

Master of Science Program
in Bioscience for Sustainable Agriculture
(International Program/New Program 2015)



Graduate School

Table of contents

	Page
Section 1 General Information	1-5
1. Program title	1
2. Degree title	1
3. Major field	1
4. Total of graduate credits	1
5. Program format	1
6. Program status program permission/approval	2
7. Dissemination of quality and standardized program timeframe	2
8. Post-graduation occupations	2
9. Name, I.D. Number, title and degree of the person in charge of the curriculum	2
10. Place of instruction	2
11. External situation or important development considered for program planning	3
12. The effects mentioned in no.11 on curriculum development and its relevance to the mission of the university/institute	4
13. Cooperation with other curricula of the university	4
Section 2 Program's Specific Information	5-6
1. Philosophy, justification and objectives of the curriculum	5
2. Plan for development and improvement	6
Section 3 Educational Management System, Curriculum Implementation and Structure	7-27
1. Educational Management System	7
2. Program Implementation	7
3. Curriculum and Lecturers	9

	Page
Section 4 Learning outcome, Teaching strategy and Evaluation	28-35
1. Developing a Special Student Characters	28
2. Developing Learning Outcomes in Each Area	28
3. Curriculum Mapping	32
Section 5 Evaluation criteria	36-37
1. Grading regulations or criteria	36
2. Student's achievement standard review process	36
3. Graduation criteria	37
Section 6 Teaching staff development	38-39
1. New instructor's orientation	38
2. Development the knowledge and the skills to the newly-recruited lecturers	38
Section 7 Curriculum quality assurance	40-45
1. Curriculum administration	40
2. Instructional resources management	41
3. Teaching-staff management	42
4. Administration of instruction support personnel	43
5. Student assistant and consultation	43
6. Job market and social needs and/or users satisfaction	44
7. Key Performance Indicators	44
Section 8 Curriculum evaluation and revision	46-47
1. Teaching Efficiency Assessment	46
2. Overall Evaluation of the Curriculum	46
3. Evaluation of Performance According to Requirement Details of the Curriculum	46
4. Reviewing Assessment Results and Planning for Revision of the Curriculum	46

**Master of Science Program in Bioscience for Sustainable Agriculture
(International Program/New Program 2015)**

Institute Silpakorn University
Campus/Faculty/Department Phetchaburi IT campus, Graduate School

Section 1 General Information

1. Program title

Thai หลักสูตรวิทยาศาสตรมหาบัณฑิต สาขาวิชาชีววิทยาศาสตร์เพื่อเกษตรกรรมที่ยั่งยืน
(หลักสูตรนานาชาติ)
English Master of Science Program in Bioscience for Sustainable Agriculture
(International Program)

2. Degree title

Master of Science (Bioscience for Sustainable Agriculture)
M.Sc. (Bioscience for Sustainable Agriculture)

3. Major field

None

4. Total of graduate credits

Plan 1 36 credits
Plan 2 not less than 36 credits

5. Program format

5.1 Format: Master of Science, 2-year program
5.2 Language: English
5.3 Admission: Thai and foreign students
5.4 Collaboration with other institute: The program is administered solely by the
Silpakorn University
5.5 Degree awarded: Degree in Bioscience for Sustainable Agriculture

6. Program status program permission/approval

New program for 2015. Instruction begins in the second semester of Academic Year 2015

The University Academic Committee granted program approval at Meeting Number

4/2557 Date 1 Month May Year 2014

The University Council granted program permission at Meeting Number 11/2558

Date 11 Month November Year 2015

7. Dissemination of quality and standardized program timeframe

Academic Year 2016

8. Post-graduation occupations

1. Agricultural research and development officer such as researcher, developer, and scientist in government sector or research institute

2. Agricultural research and development officer in private corporations

3. Owner of farms including livestock such as swine, poultry, cattle, owner of crop production such as plant tissue culture, flower garden, and integrated agricultural farming

9. Name, I.D. Number, title and degree of the person in charge of the curriculum

1. Mr. Narin Preyavichyapugdee

Position Lecturer

Qualification Ph.D. (Pathobiology), Mahidol University (2007)

D.V.M., Kasetsart University (1995)

2. Miss. Chanjira Sitthiya

Position Lecturer

Qualification Ph.D. (Animal Science) Ehime University, Japan (2015)

M.Sc. (Animal Science) Kagawa University, Japan (2012)

B.Sc. MaeJo University (2005)

3. Mr. Atthapol Thiantong

Position Lecturer

Qualification Ph.D. (Animal Science) National Chung Hsing University,
Taiwan (2015)

B.Sc. (Animal Breeding) Maejo University (2009)

10. Place of instruction

Faculty of Animal Sciences and Agricultural Technology, Silpakorn University,
Phetchaburi IT Campus

1 Moo 3 Sampraya, Cha-am, Phetchaburi.

11. External situation or important development considered for program planning

11.1 Economic situation or development

The increasing world population means more increased demand in food resulting to the need of arable land for food production. As a result, water-shed area in the forest has been encroached initiating environmental degradation. This also causes the reduction of biodiversity and brings about greenhouse effect and global warming. The current agricultural practice causing negative effect has occurred in the countries all over the world.

For Thailand, the above mentioned scenario has been happening with the obvious example in the case of the encroachment of mangrove forest for the production of commercial marine produces, such as the culture of tiger prawn along the coastal region. The encroachment into the forest in the North also causes the degradation of water-shed area resulting to soil erosion which in turn brings about the accumulation of soil sediment in the rivers. Moreover, Thailand ranged 40 among the countries all over the world for the area used in agriculture but Thailand ranks fourth as the main importer of a chemical used for agriculture. This information indicates that agricultural production in Thailand has been contribution to a certain degree of the degradation of an environment. In the Phetchaburi province, particularly in Cha-am district and the adjacent areas of the Faculty of Animal Science and Agricultural Technology (ASAT), Silpakorn University, Phetchaburi IT campus, there are several agricultural activities, involving extensive production of plants, animals and aquatic animals, such as pineapple production, dairy farming, goat raising and cultivation of commercial aquatic animals. These activities cause the above-mentioned environmental degradation. The pineapple production is the obvious example in which the farmers have used herbicides continuously resulting to the accumulation of toxic herbicides and rendering the land un-usable for producing other crops.

For this reason, ASAT, Silpakorn University, Phetchaburi IT campus, has initiated the project to launch the curriculum with the emphasis on teaching and researching in sustainability in agriculture. This curriculum will emphasize on the use of tool and technology in biological science to solve the problem in agriculture production sector.

11.2 Socio-cultural situation and development

In the current time, populace all over the world, particularly in the developed countries, has regarded food quality as an important issue. As food comes mainly from agricultural production, there are several reports in the past and at present about the contamination of chemicals used as fertilizers and pesticides resulting to problems of chemical residues in agricultural produces and negative effect to health of the consumers.

Nevertheless, agricultural production particularly in Thailand, some Thai farmers have applied appropriate local traditional wisdom for agricultural production with minimal or

no reliance on chemical pesticide and modern technology. These farmers still conduct efficient and safe agricultural production.

For the area in Phetchaburi province, particularly in Cha-am district, there is HuaySai Royal Development Study Center which has coordinated various governmental agencies to provide knowledge to the farmers so that they can apply the knowledge and understanding for sufficient and sustainable agricultural production. This will provide the farmers with principles and assist them to conduct agricultural production safely and sustainably. All in all, this practice will not only benefit the livelihood of the farmers but also provide safe food for the consumers.

12. The effects mentioned in no.11 on curriculum development and its relevance to the mission of the university/institute

12.1 Program development

The current curricular development needs proactive approach to respond to the society and prepares for the competition in globalization. This requires the highly capable personnel in agriculture with the ability to develop themselves to respond the changing world. The curriculum needs to respond to the need of the country, the changing world, and requirement for standardization both in term of safety and law

12.2 Its relevance to the missions of the university/institute

The impact from the outside or the social and cultural development to the mission of the university which aims for academic excellence means that the university must produce graduate with ethic. The curricular development must emphasize on producing postgraduate personnel who possess academic capability, ethical and social acceptance, ability to conduct research to create new knowledge and ability to transfer this knowledge for developing the community, the society and the nation.

13. Cooperation with other curricula of the university (if any).

None

Section 2 Program's Specific Information

1. Philosophy, justification and objectives of the curriculum

1.1 Philosophy

To create personnel in agriculture with the capability to integrate bioscience knowledge with local wisdom on the emphasis of the conservation of natural resources and environment to promote and develop the sustainability of agriculture

1.2 Justification

The land in South-East Asia is unique in term of biological, cultural, environmental and geography. Thailand as one of the countries in this area also possesses this uniqueness.

