MINISTRY OF EDUCATION AND TRAINING

DALAT UNIVERSITY

CREDIT-BASED HIGHER TRAINING PROGRAM

(APPLYING CDIO OUTCOME STANDARDS)

ACADEMIC DISCIPLINE: BIOTECHNOLOGY

Lam Dong - 2020

GENERAL INTRODUCTION

Bachelor of Biotechnology training program was designed to adapt to CDIO expected learning outcomes based on General education program attached by Circular No. 32/2018/TT-BGDĐT dated December 26, 2018 issued by Minister of Education and Training and Framework of Credit-based higher training program established by Dalat University. The Editorial Board also consulted the featured advantages of the Bachelor of Biotechnology training programs of the University of Agriculture and Forestry, Ho Chi Minh City University of Natural Sciences to build the current program. The program has been edited and improved based on reasonably absorbing the comments of stakeholders (education experts; educational administrators, lecturers, alumni, and students...) via email survey, direct survey, online survey, Workshop "Training and scientific research: Achievements and directions" organized by the Faculty of Biology in July 2020, and contributed opinions from businesses operating in the fields of Biotechnology application.

The training program includes 131 credits excluding courses related to physical education and defense and security. The overall knowledge of the program can be divided into two blocks:

1. The General knowledge block includes the scientific courses of Political Theory, Foreign Languages, Physical Education, National Defense and Security Education, Natural Science and Society.
2. The Professional education knowledge block consists of courses of basic of academic discipline knowledge, specialized knowledge and supplementary knowledge. In which, there are basic and specialized courses on Biology, Biotechnology were designed for three optional majors: Plant Biotechnology, Microbiological & Food Technology, and Agricultural Biotechnology. Students acquire and practice practical professional skills, personal skills to be able to develop their competencies in study, research and work after graduation.

In the specialized knowledge and skills block, there are elective courses, giving students the opportunity to update their knowledge, develop their professional skills, and meet output standards to become Bachelors of Biotechnology. Graduates can well implement career activities in domestic and abroad research institutes, universities, production and service enterprises or to continue studying at higher levels.

The training program pays a lot of attention to the training of knowledge, skills and attitudes with internships in nature experience, working environment and professional practice at research institutes and enterprises, and in production or service establishments where fields of Biotechnology have been applied.

The regular occupational experience and practice in the training process helps post-graduate students to quickly access and adapt to the reality, to meet the needs of society and businesses, as well as needs for starting-up.

Lam Dong, October 10th, 2020

DEAN OF FACULTY

TABLE OF CONTENTS

MINISTRY OF EDUCATION
AND TRAINING
DALAT UNIVERSITY

SOCIALIST REPUBLIC OF VIETNAM
Independence - Freedom - Happiness

CREDIT-BASED HIGHER TRAINING PROGRAM

Training academic discipline: BIOTECHNOLOGY

Vietnamese name of Training academic discipline: CÔNG NGHỆ SINH HỌC

Training Level: University degree (Bachelor)

Type of education: Formal

Academic discipline code: 52420201

Form of training: Full-time

Training duration: 4 years

Amount of full-program knowledge: 131 credits (excluding physical education, national defense and security)

1. TRAINING OBJECTIVE

General objectives

Biotechnology training program aims to train bachelors in Biotechnology with good ethical qualities, solid professional knowledge and skills, appropriate foreign language and information technology application proficiency. Graduates are knowledgeable, have expertise skills, are able to explain the basics and biological processes in differently structural level of biological world; dynamic and creating in the process of self-learning and self-scientific research; access and apply the achievements of science and technology in the field of biotechnology to perform professional activities to meet social needs.

Specific objectives

Graduates of Biotechnology are aiming to meet the following requirements:

- *Objective 1: Learners have good political qualities and standards of morality; have a sense of responsibility to contribute to the development of the community and society.*
- *Objective 2: Learners master knowledge, have ability to reason and explain the nature of life based on biology and biotechnology in a harmonious relationship with other natural science, social science and humanities.*

- *Objective 3: Learners are equipped with thinking and creating skills, professional practice skills, soft skills to implement professional activities and meet the trend of biotechnology development in the world and in Vietnam.*
- *Objective 4 Learners are capable of manipulating and promoting effective qualities, knowledge and skills for career development, meeting social needs.*

Employment and professional qualification opportunities

The professional positions learners can take on after graduation

- Participate in research and teaching at the institutes, centers and research institutions of the ministries, branches, universities, colleges, high schools in the country on Biology, Biotechnology in general and specialized fields such as genetics, microbiology, molecular biology, tissue culture ...…

- Working in biotechnology related regulatory agencies of industries, ministries, centers, provinces and cities as biotechnology specialists.

