



Master of Science Program in Industrial  
Biotechnology  
(International Program)

2014

Department of Biotechnology, Faculty of Technology

&

Graduate School

Khon Kaen University

## **1. Rationale & Objectives**

Graduate Program in Biotechnology, Faculty of Technology provides a nurturing interactive environment to promote learning in all aspects of biotechnology, and to promote integration of multi-disciplinary approaches to the conduct of research. The program merges the study of physical and life sciences and bioengineering, which offers courses focusing on fundamental sciences, principle and applied biotechnology, process and biochemical engineering, genetic engineering, quality assurance, experimental design, and other elective courses on diverse areas of biotechnology. Graduate students are actively engaged in both fundamental and applied research designed to have targeted impact on biotechnology. Students will have the opportunities to present their research work and gain practical experiences abroad.

Master of Science Program in Industrial Biotechnology (International Program) aims to prepare highly-qualified and outstanding graduates, who will be recognized for their knowledge, academic proficiency, leadership, creativity as well as moral and ethical judgment. The graduates will also be able to generate advanced research work in industrial biotechnology, which will be beneficial for the community. This program offers the courses in the principles and theories of industrial biotechnology as well as the applications of biotechnology techniques to resolve the bio-industrial problems, and to address a wide variety of problems and applications.

## **2. Academic Term**

First semester: August-December

Second semester: January-April

## **3. Admission Requirement**

3.1 Holding a Bachelor's degree or equivalent academic credentials, with a minimum undergraduate grade-point average (GPA) of 3.25 (Plan A1) or 2.75 (Plan A2). All GPAs are based on a 4.00 scale.

3.2 Every applicant whose native language is not English, or whose undergraduate instruction was not in English, must provide an English proficiency test score. Your score will not be accepted if it is more than two years old from the start of your admission term.

The following English proficiency tests are accepted for graduate admissions, and a minimum score should be as follows:

TOEFL (Paper-based)	475
TOEFL (Computer-based)	152
TOEFL (Internet-based)	52
IELTS	5

*An applicant who cannot meet these criteria is required to take KKU English proficiency test and should consult the executive graduate program committee.*

- 3.3 Two (2) letters of recommendation
- 3.4 Official transcript(s) (original or Certified True Copies) of all academic records. All foreign documents must be accompanied with an English translation by an approved foreign credential evaluation service.
- 3.5 A copy of a degree certificate in English
- 3.6 A one-page statement of purpose explaining why you are applying and how you believe this degree will help you accomplish your goals.
- 3.7 Additional document needed for international students: A copy of a passport (profile page)

#### 4. Program Plan

There are 2 plans under this program:

Plan A1 (Research plan) is for an applicant who holds a Bachelor’s degree in Biotechnology with a Grade Point Average (GPA) of at least 3.25. Students will conduct a research for a total of 36 credits and participate in 2 required courses (graduate seminars 1 & 2, non-credit).

Plan A2 (Research and Coursework plan) is for an applicant who holds a Bachelor’s degree in Biotechnology, Engineering or Science of related fields, with a GPA of at least 2.75. Students have to enroll in several required and elective courses for 21 credits and conduct a research for a total of 15 credits.

#### 5. The Structure of the Curriculum

To obtain a Master of Science degree in Industrial Biotechnology, the student must choose to follow either Plan A1 or Plan A2 below, and fulfill their requirements. Each requires a total of 36 credits.

Course	The Number of Credit Hours	
	Plan A1	Plan A2
Required Course	2 (non-credit)*	15
Elective Course	-	6
Thesis	36	15
<b>Total</b>	<b>36</b>	<b>36</b>

\* Seminar in Industrial Biotechnology I & II

#### 6. Courses

##### 6.1 Required Course

672 731	Biochemical Engineering and Bioprocess Design	3 credits
672 741	Business and Regulatory Practices in Bioindustries	2 credits
672 771	Industrial Fermentation Technology	3 credits
672 781	Research Methodology in Biotechnology	3 credits
672 782	Industrial Visits to Bio-Manufacturing Industries	2 credits
672 891	Seminar in Industrial Biotechnology I	1 credit

672 892 Seminar in Industrial Biotechnology II 1 credit

### 6.2 Elective Course

672 721	Biotechnological Instrumentation	2 credits
672 722	Biotechnological Instrumentation Laboratory	1 credit
672 733	Mass Transfer and Separation Technology	3 credits
672 751	Environmental Biotechnology	3 credits
672 752	Bioenergy Technology	3 credits
672 761	Molecular Biotechnology	3 credits
672 762	Plant and Animal Cell Cultures for Fine Biochemical Production	3 credits
672 763	Genetic Engineering Laboratory	1 credit
672 764	Protein Engineering	3 credits
672 765	Bioinformatics	3 credits
672 772	Appropriate Industrial Biotechnology for Developing Countries	3 credits
672 773	Biotechnology for Food and Beverage Industries	3 credits
672 774	Downstream Processing and Product Formulation	3 credits

