses (Non-credit) 6 credits

Student who did not earn a degree in pharmacy must also need to take remedial courses as suggested by advisor and curriculum committee. However, the credits earned from these courses will not be counted as cumulative credits of the program

551 708	Principles of Pharmaceutical Engineering	3(3-0-6)
551 742	Basic Theory in Industrial Pharmacy	3(3-0-6)

1. Type 1.1: There are 48 credits for thesis and 7 credits for additional non-credit courses that will be assessed as S/U as follows;

1.1 Core Courses (Non-credit) 7 credits

550 535	Research Methodology in Pharmaceutical Engineering	3(3-0-6)
551 681	Seminar in Pharmaceutical Engineering I	1(0-3-0)
551 682	Seminar in Pharmaceutical Engineering II	1(0-3-0)
551 683	Special Problem in Pharmaceutical Engineering I	1(0-3-0)
551 684	Special Problem in Pharmaceutical Engineering II	1(0-3-0)

1.2 Thesis (equivalent to) 48 credits

550 911	Thesis	equivalent to 48 credits

2. Type 1.2: There are 72 credits for thesis and 7 credits for additional non-credit courses that will be assessed as S/U as follows;

2.1 Core Courses (Non-credit) 7 credits

550 535	Research Methodology in Pharmaceutical Engineering	3(3-0-6)
551 681	Seminar in Pharmaceutical Engineering I	1(0-3-0)
551 682	Seminar in Pharmaceutical Engineering II	1(0-3-0)
551 683	Special Problem in Pharmaceutical Engineering I	1(0-3-0)
551 684	Special Problem in Pharmaceutical Engineering II	1(0-3-0)

2.2 Thesis (equivalent to) 72 credits

550 912	Thesis	equivalent to 72 credits

3. Type 2.1: Course work is not less than 12 credits and 36 credits of thesis as follows;

3.1 Core Courses 7 credits

550 535	Research Methodology in Pharmaceutical Engineering	3(3-0-6)
551 681	Seminar in Pharmaceutical Engineering I	1(0-3-0)
551 682	Seminar in Pharmaceutical Engineering II	1(0-3-0)
551 683	Special Problem in Pharmaceutical Engineering I	1(0-3-0)
551 684	Special Problem in Pharmaceutical Engineering II	1(0-3-0)

3.2 Elective Courses 5 credits minimum

551 704	Colloidal Sciences and Nanotechnology	3(3-0-6)
551 706	Hygiene and Safety in Pharmaceutical Manufacturing	3(2-3-4)
551 708	Principles of Pharmaceutical Engineering	3(3-0-6)
551 716	Biomaterials in Drug Delivery System	3(2-3-4)
551 726	Pharmaceutical Material Science	2(2-0-4)
551 727	Advanced Pharmaceutical Engineering	3(2-3-4)
551 729	Design and Development of Pharmaceutical Process	3(2-3-4)
551 731	Statistical Modeling and Analysis	2(2-0-4)
551 735	Current Topics in Pharmaceutical Engineering	2(2-0-4)
551 739	Manufacturing Resource Management	4(3-3-6)
551 743	Equipments in Pharmaceutical Technology	3(2-3-4)
551 745	Regulatory Affairs in Industrial Pharmacy	3(3-0-6)
551 746	Sterile Pharmaceutical and Biopharmaceutical Product	2(2-0-4)
551 747	Material Sciences for Pharmaceutical Industry	2(2-0-4)
551 748	Computer Simulation in Pharmaceutical Engineering	2(2-0-4)

3.3 Thesis (equivalent to) 36 credits

550 910	Thesis	equivalent to 36 credits

4. Type 2.2: Course work is not less than 24 credits and 48 credits of thesis as follows;

4.1 Core Courses 13 credits

550 535	Research Methodology in Pharmaceutical Engineering	3(3-0-6)
551 681	Seminar in Pharmaceutical Engineering I	1(0-3-0)
551 682	Seminar in Pharmaceutical Engineering II	1(0-3-0)
551 683	Special Problem in Pharmaceutical Engineering I	1(0-3-0)
551 684	Special Problem in Pharmaceutical Engineering II	1(0-3-0)
551 708	Principles of Pharmaceutical Engineering	3(3-0-6)
551 742	Basic Theory in Industrial Pharmacy	3(3-0-6)