- Become an executive or specialist in charge of engineering, product research and development, exploitation of biological material inputs, and quality control of biotechnology-applied products in domestic and foreign production facilities, farms, hospitals, businesses.

- Technical consulting, market research, marketing at service trade enterprises in the fields of agriculture, forestry, fisheries, medicine, food technology.

- Establish own businesses, farms and start-ups in the field of biotechnology application.

Ability to continue to study, improve the professional level after graduation

Graduates can continue to participate in training programs at higher levels with many opportunities to be trained domestically and internationally.

2. SUBJECTS OF ADMISSION

Enrollment subjects is in accordance with the current regulations of the Ministry of Education and Training and Dalat University.

3. TRAINING PROCESS AND GRADUATION CONDITIONS

Follow the regulations on university training under the credit system of Dalat University.

4. SCORE

The scoring system complies with the Dalat University's regulations on university and college training.

5. COMPARE EXPECTED LEARNING OUTCOMES WITH TRAINING OBJECTIVES

There are 4 output learning outcomes groups for the Biotechnology Programe:

Disciplinary knowledge and reasoning

Personal and professional skills and attributes

Interpersonal skills: Teamwork and communication

Ability to be aware and practice professionally

EXPECTED LEARNING OUTCOMES				OBJECTIVES
1	Disciplinary knowledge and reasoning			
	1.1	Knowledge of General Curriculum		
		1.1.1	Understanding of Philosophy, Political Economy, Scientific Socialism, history of the Communist Party of Vietnam, Ho Chi Minh Thought to forming the political and ethical qualities of individuals to apply in persional and professional life and also effectively contribute to the sustainable development of the community and society.	1
		1.1.2	Understanding of defense policies and security issues, basic defense techniques to be ready to participate in preserving security and protecting sovereignty when the country need.	1
		1.1.3	Understanding the law to build the code of conduct in the community and implement professional activities: "live, work disciplined and obey the constitution, law".	1
		1.1.4	Understanding basic sports techniques and choose the suit exercise to stay healthy.	1
		1.1.5	Understanding the criteria of bioethics, rules, and regulations, national and international laws on biosafety, genetic engineering, human experiments, CITES….	2
		1.1.6	Understanding the responsibility of citizens in contributing to the general development of the community and society.	1,2
		1.1.7	Understanding mathematical knowledge of combinatorial calculus and algebra to apply the mathematical basis to form expressions related to biology and contribute to solving technical problems.	2
		1.1.8	Understanding the characteristics of experiments and data of biological experiments, can design	2

			experiments and collect, analyse, explain biological data.	
		1.1.9	Understanding basic chemical knowledge to explain phenomena, chemical processes and apply them in active ingredient analysis, design, and operation of biological, biotechnology and environmental processes.	2
		1.1.10	Understanding the physical nature of life: the conditions of existence of the living systems; the transport of molecules and ions across cellular membranes; the circulatory systems and oxygen transport, the respiration and photosynthesis, effect of the environmental factors on the organism.	2
		1.1.11	Understanding the basic principles of heat, mechanics, optics, electricity, and nuclear physics for recognizing the physical nature of biological processes and biotechnology processes.	2
		1.1.12	Understanding of environmental science from a biological perspective to assess environmental status and its impacts on nature to ensure sustainable development and contribute to environmental protection.	2
		1.1.13	Understanding the operating principle of laboratory, laboratory regulations; having a basic understand of the principle and structure of basic instruments and equipment and how to use them in the laboratory; the properties of chemicals and their preparation according to concentration; understanding the way to manage the laboratory and equipment use.	2
		1.1.14	Understanding how to detect, identify the problem, the way to make questions and hypotheses, knowing how to make research plans to solve the problem, method of collecting and analyzing data to answer questions or test hypotheses and write research reports.	2
		1.1.15	Explaining the basic concepts of economics as well as the basic laws of the market economy. Presenting the concept and calculation method of macroeconomic indicators. Summarizing the impact of macroeconomic policies on the	2