### 6.3 Thesis

672 898	Thesis (Plan A1)	36 credits
672 899	Thesis (Plan A2)	15 credits

## 7. Study Plan (2-year program)

\* non-credit

Course Code	Course Name	The Number of Credits	
		Plan A1	Plan A2
<b>Year 1 Semester 1</b>			
672 771	Industrial Fermentation Technology	-	3
672 781	Research Methodology in Biotechnology	-	3
672 xxx	Elective(s)	-	≥ 3
672 898	Thesis (Plan A1)	9	
	<b>Total credits for this semester</b>	<b>9</b>	<b>9</b>
	<b>Accumulated credits</b>	<b>9</b>	<b>9</b>
<b>Year 1 Semester 2</b>			
672 731	Biochemical Engineering and Bioprocess Design	-	3
672 781	Industrial Visits to Bio-Manufacturing Industries	-	2
672 891	Seminar in Industrial Biotechnology I	1*	1
672 xxx	Elective(s)	-	≥ 3

Course Code	Course Name	The Number of Credits	
		Plan A1	Plan A2
672 898	Thesis (Plan A1)	9	-
	<b>Total credits for this semester</b>	<b>9 (1*)</b>	<b>9</b>
	<b>Accumulated credits</b>	<b>18 (1*)</b>	<b>18</b>
<b>Year 2 Semester 1</b>			
672 741	Business and Regulatory Practices in Bioindustries	-	2
672 892	Seminar in Industrial Biotechnology II	1*	1
672 898/ 672 899	Thesis (Plan A1 or A2)	9	6
	<b>Total credits for this semester</b>	<b>9 (1*)</b>	<b>9</b>
	<b>Accumulated credits</b>	<b>27 (2*)</b>	<b>27</b>
<b>Year 2 Semester 2</b>			
672 898/ 672 899	Thesis (Plan A1 or A2)	9	9
	<b>Total credits for this semester</b>	<b>9</b>	<b>9</b>
	<b>Accumulated credits</b>	<b>36</b>	<b>36</b>

## 8. Course Description

Course Code	Course Name	Credits
672 721	Instrumentation and Analytical Techniques in Biotechnology Basic knowledge in scientific instruments, electronics and electricity, pH and Buffer, balance, pipette and autopipette, hot air oven and incubator, cooling system, air filter system, ultrasonic cleaner, water purification system, centrifugation techniques, microscopic techniques, enzymatic assay techniques, chromatographic techniques, electrophoretic techniques, molecular biological techniques, spectroscopic techniques, immunological techniques, cell culture techniques	2
672 722	Instrumentation and Analytical Techniques in Biotechnology Laboratory The laboratory experiments consist of pH meter, balance and autopipette, microscopic techniques, centrifuge, gas chromatography, high performance liquid chromatography, electrophoresis, spectrophotometer, immunology and cell culture	1

<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
672 731	<p><b>Biochemical Engineering and Bioprocess Design</b></p> <p>Historical development, evolution and scope of biochemical engineering will be reviewed. Topics to be revealed include biocatalysts, the kinetics of enzyme-catalyzed reactions, cell thermodynamics, metabolic stoichiometry and energetics, kinetics of substrate utilization, product formation and biomass production in cell cultures, process parameter measurement, monitoring and control, transport phenomena in bioprocess systems, scale-up concepts and methods. Bioreactors as control environments, types and design of bioreactors, the criteria for process engineering and economic analysis for optimization of bioprocess design will be treated.</p>	2
672 733	<p><b>Mass Transfer and Separation Technology</b></p> <p>Principle of mass transfer, principle of unsteady-state and convective mass transfer, evaporation of biological materials, drying of bioprocess materials, stage and continuous gas-liquid separation processes, vapor-liquid separation processes, membrane, liquid-liquid and liquid-solid separation processes, mechanical-physical separation processes</p>	3
672 741	<p><b>Business and Regulatory Practices in Bioindustries</b></p> <p>The significance of biotechnology and the growth of bioindustries will be revealed, some key term e.g. biorisk, biohazard, biosafety and bioregulations will be defined and elaborate, Though case studies the commercialization of Organisms with Novel Traits (ONTs) and living Modified Organisms (LMOs) will be demonstrated, Thus results in the international movements to create regulatory measures for biotechnology safety, the ecosystem conservation and the sustainability of biological diversity, The patent screening, patenting, licensing protocol, and biosafety regulations will be revealed</p>	2
672 751	<p><b>Environmental Biotechnology</b></p> <p>Control and protection of pollution to the environment by using biotechnological techniques such as biological treatment, biodegradation of xenobiotics, biostimulation, phytoremediation of contaminated matrices, utilization of the genetically engineered microbes for a remediation of recalcitrant xenobiotics and innovative remediation technology</p>	3
672 752	<p><b>Bioenergy Technology</b></p> <p>Types of bioenergy; bioenergy conversion technologies (biochemical, physicochemical, thermocemical), birefinery, technologies by use</p>	3

