Course detail

Master of Science Program in Biological Science

1. **Program Title:** Master of Science Program in Biological Science
2. **Degree:** Master of Science (Biological Science)
3. **Academic institution:** School of Science, Mae Fah Luang University
4. **Duration:** 2 years (August 2025 – May 2027)
5. **Background and Rational**

Based on the United Nations Sustainable Development Goals plan, the 2nd goal is zero-hunger. The aim of this goal is to end hunger, achieve food security and improved nutrition and promote sustainable agriculture. To that end, international policy focuses on managing the zero-hunger issue. Biodiversity is one of the main factors to achieve this goal via food security and improved nutrition. Biodiversity sustains food webs and food systems and is associated with ecosystem services. Thus, understanding biodiversity is key to food security. Thailand is situated in a biodiversity rich area, comprising approximately 6-10% of the total number of species known thus far making the country a resource rich area. Chiang Rai specifically is rich in unique bioresources, such as varieties of upland rice, coffee and fungi and mushroom. The potential of these resources for research and innovation is vast. Science and technology have important roles on obtaining a clear understanding on biodiversity and its utilization, thus enhancing food innovation and security. Therefore, promoting research in science and technology will accelerate solution of this issue in the future.

Being situated in the north of Thailand, Mae Fah Luang University is surrounded by bioresources. The Master of Science in Biological Science program focuses on describing biodiversity and its sustainable utilization leading to long term conservation and improved value of bioresources associated with biodiversity. With our program we provide the courses that aid the students to have a better understanding on using bioresources in a sustainable manner, generate and analyze big data and explore the economic impact of macro and microorganisms on biotechnological applications. These include future food products, pharmaceutical, diagnostic, agricultural, environmental, and other products that benefit society and lead to advanced technological innovations. Our program offers a vast variety of scientific courses for students to gain in-depth knowledge. For students who have

the entrepreneur mind and want to start their own business based on biosciences we also offer courses, such as Research innovation and business development as well as Bioentrepreneurship. The program is also engaged in the cooperation with the national partnerships, such as coffee growers, upland rice farmers and The Center of Excellence in Fungal Research as well as the government sector such as National Science and Technology Development Agency (NSTDA) for deep technology and business development as well as other business sectors. Furthermore, we have developed strong bonds and international collaborations with Kyoto University, Yamakuchi University, Japan; Shanghai Academy of Agricultural Sciences, South China Agricultural University, People's Republic of China; Taylor’s University, Universiti Putra Malaysia, Malaysia; Kangwon National University, Republic of Korea.

6. Objectives

The Biological Sciences program is broad and flexible, allowing students to study multiple aspects of the biological sciences or take on an interdisciplinary approach. We groom the students with knowledge and hands on experience by offering a vast variety courses and research-based projects. Our program aims to create the manpower, who are experts in the biological science area. Being a biologist today is also connected to providing research solutions to vital concerns such as increasing world food supply, improving the value-added products, improving and protecting our environment, and conquering diseases. With the philosophy of our program, we are embracing modern trends and preparing students suitable for future science careers.

7. Course Synopsis

7.1 Study plan

Study plan for Master of Science (Biological Science) for Academic year 2022 onwards

Plan A1 (By research)

Total credits: 36 credits

Year 1					
1st Semester (August – December)			**2nd Semester (January – May)**		
Course code	**Course title**	**credits**	**Course code**	**Course title**	**credits**
1100792	Thesis	9(0-27-9)	1100792	Thesis	9(0-27-9)
1100781	Seminar 1	0(0-3-1)	1100782	Seminar 2	0(0-3-1)
1100721	Integrated Biology	0(2-3-5)			
1100722	Biostatistics	0(2-3-5)			
Total credits		**9**	**Total credits**		**9**

Year 2					
1st Semester (August – December)			**2nd Semester (January – May)**		
Course code	**Course title**	**credits**	**Course code**	**Course title**	**credits**
1100792	Thesis	9(0-27-9)	1100792	Thesis	9(0-27-9)
Total credits		**9**	**Total credits**		**9**

Plan A2 (With coursework)

Year 1					
1st Semester (August – December)			**2nd Semester (January – May)**		
Course code	**Course title**	**credits**	**Course code**	**Course title**	**credits**
1100721	Integrated Biology	3(2-3-5)	1100726	Research Innovation and Business development	3(3-0-6)
1100722	Biostatistics	3(2-3-5)	11007xx	Elective 2	3
1100725	Biolaws	3(3-0-6)	11007xx	Elective 3	3
11007xx	Elective 1	3	11007xx	Elective 4	3
1100781	Seminar 1	0(0-3-1)	1100782	Seminar 2	0(0-3-1)
Total credits		**12**	**Total credits**		**12**