			economy. Explaining the relevant economic phenomena by applying economic theory.	
		1.1.16	General understanding of all fields of biology, biotechnology, and its application. Knowing main research trends and international, national achievements as well as the achivements of Dalat university.	2
		1.1.17	Understanding the basics of English grammar, vocabulary, and biology/biotechnology terms for understanding and translating documents relating to biotechnology (level 3/6 according to the Vietnamese language capacity framework). Knowing how to use tools to search and translate in biotechnology.	2
		1.1.18	Understanding the essence of all types of energy, renewable energy and exploitation potentials, characteristics of biomass, the origin of biomass energy, the role of biomass energy in life, methods of biomass extraction. Biomass energy products and processing methods. Prospects and challenges of renewable energy, biomass energy.	2
		1.1.19	Understand project management basics; knowledge relating to the project selection; how to organize the project; methods of project planning and budgeting; how to plan a resource allocation; project control method; how to management the risk of the project during implementation	2
	1.2	Core fundamental knowledge		
		1.2.1	Understanding the the structure, function of cells and zygotes, and the essence of metabolism and energy in organisms, mitosis and meosis, the differences between prokaryotes and eukaryotes. Understanding the principles of basic methods and techniques used in cell research.	2
		1.2.2	Understanding and remembering basic knowledge about morphology, plant anatomy and identification, taxonomy principles, and evolutionary relationships among taxa. Understanding the basic methods and techniques used in the research on plant migration. Remembering characteristics of some typical taxon that play an important role in theory and	2

			practical application in life.	
		1.2.3	Understanding and remembering the animal morphology, classification of phylum, class of animal, and analyzing the differences between phylum, class by the representative examples. Understanding basic methods and techniques used in animal research and its application.	2
		1.2.4	Understanding and remembering the morphology, structure, and life cycle of microorganisms as well as the basic methods and techniques used in microorganisms research. Understanding the meaning and role of microorganisms in the agricultural, food industry, health, environmental protection, and social life, knowing the way to use beneficial microorganisms, and to limited harmful microorganisms.	2
		1.2.5	Understanding the basic knowledge of the genetic material, hereditary rules, cross, structure and classification of genes, gene interactions, mechanisms and roles of variation and mutation, population genetics, and the basic methods used in genetic research at the molecular, cellular, individual, and population levels and its applications.	2
		1.2.6	Understanding the basic ecological rules, the effects of both abiotic or biotic factors on organisms; the characteristics of population, community, ecosystem, biome; biogeochemical cycles and applying that knowledge in biological processes, biotechnology solutions.	2
		1.2.7	Understanding the structure, function, and interaction of molecules: proteins, enzymes, nucleic acids, carbohydrates, and lipids, their conversion in the cell, the rule governing of this conversion, the variation of energy in various biochemical metabolic processes, and the relationship between metabolism and energy conversion; understanding the basic metabolic cycles and its role as well as basic methods and techniques used in biochemical research.	2
		1.2.8	Understanding the structure and function of biological macromolecules, the central theory on the processes of conversion DNA, to RNAs and	2

			proteins; Understanding the genetic essence and gene regulation, DNA damage and repair, DNA recombinant and gene transfer. Understand the principles of the basic methods used in the research of the molecular and its applications.	
		1.2.9	Understanding knowledge of transpiration, photosynthesis, respiration, mineral exchange, the effect of growth regulators in plants. Explaining the growth and development as well as physiological phenomena in plant cells and plants. Understanding the principle of the basic methods used in research on plant physiology and the application of this field to the cultivation.	**2**
		1.2.10	Understanding the basic knowledge of the functions and activities of animal or of living matter (as organs, tissues, or cells) and of the physical and chemical phenomena involved, the relationship between structure and function as well as the adaptation of the organism to the environment. Understanding basic techniques used in animal physiology research and the application of this field in life.	**2**
		1.2.11	Understanding and remembering basic knowledge about morphology, fungal anatomy, and identification; building relationships among taxons, specific features in the fungal life cycle, structure, growth and development, active ingredients .... Understanding the principles of basic methods and techniques used in research on fungi and the important role of fungi in life.	**2**
		1.2.12	Understanding the basics of evolutionary dynamics, the relationship between evolution and biodiversity in the ecosystem, forms of evolution, the relationship between evolution classification and geographical distribution; Understanding method of applying evolutionary knowledge in biological taxonomy, basic research methods used in research on evolution and biodiversity, and application of this field in practice.	**2**
	1.3	**Fundamental Knowledge of academic discipline**		
		PLOs of required courses		
		1.3.1	Understanding the principles of classifying plant resources by system, by functional group, by human need, and by origin. Understanding the	**2**