In biological term, Thailand possesses diversity in aquatic and terrestrial animals as well as plants. This biological diversity can be utilized sustainably. In term of environment, Thailand locates in the tropical region in which the climate is different from other regions. The monsoon season in the tropical region is conducive for producing certain crops such as rice. In geographical term, Thailand has approximately 2,815 kilometers long coastal line, encompassing various ecological niches (such as mangrove forest, estuary and coastal region) which are suitable for producing commercial aquatic animals for export. All this contribute Thailand as a country which a stature to conduct research within the concept of sustainable agriculture to produce agricultural commodity sustainably.

Faculty of ASAT - locating in the area which has been developed under His Majesty the King Royal Projects (such as the Sirindhorn International Environment Park, "Chang-Hua-Mun" Royal Initiative Project and the King Royally Initiated LaemPhakBia Environmental Research and Development Project) -is thus in a suitable position to produce graduates who are capable of solving agricultural problems using the theory of sufficient economy.

The research topics, in which both the Faculty of ASAT and other collaborative governmental agencies should conduct under the framework of sufficient economy, include sustainable animal production, clean technology, animal care and hygiene, plant pest control, sustainable coastal resource management, appropriate technology for environmental control, soil conservation, integrated soil fertility management, plant genetic management, efficient waste management and waste utilization. These researches will be highlighted by the ASAT staffs and will be emphasized so that the concept of sustainable agriculture will be put realistically into practice.

Faculty of ASAT aims to implement this curriculum for the benefit of the agriculturist in Thailand and other ASAEN members such as Cambodia, Indonesia, Laos,

Myanmar and Vietnam. With the same line of agricultural development with Thailand, this curriculum will be used as a tool to develop their human resources.

1.3 Objectives

1.3.1 To produce a holder of a master's degree capable in doing research in the field of Bioscience for Sustainable Agriculture

1.3.2 To develop human resource accommodated for the national and international government or Private Corporation requirements in the development of sustainable agriculture

2. Plan for development and improvement

Plan for development/revision	Strategies	Indexes
Revise the program in accordance with the minimum standard specified by OHEC within 5 years	1.Prepare course details according to TQF3 2.Prepare report of course operation outcome according to TQF5 3. Prepare report of program operation outcome according to TQF7	1.TQF3 of all courses 2.TQF5 of all courses 3. Annual TQF7
Revise the program to keep it updated and consistent with the labor market demand within 5 years	Evaluate the program from its operation, instruction management, organization and operator demand, and graduate employment	The program's evaluation outcome report
Plan to utilize research results within 4 years	Disseminate instructor's and students' research results and academic works	Disseminated articles or presentation of research results

Section 3 Educational Management System, Curriculum Implementation and Structure

1. Educational Management System

1.1 System

Bi-semester instructional system. All regulations are in accordance with Silpakorn University's Regulations on Graduate Study B.E.2550 (2007).

1.2 Summer session

Summer courses are available based on the Program Committee's judgment.

1.3 Credit equivalent to semester system

None

2. Program Implementation

2.1. Instruction Period

Semester 1	August – December
Semester 2	January – May
Summer	June – August

2.2. Student qualifications

2.2.1 Plan 1 (Thesis)

Graduates of Bachelor degree in science or related fields with an equivalent or with the decision and consent of the curricular academic committee

2.2.2 Plan 2 (Thesis and course works)

Graduates of Bachelor degree in science or related fields with an equivalent GPA not less than 2.50

2.2.3 Eligible candidates under Clause 2.2.1 and 2.2.2 must have all the qualifications specified in Clause 7 of Silpakorn University's Regulation on Graduate Study B.E. 2550 (2007).

2.2.4 The eligible candidate for this curriculum must pass the English test as stipulated by Silpakorn University Regulation 2007 or other similar standards. The result of the test should not exceed 2 years prior to the admission to study. The curricular academic committee shall consider temporarily waiving the English test on the case by case basis.

2.3 Problems of incoming students

The students also require intensive training to elevate their English proficiency to study in this curriculum.

2.4 Strategies to solve problems in No.2.3

The students will be provided with intensive training for improving both their writing and their communication skills in English so that they are ready to engage in the learning process of this curriculum.

2.5 Admission plan and graduation projection in the next 5 years

2.5.1 Plan 1 and Plan 2

Academic Year	Number of Students				
	2015	2016	2017	2018	2019
Year 1	5	5	10	10	10
Year 2	-	5	5	10	10
Total	5	10	15	20	20
Number of expected graduates	-	5	5	10	10

2.6 Planned Budgets

2.6.1 Revenue Budget (Baht)

Revenue Budget	Fiscal Year				
	2015	2016	2017	2018	2019
Tuition fee	25,000	50,000	75,000	100,000	100,000
Registration fee*	300,000	600,000	900,000	1,200,000	1,200,000
Total	325,000	650,000	975,000	1,300,000	1,300,000

Thai students must pay the registration fee at 25,000 baht/semester

Foreign students must pay the registration fee at 50,000 baht/semester

*Registration fee is calculated by using the average registration fee of Thai and foreign students.

2.6.2 Expenditure budget (Baht)

Expenditure	Fiscal year				
	2015	2016	2017	2018	2019
A. Administrative budget					
1. Personnel expenditure	75,000	150,000	225,000	300,000	300,000
2. Administrative expenditure	50,000	100,000	150,000	200,000	200,000
3. Scholarship	30,000	60,000	90,000	120,000	120,000
4. Expense for University level	45,000	90,000	135,000	180,000	180,000
Total (A)	200,000	400,000	600,000	800,000	800,000

Expenditure	Fiscal year				
B. Investment budget					
Cost for hardware	50,000	100,000	150,000	200,000	200,000
Total (B)	50,000	100,000	150,000	200,000	200,000
Total (A) + (B)	250,000	500,000	750,000	1,000,000	1,000,000
Total students	5	10	15	20	20
Total cost per one student (4 semesters)	50,000	50,000	50,000	50,000	50,000

2.7 Educational systems

- Classroom
- Distance learning through the primary source of printed media
- Distance learning through the primary source of audio-visual media
- Distance learning through the primary source of E-learning media
- Distance learning through the primary source of Internet media
- Others (please specify)

2.8 Transfer of credits, courses and cross university registration (if any)

In accordance with Silpakorn University's Regulation on Graduate Study B.E. 2550 (2007)

3. Curriculum and Lecturers Ph.D. Program

3.1 Curriculums: with no less than the enrollment of 4 consecutive academic semesters

3.1.1 Number of credits	total	36 credits
Plan 1		36 credits
Plan 2	not less than	36 credits

3.1.2 Curriculum Structure

Plan 1	36 credits
Thesis (equivalent)	36 credits
Seminar	3 credits*
Plan 2	not less than 36 credits
Required courses	12 credits
Elective courses	not less than 12 credits
Thesis (equivalent)	12 credits

*As non-credit subjects.

Note: All students enrolled in both plans are required to pass the comprehensive examination.

3.1.3 Courses

3.1.3.1 Courses Code

The reference code for each subject is determined by 6 digits which are divided into two groups:

The first three digits designating the faculty/program:

715 Indicate Bioscience for Sustainable Agriculture Program of Faculty of Animal Sciences and Agricultural Technology

The last three digits designating the course code:

First digit refers to the hierarchy of the courses.

5 Indicates graduate courses

Second digit refers to the course type as below:

0-1 Indicates required courses

2-8 Indicates elective courses

9 Indicates thesis

Third digit indicates the numerical order of the courses.

3.1.3.2 Calculation of Credit Point

Lecture or discussion: 1 credit is equivalent to 1 hour per week

Laboratory or practice: 1 credit is equivalent to 2-3 hours per week

Thesis: 1 credit is equivalent to 3-4 hours per week

The number of credits for a course is calculated from the summary of the lecture hours per week (L), the practical hours per week (P) and the self-study hours per week (S) divided by 3 as shown the following formula:

$$\text{Number of credits} = \frac{L + P + S}{3}$$

Credit representation for a course including 4 digits:

The first digit, outside the parentheses, represents the number of credit of that course

The second, third and fourth digits, inside the parentheses, represent the following:

The second digit indicates the number of lecture hours per week(L)

The third digit indicates the practical hours per week (P)

The fourth digit indicates the self-study hours per week (S)

3.1.3.3 Curriculum Courses

Plan 1

Seminar 3 credits

(Course in which no credit will be given as part of the curriculum and its assessment will be given as S or U)

715 507	Seminar I	1*(1-0-2)
715 508	Seminar II	1*(1-0-2)
715 509	Seminar III	1*(1-0-2)

Thesis 36 credits

715 591	Thesis (equivalent to)	36 credits
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*As non-credit subjects.