<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
672 761	<p>Molecular Biotechnology</p> <p>Fundamentals of molecular biotechnology, structures and functions of cellular macromolecules (sugars, lipids, proteins and nucleic acids) and a cell, standard methods in molecular biotechnology; for example, isolation and electrophoresis of DNA and RNA, hybridization of nucleic acids, the use of enzymes in the modification of nucleic acids, polymerase chain reaction (PCR), cloning procedures, expression of recombinant proteins, isolation and purification of proteins, principles of recombinant DNA technology, examples of genetic manipulation of different organisms and applications in biotechnology, introduction to molecular database searches, analyses and bioinformatics, information and discussion of biosafety and impacts of genetically modified organisms on humans, society and environments</p>	3
672 762	<p>Plant and Animal Cell Cultures for Fine Biochemical Production</p> <p>Introduction, principle in plant and animal cell culture, cultivation of plant and animal cell in bioreactor, production of fine biochemical by plant and animal cell culture, gene transformation into plant and animal cell and its safety, and case study of application of plant and animal biotechnology</p>	3
672 763	<p>Genetic Engineering Laboratory</p> <p>Genetic engineering laboratory techniques such as chromosomal DNA, plasmid and RNA extraction , nucleic acid analysis using spectrophotometer and agarose gel electrophoresis, gene cloning, transformation of recombinant DNA, DNA or gene amplification, Southern, Northern and Western blotting techniques</p>	1
672 764	<p>Protein Engineering</p> <p>Protein structure, properties and functions of protein particularly enzyme, structure and function relationship of protein, the use of genetic and chemical technology to change the structure and function for producing novel products with specific and desired properties, examples of modified proteins and enzymes used in medicine, agriculture and industry</p>	3
672 765	<p>Bioinformatics</p> <p>Introduction to bioinformatics, application of bioinformatics database for structural analysis, DNA and amino acid sequences analysis, database searching and molecular modeling design for analysis of structure and function of gene and protein, application of computer program on internet for analysis of biological data, molecular biochemistry and applications of bioinformatics in agriculture, environment, bio-industry and medical</p>	3

<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
672 771	Industrial Fermentation Technology	3
	Principle of fermentation processes, microbial growth kinetics and metabolism, techniques of isolation, preservation and improvement of industrially important microorganisms, media fermentation and preparation for industrial fermentation, media and air sterilization, development of inocula for industrial fermentation, measurement and control in fermenter and fermenter operation, aeration and agitation for oxygen requirements of industrial fermentations and fermenter design for scale-up	
672 772	Appropriate Industrial Biotechnology for Developing Countries	3
	Definition, examples and sustainability of appropriate technology, biotechnology and developing countries, applications of biotechnology in food, agriculture and environment, technology transfer	
672 773	Biotechnology for Food and Beverage Industries	3
	The applications of microorganisms, enzymes, bioreactors and bioreaction kinetics for food processing and quality assurance, the application of biotechnology in the production of fermented oriental foods, amino acids and flavor enhancers, yoghurt and cheese, wines, beers, sake, and health drinks, the use of modern biotechnology techniques in the improvement of starter cultures for fermented food and beverages, the possibility for producing GM-crops, GM-livestock and GM-fishes.	
672 774	Downstream Processing and Product Formulation	3
	Introduction, recovery of particulates between cell and solid particles (filtration, centrifugation and sedimentation), product isolation (extraction and sorption), precipitation, chromatography and fixed-bed adsorption by batch processing, membrane separations, electrophoresis, combined operations (immobilization, whole broth processing and mass recycle), bioproduct recovery trains, product formulation kinetics segregated kinetic models of growth and product formation.	
672 781	Research Methodology in Biotechnology	3
	Definition and basic principles of research, conceptual research framework, research review, research design in biotechnology, writing of the research proposal, application of statistical procedures for data analysis, writing of the research report and research publication	