			diversity, the value of resources and applications of trees, food crops, vegetables, medicinal plants, industrial crops, fruit trees, ornamental trees ..., exploitation methods and development sustainable solutions of plant resources as well as methods of natural plant resource assessment.	
		1.3.2	Understand the main groups of organic compounds, secondary compounds in plants, extraction, purification, qualitative and quantitative methods; their roles for plants and humans; application of secondary compounds in life sectors such as food industry, protein technology, enzymes, pharmaceuticals, cosmetics, materials industry.	**2**
		1.3.3	Understanding the targets of multiplication and storage of plant cultivar, knowledge about reproduction, dispersal, differentiation, and undifferentiation, essence, biosynthesis and physiological; effecting of growth regulators and environmental factors on the growth and development of plants. Based on that effective implementation of sexual propagation methods (from seeds, spores, natural pollination, multiplication create), asexual (pickling, grafting, extracting, potting, rooting, separating seedlings, in vitro ...), methods of preserving, storing, and conserving plant seed sources (seed physiology, ex-situ, in situ, on-farm, in vitro, top garden/conservation).	**2**
		1.3.4	Understanding the purpose of breeding, the genetic role for the breed trait, the role and genetic techniques in the breeding steps, the role of allele frequency in a population, in breeding selection, how to apply traditional breeding methods, select and breed with molecular marker, mutation breeding, and GMO. Understanding the principles of specific genetic techniques in breeding, seed production, identification of varieties, and mutagenicity.	**2**
		1.3.5	Understanding plant diseases caused by pathogenic microorganisms, primarily fungi, bacteria, and viruses; Understanding of inorganic, organic, and natural pesticides as well as microbiological preparations in plant protection. Understanding and applying solutions to farming	**2**

			methods (Mineral nutrient regulation, shielding, site selection, crop rotation, ...) and using natural enemies as well as integrated control solutions IPDM and the use of chemistry in plant protection.	
		1.3.6	Understanding the characteristic of laboratory equipment and lab safety in the field of genetic engineering. Understanding the principle and knowing to use basic equipment to implement extraction, qualitative, quantitative techniques of DNA, RNA; Electrophoresis; PCR; DNA fingerprinting; ELISA, using RE, RT, and key enzymes. Understanding the principle of sequencing techniques according to the Sanger method, the gene transfer method. Understanding how genetic techniques can be used in Diagnosis; Classifying and building the generation of taxa based on molecules; Evaluation of genetic diversity and stability; Identify varieties; Mutation identification; Molecular marker-assisted screening.	**2**
		1.3.7	Understanding the role of informatics in the development of Biotechnology, knowing how to use data gene banks/databases, and related websites. and the way discovers data and documents. Using computer and bioinformatics software to search, exploit, process information, and comparing experimental data of molecular biology; Analyze in silico biological problems through algorithms and statistics.	**2**
		1.3.8	Understanding technologies related to isolating, classifying, testing, multiplying, and storing microorganisms strain, choosing suitable fermentation methods, and setting appropriate parameters for biomass multiplication. Knowing how to combine the knowledge and the techniques to produce biological products that can use to enhance crop yields and protect the environment.	**2**
		1.3.9	Understanding the basic principles and stages in food processing, traditional food processing techniques such as drying, frying, freezing, distillation ... and modern techniques: irradiation, microwaves, high pressure, ultraviolet rays,	**2**

			ultrasonic sound, ultrafiltration ...	
		1.3.10	Understanding the principle of food testing, applying suitable protocol to perform food testing and evaluation processes	**2**
		1.3.11	Understanding about biochemical reactions (hydrolysis and redox reactions) and application of biochemical technology in life.	**2**
		1.3.12	Understanding the growth and development, lifestyles and reproduction characteristics of different fungi groups and their representatives of edible and medicinal mushrooms.	**2**
		1.3.13	Understanding the role of mineral nutrition in plants and the plant's response to poly, secondary, and trace mineral deficiencies. Understanding the relationship between mineral nutrients in soil - manure – crop.	**2**
		1.3.14	Understanding the plant physiology, growth and development characteristics; effects of plant growth regulators in plant cell tissue culture techniques and plant genetic engineering.	**2**
		1.3.15	Understanding the biological background of ripening, degradation, spoilage, germination of post-harvest agricultural products and technical solutions to maintain the product quality.	**2**
		1.3.16	Understanding the farming technique, distinguishing traditional farming from high-tech farming, chemical, organic and semi-organic farming. Understanding farming principles according to Vietgap and Globalgap standards.	**2**
		1.3.17	Understanding the biological processes at the cellular to biomes levels in nature. Understanding the applications of the biotechnology in manufacturing.	**2**
		1.3.18	Understanding the organization, scale, functions, duties, and implementation methods of career activities associated with plant biotechnology majors, human resource requirements, and human qualifications in research and production units. Increasing in-depth plant biotechnology knowledge related to the actual work will	**2**