Plan 2

Required Courses 12 credits

715 501	Cell Science and Molecular Biology	3(3-0-6)
715 502	Bioscience for Agricultural Sustainability	3(2-3-4)
715 503	Research Methodology and Applied Bioscience for Agricultural Sustainability	3(3-0-6)
715 504	Seminar I	1(1-0-2)
715 505	Seminar II	1(1-0-2)
715 506	Seminar III	1(1-0-2)

Elective courses not less than 12 credits

The elective courses can be chosen from the following list or can be chosen from the post-graduate courses provided by the Faculty of Animal Sciences and Agriculture Technology with the decision and content of the curricular academic committee.

715 521	Animal Genetic Improvement and Conservation	3(3-0-6)
715 522	Biotechnology for Sustainable Animal Production	3(2-3-4)
715 523	Farming System Management in Integrated Animal Production	3(3-0-6)
715 524	Laboratory Animal Management and Welfare	3(2-3-4)
715 525	Hygiene in Dairy Production	3(3-0-6)
715 526	Nutraceuticals in Animal Health and Production	3(3-0-6)
715 527	Diagnosis of Aquatic Animal Diseases	3(2-3-4)

715 528	Ecology and Management of Aquatic Resources	3(3-0-6)
715 529	Selective Breeding of Aquatic Animals	3(3-0-6)
715 530	Genetic Improvement for Crop production	3(3-0-6)
715 531	Integrated Pest Management	3(2-3-4)
715 532	Microbial Diversity and Application	3(2-3-4)
715 533	Plant Genetic Resource and Application	3(3-0-6)
715 534	Postharvest Physiology and Technology	3(2-3-4)
715 535	Seed Technology	3(2-3-4)
715 536	Soil Fertility and Integrated Soil Resource Management	3(2-3-4)
715 537	Natural Resources and Management	3(3-0-6)

Thesis 12 Credits

715592	Thesis(equivalent to)	12 credits
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3.1.4 Study Plan

Plan 1 (Thesis only option)

Year	Semester1			Semester2		
1	715 507	Seminar I	1*(1-0-2)	715 508	Seminar II	1*(1-0-2)
				715 591	Thesis (equivalent to)	12credits
		Total	1 credit		Total	12credits
2	715 509	Seminar III	1*(1-0-2)	715 591	Thesis	12credits
	715 591	Thesis (equivalent to)	12credits		(equivalent to)	
		Total	12credits		Total	12credits

*As non-credit subjects

Plan 2 (Thesis and coursework option)

Year	Semester1			Semester2		
1	715 501	Cell Science and Molecular Biology	3(3-0-6)	715 505	Seminar II	1(1-0-2)
	715 502	Bioscience for Agricultural Sustainability	3(2-3-4)	715 xxx	Elective courses	6 credits
	715 503	Research Methodology and Applied Bioscience for Agricultural Sustainability	3(3-0-6)			
	715 504	Seminar I	1(1-0-2)			
		Total	10 credits	Total	7 credits	
2	715 506	Seminar III	1(1-0-2)	715 xxx	Elective courses	3 credits
	715 xxx	Elective courses	3 credits	715 592	Thesis(equivalent to)	6 credits
	715 592	Thesis (equivalent to)	6 credits			
		Total	10 credits	Total	9 credits	

3.1.5 Course Description

715 501 Cell Science and Molecular Biology 3(3-0-6)

Cell structure and function, structure of genetic materials, DNA replication, cell cycle, cell division, gene expression, gene regulation, cell differentiation, mutation, cell-cell communication, energy flow in biosystem, basic technique in molecular biology.

715 502 Bioscience for Agricultural Sustainability 3(2-3-4)

Integration of bioscience with local wisdom, relationship between natural resources and farming, models of sustainable farming, impact of farming to the environment, bioscience in agricultural product development and processing, and marketing of agricultural products.

Field trip required.

715 503	Research Methodology and Applied Bioscience for Agricultural Sustainability	3(3-0-6)
	Research and research questions, error in research, research design, research method, research tool, population and sampling, statistical analysis techniques and research presentation.	
715 504	Seminar I	1(1-0-2)
	Criteria: For student enrolled in plan 2. Practice of reading skill on recent agricultural bioscience research documents, improving ability on critical thinking process, discussion and presentation of research work under advisory of seminar instructors.	
715 505	Seminar II	1(1-0-2)
	Criteria: For student enrolled in plan 2. Pre-requisite: 715 504 Seminar I Searching, compiling the information, discussion and presentation of research in bioscience for sustainable agriculture.	
715 506	Seminar III	1(1-0-2)
	Criteria: For student enrolled in plan 2. Pre-requisite: 715 505 Seminar II Seminar in the topics of interest in bioscience for sustainable agriculture or topics related to student's thesis, competency of scientific analytical thinking and research planning related to the student's thesis.	
715 507	Seminar I	1(1-0-2)
	Criteria: For student enrolled in plan 1. Assessment will be given as S or U. Practice of reading skill on recent agricultural bioscience research documents, improving ability on critical thinking process, discussion and presentation of research work under advisory of seminar instructors.	

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|----------------|--|----------|
| 715 508 | <p>Seminar II</p> <p>Criteria: For student enrolled in plan 1. Assessment will be given as S or U.</p> <p>Pre-requisite: 715 507 Seminar I</p> <p>Searching, compiling the information, discussion and presentation of research in bioscience for sustainable agriculture.</p> | 1(1-0-2) |
| 715 509 | <p>Seminar III</p> <p>Criteria: For student enrolled in plan 1. Assessment will be given as S or U.</p> <p>Pre-requisite: 715 508 Seminar II</p> <p>Seminar in the topics of interest in bioscience for sustainable agriculture or topics related to student's thesis, competency of scientific analytical thinking and research planning related to the student's thesis.</p> | 1(1-0-2) |
| 715 521 | <p>Animal Genetic Improvement and Conservation</p> <p>Biodiversity, animal genetic resources, domestic animal diversity, loss of genetic diversity in domestic animals, reasons and criteria for breed selection and conservation, methods for conservation of animal genetic diversity, status of breeds, concepts and principles in genetic improvement of livestock.</p> | 3(3-0-6) |
| 715 522 | <p>Biotechnology for Sustainable Animal Production</p> <p>Constraints in production process, health management, welfare and waste from household animal productions, small farms and large farms, use of biotechnology in mitigating the constraints in production process, health management, welfare and waste from animal productions for sustainable animal production.</p> | 3(2-3-4) |

- 715 523 Farming System Management in Integrated Animal Production** 3(3-0-6)
Models and management of animal production process in integrated agriculture, interactions among crops, animals and aquatic animals under appropriate agro-ecosystems.
- 715 524 Laboratory Animal Management and Welfare** 3(2-3-4)
Management and care of laboratory animals, health management and laboratory animal ethic, animal restraint, animal constraints, techniques pertaining to anesthesia, euthanasia and necropsy.
- 715 525 Hygiene in Dairy Production** 3(3-0-6)
Factors affecting milk quality, milking parlor design and management, milking systems and analysis, milking machine, mastitis and milk quality management, waste management from dairy farm.
- 715 526 Nutraceuticals in Animal Health and Production** 3(3-0-6)
Principles of threpsology, role of nutraceuticals, functional foods and dietary supplements on animal health and diseases, discussion about these products, application of nutraceuticals and functional foods from natural sources as being part of animal feed.
- 715 527 Diagnosis of Aquatic Animal Diseases** 3(2-2-5)
Common and emerging infectious diseases in wild and farmed aquatic animals, diagnostic tools used in disease diagnosis, pathological and molecular diagnostic procedures for bacterial and viral infections in aquatic animals.
- 715 528 Ecology and Management of Aquatic Resources** 3(3-0-6)
Ecology of aquatic ecosystems, resource use and related environmental issues, ecological concepts, principles and application in conservation and restoration of aquatic resources.