4.2 Elective Courses 11 credits minimum

551 704	Colloidal Sciences and Nanotechnology	3(3-0-6)
551 706	Hygiene and Safety in Pharmaceutical Manufacturing	3(2-3-4)
551 716	Biomaterials in Drug Delivery System	3(2-3-4)
551 726	Pharmaceutical Material Science	2(2-0-4)
551 727	Advanced Pharmaceutical Engineering	3(2-3-4)
551 729	Design and Development of Pharmaceutical Process	3(2-3-4)
551 731	Statistical Modeling and Analysis	2(2-0-4)
551 735	Current Topics in Pharmaceutical Engineering	2(2-0-4)
551 739	Manufacturing Resource Management	4(3-3-6)
551 743	Equipments in Pharmaceutical Technology	3(2-3-4)
551 745	Regulatory Affairs in Industrial Pharmacy	3(3-0-6)
551 746	Sterile Pharmaceutical and Biopharmaceutical Product	2(2-0-4)

551 747	Material Sciences for Pharmaceutical Industry	2(2-0-4)
551 748	Computer Simulation in Pharmaceutical Engineering	2(2-0-4)

4.3 Thesis (equivalent to) 48 credits

550 911	Thesis	equivalent to 48 credits

However, students can take couses in other programs available inside or outside the country if necessary for their specific work or profession with an approval from Faculty Committee of Faculty of Pharmacy. As part of the preparatory program to increase applicant's fundamental knowledge, student may be required to take extra designated courses by academic advisor and/or Faculty Members Responsible for the Program. These subjects cannot be counted towards accumulation of course credits in the program.

Course Description

550 535 Research Methodology in Pharmaceutical Engineering 3(3-0-6)

Condition: Students of Type 1.1 and 1.2 are evaluated as S/U

Systematic approach in conducting a research; selection of research topic, planning and design of a research project, research proposal preparation, data collection, statistics for research, analysis and interpretation of research data, research work dissemination and research ethics in pharmaceutical engineering.

550 910 Thesis equivalent to 36 credits

An independent research on pharmaceutical engineering under the supervision of thesis advisors.

550 911 Thesis equivalent to 48 credits

An independent research on pharmaceutical engineering under the supervision of thesis advisors.

550 912 Thesis equivalent to 72 credits

An independent research on pharmaceutical engineering under the supervision of thesis advisors.

551 681 Seminar in Pharmaceutical Engineering I 1(0-3-0)

Condition: Students of Type 1.1 and 1.2 are evaluated as S/U

Searching, retrieving and compiling data in pharmaceutical engineering from various sources, analysis of collected data to present and discuss with rational reason.

551 682 Seminar in Pharmaceutical Engineering II 1(0-3-0)

Condition: Students of Type 1.1 and 1.2 are evaluated as S/U

Searching, retrieving and compiling data in pharmaceutical engineering from various sources, analysis of collected data to present and discuss with rational reason.

551 683 Special Problem in Pharmaceutical Engineering I 1(0-3-0)

Condition: Students of Type 1.1 and 1.2 are evaluated as S/U

Selected topics in pharmaceutical engineering and related fields, data collection and analysis including research process to solve problems.

551 684 Special Problem in Pharmaceutical Engineering II 1(0-3-0)

Condition: Students of Type 1.1 and 1.2 are evaluated as S/U

Continueous selected topics in pharmaceutical engineering and related fields, data collection and analysis including research process to solve problems.

551 704 Colloidal Sciences and Nanotechnology 3(3-0-6)

Theories and principles of colloidal sciences including their applications in nanotechnology and drug delivery systems.

551 706 Hygiene and Safety in Pharmaceutical Manufacturing 3(2-3-4)

Hygiene of employees in industrial plants including the prevention of physical and chemical hazards to mental and physical health of employees, waste management, environment control, work safety, hygienic services, law and regulation, fringe benefits and recreation.