			experience.	
		1.3.19	Understanding the organization, scale, functions, duties, and implementation methods of career activities associated with Microbiology and Food Technology majors, human resource requirements, and human qualifications in research and production units. Increasing in-depth Microbiology and Food Technology knowledge related to the actual work will experience.	**2**
		1.3.20	Understanding the organization, scale, functions, duties, and implementation methods of career activities associated with Agriculture Biotechnology majors, human resource requirements, and human qualifications in research and production units. Increasing in-depth Agriculture Biotechnology knowledge related to the actual work will experience.	**2**
		PLOs of elective courses		
		1.3.21	Understanding the concept of microbiological and fungal resources, basic application-oriented microbiological and fungal resource groups. Understanding the microbial and fungal resources as forest products, probiotics products as well as ecological balance factors.	**2**
		1.3.22	Understanding the basic knowledge of soil, the process of soil formation in order to classify soil types; understanding the physical and chemical features of fertility and sustainability of soil fertility.	**2**
		1.3.23	Understanding the basic of proteins and enzyme, the method to quantify proteins and enzymes, to determine enzyme activity; understanding the application of proteins and enzymes in basic research and industry.	**2**
		1.3.24	Understanding the post-fermentation techniques and technological solutions: centrifugation, drying, mixing, pelleting, packaging, preservation ...) to apply in bio-products production. Learning and applying microbiological technology to serve life and protect the environment.	**2**
		1.3.25	Understanding the role, meaning and influence of key ingredients such as water, protein, lipid,	**2**

			polysaccaride, polyphenol ... as well as several specific activities result in the changes of food quality (their colorants, odors, active ingredients, food toxins). Undersantding methodological analysis tools for application in the management and processing of food products.	
		1.3.26	Understanding the role of microorganisms in agro-ecological balance, research methods of symbiotic microbial groups. In addition, understand the composition, types, mechanisms of harmful effects of micro-organisms effect to agricultural production.	**2**
		1.3.27	Understanding the main principles and techniques of animal biotechnology (animal cell culture, gene transfer, stem cell technology, reproduction technology, gene therapy, and sterility genetically modified animals, biomedical - biological materials). To be able to explain, grasp and understand commercial problems and products related to animal biotechnology in practical life, to find the most effective application direction (in health, animal husbandry ...)	**2**
		1.3.28	Understanding the criteria used in assessing biodiversity, pollution, sustainability and biotechnology solutions for the improvement of environmental types: bio-ecological environment, the agricultural ecological environment, the urban ecological environment in terms of both air, water and student composition.	**2**
		1.3.29	Understanding the vegetables and flowers growth in Da Lat, Lam Dong; applying hi-tech organic and semi-organic methods in soiless culture.	**2**
		1.3.30	Understanding the principles of diagnosing plant diseases based on symptoms, external conditions and indicator organisms; Diagnose diseases based on molecular biology tools: PCR, RT-PCR, ELISA, commercial kits.	**2**
		1.3.31	Being able to figure out and evaluate problems when implementing a scientific research in biotechnology.	**2**
		1.3.32	Being able to analyze problems for planning or	**2**