- 715 529 Selective Breeding of Aquatic Animals** 3 (3-0-6)
Concept of quantitative genetics and selective breeding for quantitative traits in aquatic animals, genetic variation, statistical methods for measures of phenotypic variation, environmental effects, genotype-environment interactions, molecular marker and genetic map, quantitative trait loci analysis, marker-assisted selection, design of selective breeding program for genetic improvement of aquaculture species.
- 715 530 Genetic Improvement for Crop Production** 3 (3-0-6)
Genetics theory, conventional breeding and gene manipulation methods for genetic improvement in plant, utilization of genetic resource for qualitative and quantitative improvement, socio-economic aspect in adopting genetically modified crops.
- 715 531 Integrated Pest Management** 3 (2-3-4)
Definition of pests, key historical events in pest outbreak, effect of pest outbreak to agriculture, pest control tactics, integrated pest management (IPM) concept, components and steps of IPM, sampling techniques and decision tool of IPM, examples of IPM in current practices.
- 715 532 Microbial Diversity and Application** 3 (2-3-4)
Habitat of microbe, isolation and identification of microbes, detection and utilization of potential microbes for plant production in sustainable agriculture, types of plant-microbe association, factors affecting plant-microbe association, utilization of microbes for plant production in adverse environment, production, product formulation and commercialization of beneficial microbe for plant production.
- 715 533 Plant Genetic Resource and Application** 3 (3-0-6)
Genetic diversity of plant in the agro-ecosystem in Thailand, methods in determining genetic diversity of plant, preservation of plant genetic diversity in agro-ecosystem, identification of indigenous plant species with potential for conservation and commercial utilization.

715 534	Postharvest Physiology and Technology Causes of loss in post-harvest products, physiology of maturity, ripening, and senescence, genetic control of maturity, ripening, and senescence, post-harvest loss, prevention of post-harvest loss, insect pests and diseases of post-harvest products.	3(3-0-6)
715 535	Seed Technology Seed morphology and physiology of seed under storage and germination, process of seed production, methods in determining seed quality, seed pathology and insect pests of seed, techniques used in seed storage.	3(2-3-4)
715 536	Soil Fertility and Integrated Soil Resource Management Nutrient and organic matter recycling in soil, soil fertility analysis, plant-soil-microbe interaction, method of measuring the status of soil fertility, methods of enhancing the status of soil fertility for crop production in sustainable agriculture.	3(2-3-4)
715 537	Natural Resources and Management Approaches in natural resource management, stakeholder analysis for natural resource management, Geographic Information Systems (GIS), auditing systems for natural resource management, biodiversity conservation.	3(3-0-6)
715 591	Thesis (equivalent to) Original research dissertation undertaken under guidance of advisor(s).	36 credits
715 592	Thesis (equivalent to) Original research dissertation undertaken under guidance of advisor(s).	12 credits

3.2 Name, I.D. number, title and degree of the lecturers

3.2.1 Full time lecturers of the curriculum

No.	Name (Academic position and ID number)	Education and institutions	Teaching hours/week	
			Current program	Revised Program
1.	Dr. Narin Preyavichyapugdee	Ph.D. (Pathobiology) Mahidol University (2007) D.V.M., Kasetsart University (1995)	12	9
2.	Dr. Chanjira Sitthiya	Ph.D (Animal Science) Ehime University, Japan (2015) M.Sc. (Animal Science) Kagawa University, Japan (2012) B.Sc. MaeJo University (2005)	9	6
3.	Dr. Atthapol Thiantong	Ph.D. (Animal Science) National Chung Hsing University, Taiwan (2015) B.Sc. (Animal Breeding) Maejo University (2009)	12	9
4.	Dr. Panida Duangkaew	Ph.D. (Biochemistry) Mahidol University (2012) B.Sc. (Biology) Mahidol University (2005)	15	9
5.	Dr. Chaowanee Laosutthipong	Ph.D. (Biotechnology) Mahidol University (2012) M.Sc. (Immunology) Mahidol University (2005) B.Sc. (Biology) Silpakorn University (2002)	12	9

3.2.2 Full time instructors

No.	Name (Academic position and ID number)	Education and institutions	Teaching hours/week	
			Current program	Revised Program
1.	Dr. Narin Preyavichyapugdee	Ph.D. (Pathobiology) Mahidol University (2007) D.V.M., Kasetsart University (1995)	12	9
2.	Dr. Chanjira Sitthiya	Ph.D. (Animal Science) Ehime University, Japan (2015) M.Sc. (Animal Science) Kagawa University, Japan (2012) B.Sc. MaeJo University (2005)	9	6
3.	Dr. Atthapol Thiantong	Ph.D. (Animal Science) National Chung Hsing University, Taiwan (2015) B.Sc. (Animal Breeding) Maejo University (2009)	12	9
4.	Dr. Panida Duangkaew	Ph.D. (Biochemistry) Mahidol University (2012) B.Sc. (Biology) Mahidol University (2005)	15	9
5.	Dr. Chaowanee Laosutthipong	Ph.D. (Biotechnology) Mahidol University (2012) M.Sc. (Immunology) Mahidol University (2005) B.Sc. (Biology) Silpakorn University (2002)	12	9
6.	Assoc. Prof. Dr. Pantipa Na Chiangmai	Ph.D. (Crop Production Technology) Suranaree University of Technology (2004) M. Sc. (Agriculture) Chiang Mai University (1999) B.Sc. (Agriculture) Chiang Mai University (1997)	15	6

No.	Name (Academic position and ID number)	Education and institutions	Teaching hours/week	
			Current program	Revised Program
7.	Assist. Prof. Dr. Pattaraporn Poommarin	Ph.D. (Animal Science) University of the Philippines at Los Baños (2014) M.Sc. (Animal Science) KhonKaen University (2002) B.Sc. (Agriculture) KhonKaen University (2002)	12	6
8.	Assist. Prof. Dr. Surawat Chalorsuntisakul	Ph.D. (Pharmacy) Chiang Mai University (2010) M.Ag. Sukhothai Thammathirat Open University (2006) D.V.M., Chulalongkorn University (2001)	15	9
9.	Dr. Wilaiwan Sirirotnjanaput	M.S. (Agricultural Economics) Kasetsart University (1999) B.S. (Agricultural Economics) Kasetsart University (1995)	12	15
10.	Dr. Pawapol Kongchum	Ph.D. (Fisheries and Wildlife Sciences) Virginia Polytechnic Institute and State University, USA (2010) M.S. (Aquaculture) Central Luzon State University, Philippines (1999) B.Sc. (Fisheries) Rajamangala Institute of Technology (1992)	10	15
11.	Dr. Kaewta Limhang	Ph.D. (Fisheries Science) Kasetsart University (2010) M.Sc.(Fisheries Science), Kasetsart University (2005) B.Sc. (Fisheries), Kasetsart University (2003)	15	15

No.	Name (Academic position and ID number)	Education and institutions	Teaching hours/week	
			Current program	Revised Program
12.	Dr. Kritiya Lertchunhakite	Ph.D. (Animal Science) KhonKaen University (2012) M.Sc. (Zoology) Kasetsart University (2002) B.Sc. (Agriculture) King Mongkut's Institute of Technology Ladkrabang (1998)	12	6
13.	Dr. Anan Choukrou	Ph.D. (Animal Science) KonKaen University (2009) M.Sc. (Animal Science) KhonKaen University (2546) B.Sc. (Animal production technology) Suranaree University of Technology (1998)	12	9
14.	Dr. Supawadee Manatrinon	Ph.D. (Animal Breeding) University of Natural Resources and Applied Life Sciences, Vienna, Austria (2009) M.Sc. (Animal Production Technology) Suranaree University of Technology (2002) B.Sc. (Biotechnology) Silpakorn University (1999)	15	15
15.	Assist. Prof. Charunee Kasornpikul	Ph.D. (Pharmacy) Chiang Mai University (2009) M.P.H (Veterinary Medicine) Mahidol University (2003) D.V.M. Chulalongkorn University (2001)	15	9
16.	Dr. Pornpan Saenpoom	Ph.D.(Animal Nutrition) Universiti Putra Malaysia (2012) M.Sc. (Animal Science) KhonKaen University (2003) B.Sc. (Agriculture) KhonKaen University (2000)	12	6

No.	Name (Academic position and ID number)	Education and institutions	Teaching hours/week	
			Current program	Revised Program
17.	Dr. Warangkana Kitpipit	Ph.D (Animal Science) Kasetsart University (2012) M.Sc. (Animal Breeding) Chulalongkorn University (2002) B.Sc. (Agriculture) Prince of Songkla University (1998)	12	6
18.	Dr. Thanawadee Promchan	Ph.D. (Plant Science) Prince of Songkla University (2005) M.Sc. (Plant Science) Prince of Songkla University (2005) B.Sc. (Bioproduction) Prince of Songkla University (2005)	15	6
19.	Dr. Sararat Monkhang	Ph.D. (Plant Pathology) Chiang Mai University (2013) B.Sc. (Plant Pathology) Chiang Mai University (2008)	15	6
20.	Dr. Saowapar Khianggam	Ph.D. (Pharmaceutical Chemistry and Natural Products) Chulalongkorn University (2011) M.Sc. (Industrial Microbiology) Chulalongkorn University (2006) B.Sc. (Microbiology) Prince of Songkla University (2004)	12	9
21.	Assoc. Prof. Mana Kanjanamaneesathian	Certificate of Proficiency In English Victoria University of Wellington, New Zealand (1991) M.Appl.Sc.(Microbiology) Lincoln University, New Zealand (1994) M.Sc. (Agriculture) Kasetsart University (1988) B.Sc. (Agriculture) Kasetsart University (1985)	15	6