Year 2					
1st Semester (August – December)			**2nd Semester (January – May)**		
Course code	**Course title**	**credits**	**Course code**	**Course title**	**credits**
1100793	Thesis	6(0-18-6)	1100793	Thesis	6(0-18-6)
Total credits		**12**	**Total credits**		**12**

7.2 Course content

1. Required Course

1100723 Integrated Biology 0(2-3-5)

Cellular, molecular, and developmental biology; diversity of biomolecules and products through metabolic pathway and metabolic flux control; synthetic biology; approach to interrogate biological systems using –omics (e.g. genome, transcriptome, proteomes and metabolome); the omics in biological science research (e.g. agriculture, food or medicine)

1100724 Biostatistics 0(2-3-5)

Overview of statistical methods for analyzing correlated data; types of hypotheses, forming and testing hypotheses; designing research studies (surveys and experiments); selecting the types of statistics, analyzing data, interpreting results; Data analysis using statistical software; Statistic applications to analyze data from research topic

1100725 Biolaws 3(3-0-6)

Importance of biolaws and biosafety in research; National and International in bio-safety regulation, Issues of biodiversity exploitation; conventions, treatees, Laws on biodiversity; genetic resources; material transfer agreement (MTA); germplasms, seeds, plant variety, microbes, patent, and licensing; genetic invention; regulation for research, field test and commercialized Genetically Modified organisms (GMOs); regulation of genome editing.

1100726 Research Innovation and Business development 3(3-0-6)

Innovation and technology innovation; role of research and development in enterprises e.g. medicine and agriculture; ethics in research conducts; alliance and collaboration of research; Intellectual properties and protection; technology life cycles; overview of biotechnology applications and business trends locally and globally and basic business components

required for a start-up of biotechnology companies; Value proposition canvas; Business model canvas; overview on investment and business plan

1100781 Seminar 1 0(0-3-1)

Preparation of scientific communication skills such as written, visual and oral communication related topics or their research; Understand and discuss on scientific presentations; ethics in research

1100782 Seminar 2 0(0-3-1)

Widening perceptive and awareness of topics of interest to prepare for research thesis in biological science; Presentation and discussion of topics of interest related to the thesis

2. Thesis

1100792 Thesis (For A1 Program) 36(0-108-36)

Research and self-study under supervision of an advisor(s) which lead to develop new concepts or new findings in biological science; conducting research with concern of research ethics; presenting and publishing research in standard academic journals; complete thesis and oral defense required upon.

1100793 Thesis (For A2 Program) 12(0-36-12)

Research and self-study under supervision of an advisor(s) which lead to develop new concept or new finding in Biological Science; conducting research with concern of research ethics; presenting and publishing research in conference proceedings or standard academic journal; complete thesis and oral defense required upon

3. Elective Course (Minimum Credit Units : 12 Credit for A2 Program)

1100710 Economic Impact Insects 3(3-0-6)

Biology and ecology of economic impact insects; classification of insects; management of insects affecting economic field crops and

commercial horticultural crops; significant pollinators in crop production; insect utilization; edible insects, medicinal values of insects

1100727 Integrated Pests Management 3(2-3-5)

Utilization and integration of pest control tactics (cultural methods, biological control, pesticides, fungicides, herbicides) for management of insects and weeds and other pathogens; critical thinking skills and problem-solving skills to evaluate pest management.

1100728 Molecular Biology of Plant Growth and Development 3(2-3-5)

Structure and content of genome in plant cells; Developmental biology of plants and environmental; Constrains upon plant growth; Regulation of cell division, meristem activity, plant stem cells, embryogenesis and organogenesis; Signal transduction and plant hormones; Gene structure; Gene expression and regulation; Basic measurements of gene expression; Mechanisms regulating transcription; Apply molecular biology techniques in research

1100729 Economics Crop Production 3(3-0-6)

The theoretical and practical application of agronomic principles to crop production; economic importance of crop plants for food, feed, and fiber; conventional cropping; organic farming and hydroponic systems and practices; application of technology in farm management (smart farming, drone technology); specialty crop contributes to local economy production process (coffee, tea, rice)

1100730 Fungal Diversity and Applications 3(2-3-5)

A study of fungal biodiversity, taxonomy and phylogeny, current issues on micro-fungi technology; mushroom technology; mushroom cultivation; products from mushroom; secondary metabolites; fungal secondary metabolites in medicinal, agroindustry and agricultural applications; entrepreneurship in commercial fungal production