			improving a production process, applying specific supporting techniques based on background of knowledge, science and technology in plant biotechnology.	
		1.3.33	Being able to analyze problems for planning or improving a production process, applying specific supporting techniques based on background of knowledge, science and technology in Microbiology and Food Technology.	**2**
		1.3.34	Being able to analyze problems for planning or improving a production process, applying specific supporting techniques based on background of knowledge, science and technology in Agriculture Biotechnology.	**2**
		1.3.35	Understanding the structure of insect bodies and their applications in the fields of natural enemy use in agriculture, decoration, food, biomimicry (Biomimetic / Biomimicry), and environmental treatment, crop support (pollination, dispersal), secondary product acquisition, medicine and functional food, as a substrate for natural and artificial fungi, transgenic for the production of proteins and active ingredients.	**2**
		1.3.36	Understanding the basic of classification, properties and factors affecting milk and wine quality, distinguish basic processes in production, apply processing methods for milk and wine. Select and propose some suitable local wine and milk production processes.	**2**
	1.4	***PLOs of supportive courses***		
		PLOs of elective courses		
		1.4.1	Understanding the role, function and influence of nutritional ingredients such as protein, fat, fiber, minerals, vitamins, ... as well as some specific functional active ingredients in food. Selecting suitable methods for qualitative and quantitative analysis in order to apply for food quality assessment.	**2**
		1.4.2	Understanding the concepts and distinguishing characteristics of radiation types, the knowledge of radiation safety and basic methods of calculation, dose measurement, dose rate, activity	**2**

			and radiation interaction with objects substance, with the living system. Understand the principles and how to apply radiation in mutant breeding, water & air treatment, medicine, biological polymer circuit manipulation and disinfection, food preservation.	
		1.4.3	Understanding of water quality management and analysis techniques for aquaculture. Understanding and being able to control blue technology applications: plant and animal aquaculture (shrimp, fish, lotus, water lilies, duckweed, etc….), waste water treatment, aquariums.	**2**
		1.4.4	Understanding of the principles, structure, scale and meaning of various types of equipment and the process of manufacturing biotechnology products;	**2**
		1.4.5	Understanding and remembering the fuction and structure of ISO, TCVN, VILAS, GAP standard systems in evaluating biological product quality (livestock products, vegetables and fruits, medicinal and functional foods, agricultural microbiological product, organic fertilizers, etc…)	**2**
		1.4.6	Understanding of methods in plant research, especially medicinal plant resources based on indigenous knowledge from ethnic group.	**2**
		1.4.7	Understanding the principles and mechanism of operation of the immune system in human and animal bodies.	**2**
		1.4.8	Understanding of agriculture in the era of technology 4.0 with the application of information technology, IoT, AI and automation.	**2**
		1.4.9	Understanding agricultural ecosystems, the impact of agricultural activities on ecological and environmental balance, solutions to ensure ecological balance and sustainable agricultural development.	**2**
2	Personal and professional Skills and Atributes			
	2.1	Analytic reasoning and problem solving		

		2.1.1	Identify the issues and questions in basic research and application execution in biology and biotechnology	**3**
		2.1.2	Variance analysis brings to the comments on causes of the variances and selection of theoretical explanations: signals of gene expression process, metabolism, impact of external condition, adaption to the environment	**3**
		2.1.3	Analyze to be able to model biological problems, orient the arrangement of experiments / experiments / surveys and the recorded criteria to verify the hypotheses.	**3**
		2.1.4	Having skills in analyzing and evaluating to compare qualitatively and quantitatively the issues related to biotechnology such as biodiversity at the levels of populations, communities, and ecosystems; The differences in the expression / viability and adaptation of the organism in the respective environment in comparison with the differences in ecological factors by region, season and in experiment.	**3**
		2.1.5	Being capable of qualitative estimation and analysis of biotechnology problems, evaluation of the reasonableness of methods, supporting procedures and techniques to solve problems and to detect factors /abnormalities in the operation; and to give a correction plan, choosing an alternative method or proposing a new method	**3**
		2.1.6	Having analytical skills to propose methods of solving practical problems that arise based on knowledge, techniques and tools in the field of biotechnology	**3**
		2.1.7	Having analyzing and synthesizing skills to identify scientific theoretical bases, logic in linking / sequencing scientific theoretical bases to study, explain and solve practical phenomena or problems relating to biotechnology	**3**
		2.1.8	Having skills of analyzing, synthesizing, evaluating recorded results, observing reality in combination with reasoning based on knowledge	**3**