No.	Name (Academic position and ID number)	Education and institutions	Teaching hours/week	
			Current program	Revised Program
22.	Assist. Prof. Anawat Boonyapakdee	M.Sc. (Aquatic Science) Burapha University (2001) B.Sc. (Aquaculture) Maejo University (1997)	16	16
23.	Assist. Prof. Auraiwan I-suwan	M.Sc. (Soil Resources Management) Prince of Songkla University (2002) B.Sc. (Agriculture) Prince of Songkla University (1999)	15	6
24.	Mr. Sirichai Eardmusic	M.Sc. (Veterinary Medicine) Chulalongkorn University (2010) D.V.M., Mahanakorn University of Technology (2001) M.Sc. (Animal Health Science) Rajamangala University (1997)	12	9
25.	Miss DaorungSila-on	M.Sc. (Veterinary Anatomy) Kasetsart University (2007) B.Sc. (Biology) Kasetsart University (2002)	15	6
26.	Mr. Manatsanun Nopparatmaiitree	M.Sc. (Animal Science) KhonKaen University (2008) B.Sc. (Animal Production Technology) MahaSarakham University (2004)	15	6
27.	Mr. Kunadol Silarudee	M.Sc. (Fisheries) KhonKaen University (2007) B.Sc. (Fisheries) KhonKaen University (1999)	15	15
28.	Miss Yupa Pootaeng-on	M.Sc. (Organic Chemistry) Silpakorn University (2006) B.Sc. (Chemistry) Silpakorn University (2000)	12	6
29.	Miss ChanikaChanthasa	M.Sc.(Chemical Studies) Prince of Songkla University (2006) B.Sc. (Education) Prince of Songkla University (2001)	12	6

No.	Name (Academic position and ID number)	Education and institutions	Teaching hours/week	
			Current program	Revised Program
30.	Miss Suwimol Chinkangsadarn	M.Sc. (Biology) Chiang Mai University (2007) B.Sc. (Environmental Science) Silpakorn University (2004)	12	6
31.	Miss Nualpen Puangpunsi	M.Ed. (Teaching English as a Foreign Language) Silpakorn University (2007) B.Ed (English) Silpakorn University (2001)	12	6
32.	Miss Sirinnapa Poomjae	M.Sc. (Zoology) Chulalongkorn University (2005) B.Sc. (Biology) Prince of Songkla University (2001)	12	6
33.	Mr. Pisit Suvarnaphaet	M.Sc. (Physics) Silpakorn University (2005) B.Sc. (Physics) Silpakorn University (2007)	12	6
34.	Miss Watcharaporn Rourmtham	M.Sc. (Zoology) Kasetsart University (2002) B.Sc. (Biology) KhonKaen University (1999)	12	15
35.	Mr. Chon Poosuwan	M.Sc. (Biological Sciences) Brock University, Canada (1999) B.Sc. (Aquatic Science) Burapha University (1995)	12	6
36.	Mrs. Kataya Suvarnaphaet	M.A. (TESL) Christian University of Thailand (2008) B.A. (Social Science and Development) Silpakorn University (2004)	12	6

3.2.3 Special Instructors

Order	Position, First name-Last Name	Qualification, Major, Institute, Year of graduation
1.	Prof. Dr. Charan Chantharakhana	Ph.D. (Animal Breeding) Iowa State University, USA (1968) M.S. (Animal Science) Iowa State University, USA (1962) B.S. (Animal Science) Iowa State University, USA (1959)
2.	Prof. Dr. Metha Wanapat	Post Doc. (Straw treatment) Agricultural University of Norway, Norway (1983) Ph.D. (Ruminant Nutrition) North Dakota State University, USA (1980) M.S. (Ruminant Nutrition) North Dakota State University, USA (1978) B.Sc. (Animal Science) KhonKaen University (2519)
3.	Prof. Dr. Sanit Aksornkoae	Ph.D. (Plant Ecology) 1975 Michigan State University, USA (1975) M.Sc. (Forestry) Kasetsart University (2513) B.Sc. Kasetsart University (2508)
4.	Prof. Uthairat Na-Nakorn	Ph.D. (Genetics and Breeding in Aquatic Animals) Ehime University, JAPAN (1998) M.Sc. (Genetics) Kasetsart University (2521) B.Sc. (Fisheries) Kasetsart University (2517)

4. Details of practicum (if any)

None

5. Thesis requirement (if any)

5.1 Short description

This curriculum requires the students to use the holistic approach to identify research question and to work on thesis topic based upon the problems of the community development.

5.2 Standard learning outcomes

The students possess the understanding of systematic research planning with the capability to integrate basic and applied knowledge and write the research report which can be disseminated at the national conferences.

5.3 Instruction period

Plan 1	Semesters 2: Year 1 students Semesters 1 and 2: Year 2 students
Plan 2	Semesters 1 and 2: Year 2 students

5.4 Number of credits

Plan 1	Thesis equivalent to 36 credits
Plan 2	Thesis equivalent to 12 credits

5.5 Preparation

(1) Students (in all study plans) must be individually tasked with a research project. This will start with the seminar courses in which the students are required to undertake independent study and present the seminar in the class. During the course of engaging in seminar, the students will be in a position to identify their interest in any particular research area and this will be subsequently developed into a thesis proposal.

(2) Approval of thesis proposal by Thesis Examination Committee for graduate study.

(3) Assignment of the primary thesis advisor of individual student.

This proposal must later be approved in accordance with the standard criteria for graduate study B.E. 2550 (2007)

5.6 Assessment

The program's evaluation must be in accordance with Silpakorn University's Regulations on Graduate Study B.E. 2550 (2007) as in 26.4 and section 6 in the following topics:

- 1) Approval of thesis proposal and project, Thesis registration, Conduct of research under the guidance of a primary thesis advisor and a co-advisor (if any)
- 2) Student submission of progress report to the primary thesis advisor and a co-advisor (if any) every semester, Evaluation report on student's thesis progress at the end of every semester, and Submission to and request for evaluation from the Thesis Examination Committee. Evaluation result will be reported as IP (in progress) or NP (no progress).
- 3) There must be at least 3 but not more than 5 members of Thesis Examination Committee, which shall consist of the head of the department or a person authorized by the head of the department (which shall not be the primary advisor of the thesis being examined), the primary advisor and not more than 3 qualified persons (at least one of which must be an external examiner). The Thesis evaluation results will be reported as 4 levels including "Excellent", "Good", "Passed", and "Failed".

Section 4 Learning outcome, Teaching strategy and Evaluation

1. Developing a Special Student Characters

The Master of Science in bioscience for sustainable agriculture of the Faculty of Animal Sciences and Agricultural Technology anticipates that the students shall possess the following

Special character	Strategy or Student Activities
Academic aspect	Lecture with student participation in the classroom, after which written and oral examinations will be conducted to assess student's understanding.
Continuing study	Provide the platform for the students to conduct independent study in the current topics and assess the performance of the students in executing such activities.
Analytical	Provide the platform for the students to perform writing skills for academic purpose and evaluate their performance based upon their capability in established sound research questions in sustainable agriculture.
Morality and ethic	The lecturers point out ethical and moral issues in proper professionalism and assess their attitude.

2. Developing Learning Outcomes in Each Area

2.1 Morals and Ethics

2.1.1 Target Outcome

Students are to possess moral and professional ethics in order to live and work with others harmoniously and benefit the society. In addition, since the research in agriculture is related to the safety and life of consumers, thus the researcher in agricultural field must have responsibility to any consequence occurs due to their work similar to other discipline of career. Instructors teaching in the curriculum must teach the student to develop moral and professional ethics together with all the knowledge as a whole according to these 7 following attributes:

- (1) Moral, ethical, sacrificing and honest
- (2) Possess discipline, punctuality and responsibility to themselves and society

- (3) Possess both leadership and teamwork skills with the capacity to solve conflict and prioritize tasks
- (4) Respect and behave according to social norms under the concept and principles of good governance
- (5) Conscious of responsibility towards the rules and any regulations of organization and society
- (6) Possess professional ethics

2.1.2 Teaching Strategies

Instill the concept of morals and ethics in carrying out studies as well as learning to live and work together both in class and during fieldwork so as to develop maturity in every aspect through respecting themselves and others and respect to their career.