551 708 Principles of Pharmaceutical Engineering 3(3-0-6)

Condition: Students of Type 1.1 and 1.2 are evaluated as S/U

Requirements for design of facilities, equipment and processes in the pharmaceutical and related industries including facility layout and principles of design, planning and construction of critical facilities, emphasizing on water system, ventilation system and environmental system; manufacturing process validation.

551 716 Biomaterials in Drug Delivery System 3(2-3-4)

Theories, principles, and advanced skills in the pharmaceutical applications of biomaterials, including research and development of drug delivery systems, desired properties of biomaterial and related mechanisms, and trends in the application of newly developed biomaterials in medicals and pharmaceutical sciences.

551 726 Pharmaceutical Material Science 2(2-0-4)

Development of materials for pharmaceutical applications, theories, principles, and technology in invention of desired dosage forms of pharmaceutical products, physicochemical and biological properties of pharmaceutical materials and evaluation, including technology and trends in development of pharmaceutical materials.

551 727 Advanced Pharmaceutical Engineering 3(2-3-4)

Theories and advanced skills in pharmaceutical engineering processes emphasizing on design, scale-up, trouble-shooting, optimization of sustainable pharmaceutical processes, pharmaceutical unit operations, including design and equipments for biopharmaceutical production engineering and packaging.

551 729 Design and Development of Pharmaceutical Process 3(2-3-4)

Pharmaceutical process design and development of scaling up production of formulation obtained from research and development to the level of industrial production scale, technology related to selection of suitable processes and equipments, process validation, validation master plan, including protocol structures of installation qualification, operation qualification and performance qualification.

551 731 Statistical Modeling and Analysis 2(2-0-4)

Design of experiment (DoE) for application in research and development, product development, process analytical technology, quality control and assurance.

551 735 Current Topics in Pharmaceutical Engineering 2(2-0-4)

Novel concepts based on current information and trends in technology of research and development of new drugs, emphasizing pharmaceutical engineering to obtain drugs with required specifications.

551 739 Manufacturing Resource Management 4(3-3-6)

Effective planning, scheduling, managing, and controlling of manufacturing resources through concepts of engineering design, industrial engineering, management information systems, quality management, production management, inventory management, accounting, productivity improvement, and other novel or up-to-date technology related to resource management.

551 742 Basic Theory in Industrial Pharmacy 3(3-0-6)

Condition: Students of Type 1.1 and 1.2 are evaluated as S/U

Theories and principles of designing ideal pharmaceutical dosage forms including drug discovery and development.

551 743 Equipments in Pharmaceutical Engineering 3(2-3-4)

Theories, principles, techniques and laboratory practices of commonly encountered equipment in pharmaceutical engineering and related areas.

551 745 Regulatory Affairs in Pharmaceutical Manufacturing 3(3-0-6)

Regulations, requirements and guidelines in pharmaceutical industry and related fields issued by drug regulatory body, good manufacturing practices, related laws, including municipal law, factory act, and machinery registration act.

551 746 Sterile Pharmaceutical and Biopharmaceutical Product 2(2-0-4)

Theories and principles of sterile pharmaceutical and biopharmaceutical products formulation and manufacturing, international standards of quality control and quality assurance, including trends in production technology of sterile pharmaceutical and biopharmaceutical products.

551 747 Material Sciences for Pharmaceutical Industry 2(2-0-4)

Sciences related to the materials used for the construction of pharmaceutical plants and equipment, material and composition of pharmaceutical packaging, emphasizing properties, characterization, processing and selection of suitable materials.

551 748 Computer Simulation in Pharmaceutical Engineering 2(2-0-4)

Definition and significance of computer simulation models and techniques, defining problems, data collection and analysis, simulation model development, random number generator, model validation, experimental model design and optimization including implementation and evaluation of pharmaceutical engineering simulation.

Graduation Requirement

1. Accordance with Silpakorn University's 2007 Regulations on Graduate Study and/or updated amendment.
2. Accordance with the announcement of Ministry of Education as of standard regulation of graduate study 2558 BE. and/or updated amendment.
3. Accordance with others following qualifications;

For students who receive the Royal Golden Jubilee Ph.D. Scholarship, graduation requirements of the scholarship will be used. At least 2 research works which are parts of their thesis must be published or accepted to be published before graduation with the following conditions as specified in current scholarship requirements or later revision.