Course Code	Course Name	Credits
672 782	Industrial Visits to Bio-Manufacturing Industries Studies of the selected food, biological and agro industries, report writing and presentation	2
672 891	Seminar in Industrial Biotechnology I Searching, compiling, and oral presentation of current interesting research articles in biotechnology including a written report in a form of research article or review article	1
672 892	Seminar in Industrial Biotechnology II Searching, compiling, and oral presentation of current interesting research articles in biotechnology or oral presentation on the progress of master thesis including a written report in a form of research article or review article	1
672 898	Thesis Conducting an experiment or a research and making thesis in a special topic in biotechnology under the thesis advisory committee.	36
672 899	Thesis Conducting an experiment or a research and making thesis in a special topic in biotechnology under the thesis advisory committee.	15

## 9. Evaluation and Graduation Requirements

- 9.1 Students must take the Proposal Examination within the second semester of the first year of study. All examination committee is appointed by the Faculty.
- 9.2 Students must report the research progress every semester (Oral presentation).
- 9.3 Students have to take a Thesis Defense according to the Code of Conduct of Graduate School, Khon Kaen University.
- 9.4 To graduate, students must have a Grade-Point Average (GPA) of at least 3.00 based on a 4.00 scale.
- 9.5 Students have to present their research work at the national or international conference (with full proceedings) or have at least 1 national or international publication (according to the Code of Conduct of Graduate School, Khon Kaen University).

## **10. Research Areas**

Research in the Department of Biotechnology, Faculty of Technology, Khon Kaen University is highly interdisciplinary, significantly contributing to the advancement of different areas of biotechnology. The research areas include

- Bio-energy Production (Biogas, Bio-ethanol, Bio-butanol, Bio-hydrogen and Biodiesel)
- Fermented Food and Beverages
- Bio-based Products and Process Development
- Molecular Biology and Genetic Engineering
- Plant Tissue Culture and Animal Cell Culture
- Bio-remedial Approaches for Environments
- Enzyme Technology

## **11. How to Apply**

To apply for a Graduate Program offered by the Department of Biotechnology, please visit a Graduate School website (<http://www.gs.kku.ac.th/home/index.php/main-english.html>) and choose one of the following ways for applying.

1. Download the application form and send all documents to [graduate@kku.ac.th](mailto:graduate@kku.ac.th) or by post to the following address.

Graduate School

3<sup>rd</sup> Floor, Bimala Kalakicha Building, Khon Kaen University

123 Mittraphap Road (Friendship Highway)

Ampher Mueng, Khon Kaen, 40002

THAILAND

2. Apply online at the website

<https://gs.kku.ac.th> (follow on-screen instruction)

Graduate school flexibly allows the prospective international applicants to apply throughout the year, but normally the first semester will begin in August, and the second semester will begin in January. So, please make sure you complete the application process before the deadline of your expected semester.

## **12. Tuition & Fees**

Tuition for the graduate international program per semester is as follows: USD 1,670. For international students, there is an extra international-student fee for USD 500. Incoming students are responsible for their own traveling, accommodations and living expenses.

### **13. Financial Assistance**

Qualified international applicants with outstanding academic achievement are eligible to apply for scholarships offered by Khon Kaen University in conjunction with Faculty of Technology and Academic Departments.

### **14. Research Facilities**

The University and the Faculty offer many research facilities that are available to graduate students across disciplines. The Faculty of Technology and the Department of Biotechnology also provide basic and specialized laboratory equipment which is available for student use; for example, pH meters, balances, micropipettes, autoclaves, ultracentrifuges, fermenters, gas chromatography (GC), high performance liquid chromatography (HPLC), Thermal cycler (PCR machine), DNA and protein gel electrophoresis, gel documentation, etc. Students must take a course which introduces how to operate the equipment and can also acquire training from the Department.

### **15. Residence Life**

Students may choose to live on campus with the University's comfortable residence halls (On-campus housing). Free WiFi Internet Hotspots are available in most areas on campus. Please contact the University's housing service for more information. Students may choose to live in local communities surrounding KKU (Off-campus housing).

### **16. Transportation**

The campus is easily accessed by car and by bus using Mittraphap Road (Friendship highway) as well as by plane through Khon Kaen Airport. The University also provides a connecting shuttle bus service on campus for students, staffs and visitors (free of charge).

### **17. More Information**

If further information and assistance are needed, please contact:

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