2.1.3 Evaluation Strategies

- (1) Cases of misconduct in thesis plagiarism and misconduct in examination
- (2) Evaluate from tasks which have been assigned to accomplish

2.2 Knowledge

2.2.1 Target Outcome

Students must have good knowledge in animal husbandry, aquatic animals, and sustainable agriculture for securing job and developing the society. For this the students must possess the following:

- (1) Possess knowledge and comprehension of theories and principles in the field of study
- (2) Possess analytical ability and applied the knowledge and skill appropriately to solve the problem
- (3) Able to follow and acquire the current knowledge and apply it in a creative manner
- (4) Understand and pay attention to develop specific knowledge
- (5) Understand the subject in a broad sense so as to be able to both identify changes and the effect from application of new technology
- (6) Able to integrate the current subject with other related disciplines

2.2.2 Teaching Strategies

Use multiple methodology in the learning-teaching process based upon the real situation and the technological changes. The learning-teaching process must be conducted in the field by way of excursion and internship in the participating organizations. Special lecturers should also be invited to provide specific knowledge on the case by case basis.

2.2.3 Evaluation Strategies

Evaluate from students' achievements in terms of knowledge and performance in different aspects according to the following:

- (1) Quiz.
- (2) Midterm and Final examinations.
- (3) Assessment of the writing report.
- (4) Assessment of the research plan.
- (5) Assessment of the presentation.

2.3 Intellectual Skill

2.3.1 Target Outcome

Students are to have ability in their studies and research; able to make analyses and conduct interdisciplinary research by integrating knowledge of various fields that they have learnt from the program in striving for research excellence so as to possess the following skills:

- (1) Able to think and consider systematically
- (2) Able to search, interpret, and evaluate information in order to solve issues in a creative manner
- (3) Able to collect, study, analyze and summarize any issues and requirements
- (4) Able to integrate knowledge and intellectual skill with knowledge in other fields

2.3.2 Teaching Strategies

- (1) Use special case in research for application in animal science to solve the problem of the farmers
- (2) Organize group discussions

2.3.3 Evaluation Strategies

Evaluate the outcome with the examination paper to gauge the student's ability in solving problems and in applying knowledge, excluding the examination based upon multiple choices and questions regarding definitions.

2.4 Interpersonal Skill and Responsibility

2.4.1 Target Outcome

Students must work in the new environment where there is a need to adapt and adjust to the new people. There are various interactions, such as among colleagues, between senior staffs and junior staffs, and in hierarchical term (between boss and normal staffs), in which the students must learn so as to integrate comfortably in the organization. The following is the content in which the students should possess:

- (1) Possess the responsibility as an individual and as a member of the group

- (2) Adapt and work with other colleagues both as a leader and as a member of the group
- (3) Behave and express one opinion adequately according to role and responsibility
- (4) Plan and take proper responsibility for continuing self development in order to have high performance efficiency

2.4.2 Teaching Strategies

In assigning the group work, working with the other students across curriculum, or acquiring the knowledge from the experts through interview, the following interpersonal characteristics are needed:

- (1) Able to work with other effectively
- (2) Responsible to the task assigned
- (3) Adapt to the situation and organizational culture effectively
- (4) Possess good interpersonal with colleagues and other people
- (5) Have leadership skill

2.4.3 Evaluation Strategies

Evaluate from the behavior and attitude of the students from the accurate content and data quality of the presentation and activities in the classroom.

2.5 Skills in Statistical Analysis, Communication and Use of Information Technology

2.5.1 Target Outcome

Students are to possess the following skills:

- (1) Able to identify and use statistics or mathematics in analyzing data and use the analysis to solve the problems creatively
- (2) Able to summarize and communicate in oral and writing and choose the appropriate presentation creatively to various audiences
- (3) Able to identify, access, and screen information related to science and technology from database in the national and international sources
- (4) Possess proper skill to use appropriate information technology and apply it for proper collection, translation and communicate
- (5) Able to keep up with the latest development in the information technology
- (6) Able to use English language in general level properly

2.5.2 Teaching Strategies

Arrange the activities in the subjects so that the students will be able to analyze effectively in both the real setting and virtual setting and apply the techniques to various situations.

2.5.3 Evaluation Strategies

The evaluation can be conducted during learning-teaching process, in which the students must learn how to solve problems, analyze how effective the techniques used to solve the problems are, and present this acquired learning in the classroom. Discussion among the lecturers and the students are encouraged.

3. Curriculum Mapping

Keys to Learning Outcome Table are as follows:

1. Morals and Ethics

- (1) Moral, ethical, sacrificing and honest
- (2) Possess discipline, punctuality and responsibility to themselves and society
- (3) Possess both leadership and teamwork skills with the capacity to solve conflict and prioritize tasks
- (4) Respect and behave according to social norms under the concept and principles of good governance
- (5) Conscious of responsibility towards the rules and any regulations of organization and society
- (6) Possess professional ethics

2. Knowledge

- (1) Possess knowledge and comprehension of theories and principles in the field of study
- (2) Possess analytical ability and applied the knowledge and skill appropriately to solve the problem
- (3) Able to follow and acquire the current knowledge and apply it in a creative manner
- (4) Understand and pay attention to develop specific knowledge
- (5) Understand the subject in a broad sense so as to be able to both identify changes and the effect from application of new technology
- (6) Able to integrate the current subject with other related disciplines

3. Intellectual Skill

- (1) Able to think and consider systematically
- (2) Able to search, interpret, and evaluate information in order to solve issues in a creative manner
- (3) Able to collect, study, analyze and summarize any issues and requirements
- (4) Able to integrate knowledge and intellectual skill with knowledge in other fields

4. Interpersonal Skill and Responsibility

- (1) Possess the responsibility as an individual and as a member of the group
- (2) Adapt and work with other colleagues both as a leader and as a member of the group

- (3) Behave and express one opinion adequately according to role and responsibility
- (4) Plan and take proper responsibility for continuing self development in order to have high performance efficiency

5. Skills in Statistical Analysis, Communication and Use of Information Technology

- (1) Able to identify and use statistics or mathematics in analyzing data and use the analysis to solve the problems creatively
- (2) Able to summarize and communicate in oral and writing and choose the appropriate presentation creatively to various audiences
- (3) Able to identify, access, and screen information related to science and technology from database in the national and international sources
- (4) Possess proper skill to use appropriate information technology and apply it for proper collection, translation and communicate
- (5) Able to keep up with the latest development in the information technology
- (6) Able to use English language in general level properly

Courses	1. Morality, Ethics						2. Knowledge						3. Education skills				4. Interpersonal skills and responsibilities				5. Mathematical analysis, communication, and IT skills					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	1	2	3	4	1	2	3	4	5	6
715 525 Hygiene in Dairy Production	○	●	○	○	○	○	●	○	○	○	○	○	●	○	○	○	●	○	○	○	○	○	●	○	●	○
715 526 Nutraceuticals in Animal Health and Production	●	●	○	○	○	●	●	○	●	○	○	○	●	○	○	○	●	○	○	○	○	●	●	○	○	○
715 527 Diagnosis of Aquatic Animal Diseases	○	●	○	○	○	●	●	●	○	○	○	○	●	○	○	○	●	●	○	○	○	○	●	○	○	○
715 528 Ecology and Management of Aquatic Resources	○	●	●	○	○	○	●	○	○	○	○	○	●	●	○	○	●	○	○	○	○	○	●	○	○	○
715 529 Selective Breeding of Aquatic Animals	○	●	○	○	○	●	●	○	○	○	○	○	●	○	○	○	●	○	○	○	●	●	●	○	○	○
715 530 Genetic Improvement for crop production	○	●	○	○	○	○	●	○	○	○	○	○	●	○	○	○	●	○	○	○	●	●	●	○	○	○
715 531 Integrated Pest Management	○	●	○	○	○	●	●	○	○	○	●	○	●	○	○	○	●	○	○	○	○	○	●	○	○	○
715 532 Microbial Diversity and Application	○	●	○	○	○	○	●	●	●	○	○	○	●	○	○	○	●	●	○	○	○	○	●	○	●	○
715 533 Plant Genetic Resource and Application	○	●	○	○	○	○	●	●	○	○	○	○	●	○	○	○	●	○	○	○	○	○	●	○	●	○
715 534 Postharvest Physiology and Technology	○	●	○	○	○	○	●	○	●	○	○	○	●	○	○	○	●	●	●	○	○	○	●	●	●	○
715 535 Seed Technology	○	●	○	○	○	○	●	○	○	●	○	○	●	○	○	○	●	○	○	○	○	○	●	○	●	○
715 536 Soil Fertility and Integrated Soil Resource Management	○	●	○	○	○	○	●	○	○	○	○	○	●	●	○	○	○	○	○	○	○	○	●	○	○	○
715 537 Natural Resources and Management	●	●	○	○	○	○	●	○	○	○	○	○	●	●	○	○	○	○	●	○	○	●	●	○	○	○
715 591 Thesis	●	○	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○	●	●	●	●	●	○	●	●	●
715 592 Thesis	●	○	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○	●	●	●	●	●	○	●	●	●

Section 5 Evaluation criteria

1. Grading regulations or criteria

Assessment and Graduation are consistent with Silpakorn University's Regulations on Graduate Study B.E. 2550 (2007).