1100731 Microbiome 3(3-0-6)

An ecosystem of microorganisms in across a wide variety of organisms and habitats e.g. human, animal, plant; associations between microbial communities and host; microbial metabolism and functions; beneficial and pathogenic interactions and impact on host nutrition and health; fundamental and advanced research on molecular host-microbe interactions

1100732 Microbial Technology and Innovations 3(2-3-5)

Industrial microorganism; microbial strains and strain improvement; upscaling process; enzyme technology; protein technology; fermentation technology, the use of microbes in biotechnology such as food, chemical, medicinal, cosmetic, and other related products; current topics and prospects

1100733 Advanced Methods in Molecular Biology 3(2-3-5)

Principles of conventional genetic engineering; Principles of DNA markers; Applications of DNA markers in advanced research; advantages and disadvantages of conventional genetic engineering; Principles of genome-editing technology; basic information and major genome-editing techniques; applications of genome-editing technology; advantages and disadvantages of currently available genome-editing techniques; recent advances in the field of genome modification

1100734 Bioinformatics 3(2-3-5)

Sequence databases; retrieval, analysis, and interpretation of data from public databases; BLAST use and applications; analysis of DNA and amino acid sequences; characterization of protein properties and structures; phylogenetics basics

1100735 Big Data in Biological Science 3(2-3-5)

Knowledge from big data in bioscience e.g.”-omics” data, Transcriptomic data (RNAseq), Metabolomic data (LC-MS), and Biological image data; database segmentation; classification; Analysis and interpretation for applications in biological science

1100736 Research and Innovation Trends in Biological Science 3(3-0-6)

Current topics related to microbial life sciences, plants and animals, biotechnology, technology and innovation; application of current biological science knowledge with medical science, food industry, agriculture and other related sciences

1100737 Biorefinery 3(2-3-5)

Concept of biorefinery processes; bioresources and biomass; basics of transport phenomena in bioprocessing; chemical and biological treatment of biorefinery raw materials; types of biorefinery processes; the conceptual design and engineering of processes in biorefineries; the economic and ecological assessment of the entire value chain of biorefineries

1100738 Bioentrepreneurship 3(3-0-6)

Bridging science and business and translating biotech concepts into commercial terms; challenges in science-based industries related to entrepreneurship and innovation; sales and marketing strategies; IP analysis and initial freedom to operate, market opportunity; Pitch deck preparation; pitching

1100739 Population Biology and Conservation 3(2-3-5)

Population ecology; population genetics; conservation genetics; techniques in conservation biology; ecosystem management; restoration ecology; reinforcement and reintroduction; connectivity and biological corridors; species conservation in urban landscapes

1111730 Ecoinformatics 3(2-3-5)

Basic ecology and ecological data collection, for example sensor data, taxonomy data, biodiversity data, GIS data, models and predictions data verification and application

1102760 Drug Development from Herbal Medicine 4(3-3-7)

Quality control of drugs from medicinal plants; WHO and pharmacopoeia guidelines; Thai herbal and development, food supplements and cosmetics; pharmacological and clinical studies of traditional medicine; evaluation of efficacy of traditional

1102761 Pharmaceutical Phytochemistry 4(3-3-7)

Chemistry of herbal ingredients; classification of compounds from plants; preliminary techniques in phytochemical screening; biosynthesis of compounds; techniques in structural characterization; basic techniques in plant cell culture; pharmacological activities of natural products based on scientific evidence; structure activity relationship

8. Graduation conditions

- Complete all required courses
- Thesis oral defense
- Thesis submission
- Publication with peer reviews TCI1 or SJR, Proceeding for A2 plan
- English language: MFU-TEP 65 / TOEFL (IBT) 72 / TOEFL (ITP) 543 / IELTS 6 or English score from other sources (see the MFU announcement)

9. Applicant Qualifications

Students with a bachelor's degree in food science, Biology, Chemistry, Biochemistry, Nutrition, Biotechnology, Agricultural and related fields with cumulative undergraduate GPA ≥2.5 and TOFEL score ≥450 are encouraged to join the program. The program admissions committee makes all admission considerations on a case-by-case basis.

10. Document Required

- Application affixed with photographs.
- A copy of transcript from attended institutions
- Evidence of English proficiency, TOEFL exam or others
- Statement of purpose
- Letters of recommendation from referee
- A copy of passport

11. Contact:

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