2. Student's achievement standard review process

The review processes of student's achievement standard in all courses are as follows:

2.1 Review of student's learning outcome before graduation

- (1) Re-evaluate at the course level, in which the students should evaluate the teaching in the courses they have taken. The appointed committee will conduct review the suitability of the examination papers basing upon the teaching plan.
- (2) Re-evaluate at the curricular level under the internal quality assurance of the university after which the result should have been reported.

2.2 Review of student's learning outcome after graduation

The emphasis is on continuous research of student career achievement and use research results to improve on instructional process and integrated curriculum as well as to evaluate curriculum quality. Components to be reviewed are:

- (1) Evaluation of employment rate of each class of graduates in terms of graduate's job search period, knowledge, ability, and career confidence.
- (2) Interview or questionnaire survey of graduate employer's opinions and satisfaction at different intervals, for example, after one or three years of employment.
- (3) Evaluation by other educational institutes thought interview or questionnaire survey on the level of satisfaction on graduate's knowledge, readiness and other qualifications.
- (4) Evaluation by graduates with employment in terms of the readiness and knowledge gained from Bioscience in Sustainable Agriculture and other course provided in the program, including the relevancy of these courses to graduate's employment. Opinions on how to improve the curriculum are invited.
- (5) Concrete and measurable student's achievement such as number of patents granted, number of social and professional awards of recognition.
- (6) Assess the view from the external experts or invited lecturers with respect to the student's learning capacity or other related traits.
- (7) The number of research presented at the conferences or the number of the publication in the national and international journals.

3. Graduation criteria

3.1 In accordance with the Silpakorn University regulation regarding Postgraduate study 2007 section 7 and/or the revision of this regulation.

3.2 Comply with the conditions and rules of the curriculum as follows:

3.2.1 Passed (Obtain “S”) the comprehensive examination

3.2.2 Thesis or part of the thesis conducted has been accepted for publication in the national peer-reviewed journal/transaction at least 1 paper or present thesis/part of the thesis in the international conferences with full-paper published in the conference proceeding at least 1 paper.

3.2.3 The students must attend the national or international conference in the field related to agriculture at least one time. The students need to interact with at least one speaker and the 2-3 conference participants to develop communication skill in English. The synopsis of this interaction must be included in the thesis as an appendix.

Section 6 Teaching staff development

1. New instructor's orientation

- (1) Conduct orientation for the newly-recruited lecturers with respect to the role and duty of the lecturers in bringing about proper learning to the students.
- (2) Conduct orientation for the newly-recruited lecturers with the emphasis on the details of the curriculum, such as Philosophy, Objectives of the curriculum, Rule and Regulation promulgated by the university.
- (3) Conduct orientation for the newly-recruited lecturers with the emphasis on the details of the courses being offered at the faculty and the expectation in which the students should accomplish in each courses.
- (4) Provide coaching to the newly-recruited lecturers and monitor their working in teaching for at least 1 academic semester.

2. Development the knowledge and theskills to the newly-recruited lecturers

Ensure that all newly-recruited lecturers have the opportunity to develop further in their career path. It is a requirement that they have attended to any program aiming to develop their ability at least once a year.

2.1 Development of knowledge and skills in teaching-learning, and evaluation

- (1) Conduct hand-on training regarding teaching-learning activities (such as teaching techniques, evaluation ect.). This is implemented by the Registration Division of Silpakorn University annually and the activity aims for the newly-recruit lecturers at the first year of their work, followed by another similar activity every 2-3 years.
- (2) Equip with teaching skills with the emphasis on the philosophy of placing the students as the focal points in teaching-learning activities.
- (3) Encourage the lecturers to attend or to receive further training and transfer the knowledge to the staffs in the faculty
- (4) Exchange the ideas and share the experience among the lecturers in the faculty
- (5) Share documents among the stakeholders
- (6) Invite other lecturers to participate in the class and give recommendation.
- (7) Support classroom research for developing teaching-learning techniques and disseminate the finding to the network with work on the development of curriculum and education.

2.2 Academic and other professional skills development

- (1) Encourage instructor to participate in academic knowledge service to local community in order to enhance their experience and merit.
- (2) Encourage instructor to conduct researches to generate new body of knowledge and develop teaching skills to become experts in their field.

- (3) Stimulate, promote and encourage instructor to produce academic works: book or textbooks and academic publications in order to achieve higher academic position
- (4) Allocate research budget and arrange to have all instructors participated in various research groups in the faculty.
- (5) Promote and endorse presentation of academic work in various formats of journal publication or academic publication.

Section 7 Curriculum quality assurance

1. Curriculum administration

The curriculum shall be managed by curricular academic committee which is composed of Deputy Dean in charge of Academic Affair, as the Head of the committee, and other lecturers who are appointed to manage this curriculum. The role of this committee is to provide recommendation and set the policy in which the lecturers should transform to activities.

The committee in conjunction with the faculty administration should lay out the plan for academic activities in each semester. This committee should also monitor activities and gather the data from the implementation of the activities. This data shall be used to continually improving the curriculum.

Goals	Operations	Evaluation
1. Develop curriculum continuously and being the leader in creating new knowledge in the area of animal sciences and agricultural technology	<ol style="list-style-type: none"> 1. Provide new curriculum based on the accepted standard of animal sciences and agricultural technology 2. Revise the curriculum every 5 years 	1. The curriculum is standardized and accepted by the professional organization on the regular basis
2. Students are encouraged to learn and possess learning techniques to acquire new knowledge	<ol style="list-style-type: none"> 1. Provide learning-teaching platform where the students can conduct self-study 2. Provide teaching assistance to stimulate student learning 	1. The laboratory and self-studied subjects are provided for new knowledge acquisition
3. Curriculum review and improvement to keep up with high quality and standard	<ol style="list-style-type: none"> 1. Require that the lecturers must possess at least M.Sc. or possess enough experience as specified standard 2. Encourage the lecturers to play a leading academic role 3. Encourage the lecturers to visit the academic institutes both nationally and internationally 	<ol style="list-style-type: none"> 1. Record of number of qualified lecturers 2. Number of participants and the record of the activity 3. Result of the evaluation
4. Curriculum evaluation on the regular basis	<ol style="list-style-type: none"> 1. Review the curriculum every 4 years 2. Set up database on the students, lecturers, and equipments as well as 	1. Evaluate the result every 2 years by the internal committee

Goals	Operations	Evaluation
	international collaboration 3. Conduct satisfaction assessment	2. Evaluate the result every 4 years by the external committee

2. Instructional resources management

2.1 Budget management

Allocate annual budget (both from the government and the University's revenue budgets) to acquire permanent structures. Providing services and selling agricultural produces shall also be the source of revenue. Budget shall be allocated on the sensible basis for every subjects and monitoring on the expenditure in each subjects shall be implemented.

2.2 Existing instructional resources

The program in conjunction with the central library has appropriate and sufficient textbooks and other database resources. The faculty also possesses textbooks and other supportive materials which are sufficient for support teaching.

2.3 Procurement of additional instructional resources

University and faculty shall consider allocating sufficient resource for purchasing textbooks, academic journals and electronic database annually. The need from the full-time teaching staffs and special instructors for purchasing these academic materials shall be taken into consideration. The central library in conjunction with the faculty will be responsible for managing these resources for the students. The acquisition of laboratory instruments shall be acquired through careful planning.

2.4 Evaluation of resource adequacy

Arrange media facilities and convenience of use for instructors and evaluate instructor's media demand and media sufficiency as the details below:

Goals	Operations	Evaluation
Provide lecture, laboratory and farm facilities to support the teaching-learning in both classroom and field setting.	Equip the lecture, laboratory and farm with modern equipments in line with the international standard to provide effective learning and research.	1. Compile data regarding to the use of laboratory and/or equipment/student. 2. Compile data regarding the number of the students who use the teaching facilities. 3. Evaluate the satisfaction of the students who use these resources.

2. Provide main network and other internet facilities to effectively support the self-learning activities outside the classroom	<ol style="list-style-type: none"> 1. Provide multimedia facilities to record the teaching and create teaching materials 2. Provide enough computing facilities for the effective self-learning 3. Provide sufficient academic resources, such as textbooks, journals, and multimedia in digital format for effective self-learning by the students 	<ol style="list-style-type: none"> 1. Compile the data regarding the number of equipment, laboratory usage in hours/student and the speed of network/student 2. Compile the data regarding the number of students who use computer 3. Compile the data with respect to the number of textbooks and multimedia 4. Survey student satisfaction in the use of these facilities
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3. Teaching-staff management

3.1 New instructor recruitment

Selection of new instructors shall be in accordance with the University's regulation and criteria. The new teaching staffs shall have Ph.D. qualification pertinent to the qualification needed by the program. The candidates shall be required to present their research in the conference and subject to interview by the committee. The committee shall also take the view from the teaching staffs into consideration in recruiting the staffs.

3.2 Teaching staff's participation in curriculum planning, monitoring and review

The meeting shall be organized to convene the head of the curricular academic committee and the lecturers in order to plan, evaluate and revise (both for teaching each subject and for assessing the whole curriculum) as specified and required by the academic assurance. In case of curricular revision, the committee composing of the teaching staffs, shall be responsible for monitoring the development of curriculum.

3.3 Appoint of special teaching staff

Special instructors are deemed highly important for their ability to transfer direct and practical experiences to students. The faculty has the following policies for the invitation of special instructors:

- (1) They must be persons with direct experiences, expertise or holding not less than M.Sc. education qualification.
- (2) Invitation of special instructors must be screened by the program's administrative committee. Submission of their curriculum vitae and previous works those are relevant to the topics or the course that they are invited to teach is required.
- (3) Invitation of special instructors must be planned at least 1 semester in advance.

(4) A performance evaluation of a special instructor must be carried out for each invited lecture each semester or every time that the course is taught by a special instructor.

4. Administration of instruction support personnel

4.1 Job specification

Job specification for each position must be in accordance with the faculty's needs and university's policies. The supporting staffs shall possess at least Bachelor Degree which is pertinent to the job requirement and possess the knowledge relevant to the curriculum.

4.2 Operation knowledge and skills promotion

(1) Allocate budget to endorse institutional research and organization development research.

(2) Include institutional research finding, data on organizational needs analysis, and the need for personnel development that is consistent with the organization development in an annual operational plan to secure the faculty's budgetary support.

(3) Arrange special training relevant to the task for the staffs such as laboratory preparation to support the learning-teaching process effectively.

5. Student assistant and consultation

5.1 Academic advice and other consultations

(1) The faculty appoints academic committees to provide supervision for each student.

(2) The supervisor must allocate the time and arrange the advisory session to the students which must be posted in the supervisor office as well as in the faculty website.

(3) Provide consultation service to the students with respect to extracurricular activity.

(4) Provide consultation service to the students regarding the good lifestyle which should be conducted in the university.

5.2 Student's appeal

In the case that student have doubt about an assessment of any course they can make a written request to view their answer sheets, scores, and instructor's assessment method in each course.

6. Job market and social needs and/or users satisfaction

(1) Conduct survey to obtain employment and further education in more advanced degree after one of graduation.

(2) Conduct survey to obtain the satisfaction of employer with respect to the quality of the graduates, in which the data will be used for improving the curriculum.

7. Key Performance Indicators

7.1 Key Performance Indicators for Curriculum outcome

Types of indicator: Process

Standard criteria: Level

Key Performance Indicators	2015	2016	2017
1. Not less than 50% of the tenured instructors participate in the planning, monitoring, and review of curriculum performance	x	x	x
2. Curriculum details provided in the TQF 2 are consistent with the national qualification standard	x	x	x
3. Complete details of all offered courses in the TQF 3 prior to instruction commencement	x	x	x
4. Prepare performance outcome report of courses in accordance with TQF 5 within 30 days after the semester has ended	x	x	x
5. Prepare performance outcome report of the curriculum in accordance with TQF 7 within 60 days after the academic year has ended	x	x	x
6. Review student's achievement at least 25% of the offered courses in each semester in accordance with the learning outcome specified in TQF3	x	x	x
7. Development/improve instructional process, teaching strategies or learning performance outcome based on the performance evaluation results reported in last year TQF7		x	x
8. All new instructor (if Any) will receive orientation or advice on instructional management	x	x	x
9. All tenure instructors receive academic development training at least once a year	x	x	x
10. Not less than 50% of instructional support personnel (if any) receive academic and/or professional development training each year	x	x	x

11. The average level of senior students and new graduates' satisfaction for the quality of the curriculum is not less than 3.5 from the total score of 5.0		x	x
12. The level of employer's satisfaction is not less than 3.5 from the total score of 5.0			x
Total numbers of compulsory Key Performance Indicators (No.1-5) in each year	5	5	5
Total number of key performance indicators in each year	9	11	12

Evaluation criteria

Qualified curriculum must pass the standard qualification as following:

Compulsory KPIs (1-5) have been accomplished according to the objectives with no less than 80% of the compulsory and total KPIs in each year.

Academic year	Curriculum recognized by the standard qualification
2015	Attain obligatory KPIs 1-5 with overall accomplishment in 9 KPIs
2016	Attain obligatory KPIs 1-5 with overall accomplishment in 11 KPIs
2017	Attain obligatory KPIs 1-5 with overall accomplishment in 12 KPIs

Section 8 Curriculum evaluation and revision

1. Teaching Efficiency Assessment

1.1 Evaluation of Teaching Strategy

- (1) Evaluate from the participation of students in class discussions such as raising questions and putting forward arguments as well as from their ability in writing research papers and theses.
- (2) Carry out formal evaluation for each course.

1.2 Evaluation of Proficiency in Applying Teaching Strategy

- (1) Students evaluate teaching performance of each professor/lecturer in each course at the end of the course by answering the questionnaire set by the Coordinating Committee.
- (2) Respective professors/lecturers and Head of Curriculum shall be informed of the evaluation results for consideration and improvement in teaching performance.
- (3) The Coordinating Committee shall compile the comments concerning changes that need to be made in order to plan for improvement of teaching strategies.

2. Overall Evaluation of the Curriculum

The faculty shall arrange the assessment of the curriculum for improvement every 5 academic year in order to have the curriculum which is modern in line with the need of the country.

3. Evaluation of Performance According to Requirement Details of the Curriculum

There will be an annual internal academic assurance conducted by the appointed internal committee. The standard for evaluation will base upon a manual for an internal academic assurance for higher education (2014 edition) issued by the Office of Higher Education and/or its subsequent modified standard version.

All curriculums must be periodically updated and the evaluation for curricular development must be executed every 5 years.

4. Reviewing Assessment Results and Planning for Revision of the Curriculum

(1) The lecturers shall review the teaching evaluation given by the students, after which action should be taken to address the problems based upon the evaluation. The final report shall be submitted to the Head of the Department through the Head of curricular academic committee.

(2) The curricular academic committee shall monitor the implementation to achieve KPI in section 7 point 7 in accordance with the internal quality assurance.

(3) The curricular academic committee shall compile the teaching outcome and report the evaluation of teaching. It will also report the evaluation of the curriculum and the internal quality assurance as well as the views given by the external experts. All this shall be submitted for the Head of the Department.

(4) The curricular academic committee shall convene to review the implementation of the curriculum, in which the views from the external experts shall be used to plan for improvement in the next academic semester. The report shall be prepared for the Dean for consideration.

4.1 Amending courses

Amending or modifying courses based on results from the evaluation may be approved directly by the Coordinating Committee if the changes are minor and do not affect the structure of the curriculum.

4.2 Revising the entire curriculum

Entire overhaul of the curriculum is considered to be a major change affecting the structure of the curriculum and therefore should be carried out every 5 years at the termination of each cycle of the curriculum so that it becomes up-to-date and responds to the demands of prospective employers of graduates. The process for this undertaking shall be as follows:

- (1) The evaluation committee compiles a report on the assessment of the curriculum and points out issues that need amending.
- (2) Organize a seminar for the purpose of updating the curriculum.
- (3) Approach qualified individuals to review and give comments on the curriculum.
- (4) Submit the newly revised curriculum to the academic and curriculum review committees for deliberation before proposing it to the University Council for final approval.