			to predict trends and tendency in biological processes	
		2.1.9	Making overall assessments based on the analysis of factors of professional qualifications, technical solutions, financial conditions, human resources, equipment for technological processes, methods of implementation of scientific research or business execution, service related to biotechnology, at the same time having the ability to make conclusions about the problem and recommend solutions for innovation or improvement	**3**
	2.2	Experimentation, investigation and knowledge discovery		
		2.2.1	Applying knowledge and practical analysis to establish theoretical explanations for natural biological objects and phenomena.	**3**
		2.2.2	Applying knowledge and practical analysis to establish theoretical explanations for objects and phenomena arising in the practical implementation of biotechnology applications	**3**
		2.2.3	Applying knowledge to analyze and select and systematize information, statistics/ data from traditional and internet sources / documents related to the objects, phenomena, biological processes that need to be explained	**3**
		2.2.4	Applying knowledge to identify methods as well as accompanying equipment and techniques to conduct experiments, qualitative and quantitative analysis; drafting the implementation plan	**3**
		2.2.5	Having skills in using equipment and technology to analyze and evaluate for production research and development in biotechnology and related fields.	**3**
		2.2.6	Having skills in applying knowledge, analyzing and practical assessment to approach, acquire and apply automation in combination with IoT in controlling equipment systems in biotechnology area.	**3**
		2.2.7	Having skills in applying knowledge, analyzing problems to arrange experiments to verify hypotheses in the field of biology and	**3**

			biotechnology, skills of recording, collecting data / statistics from experiments..	
		2.2.8	Have skills in analyzing, synthesizing data / statistics from experiment or investigation process to build new knowledge, make judgments and forecasts in the field of biotechnology.	**3**
		2.2.9	Applying knowledge to analyze and select and systematize information, data / statistics from traditional and internet sources / documents related to the objects, phenomena, biological processes that need to be studied and explained	**3**
	2.3	Systematical thinking		
		2.3.1	Systemize the biological worlds, the fields of biology, biotechnology and specialties	**3**
		2.3.2	Having the ability to comprehend a specific biotechnology issue in the harmonious relationship and interaction with the natural sciences and the society.	**3**
		2.3.3	Having the skills to analyze and evaluate to consider mechanisms, dynamics and causes of biological processes under many angles: genetics, physiology, biochemistry, ecology at different levels of biological organization.	**3**
		2.3.4	Having skills to identify problems arising in the field of biotechnology and the interaction of factors in the system, to identify / determine the causes and dynamics	**3**
		2.3.5	Having analytical and evaluation skills to organize and identify key factors that need to be addressed in relation to biotechnology and life sciences.	**3**
		2.3.6	Analyzing pros and cons and choose effective solutions to solve practical problems arising with knowledge, techniques and tools in the field of biotechnology	**3**
	2.4	Attitudes, thought and learning		
		2.4.1	Learners have the ability to analyze social contexts, evaluate science and technology proficiency in the field of biotechnology and ability to orient their majors suitable to	**3**

			themselves, localities and society.	
		2.4.2	Having the spirit of creativity, showing initiative and a willingness to accept risks in studying and solving problems that arise in professional practice in the field of biotechnology	**3**
		2.4.3	Demonstrating perseverance, willingness and determination, resourcefulness and flexibility	**3**
		2.4.4	Applying creative thinking in forming scientific research ideas, applying and improving methods / ways of executing / implementing professional activities in the field of biotechnology in the learning and working process.	**3**
		2.4.5	Forming critical thinking when receiving knowledge, evaluating deployment methods and efficiency of professional activities in the field of biotechnology	**3**
		2.4.6	Being able to analyze and self-evaluate about professional knowledge of biotechnology in particular and the overall knowledge in general, thereby choosing specialized fields and positions, occupation and functions that can be assumed in the future learning and working as well as assessing their ability to adapt	**3**
		2.4.7	Demonstrating an attitude of learning eagerness, and life time learning and practice	**3**
		2.4.8	Having ability to analyze, evaluate reality and be creative to manage time and resources effectively	**3**
	2.5	Ethics, equity and other responsibilities		
		2.5.1	Applying knowledge in a flexible and creative way to ensure the criteria of bioethics, to comply with the rules and regulations, national and international laws on biosafety, transgenic, human experiments, CITES in specific work contexts	**3**
		2.5.2	Working with high responsibility and love for the job, honesty in work execution and reporting	**3**
		2.5.3	Demonstrating a proper attitude and professionalism in the implementation of the	**3**

			work	
		2.5.4	Analyzing social contexts and circumstances, personal strengths to proactively plan their career development based on the professional knowledge that is associated with the needs of society.	**3**
		2.5.5	Always showing the spirit of learning and improvement to update and acquire specialized knowledge and supporting knowledge to effectively contribute in the career field.	**3**
		2.5.6	Analyzing and evaluating work performance to ensure fairness in the organization, assigning work and distributing economic benefits and encouragement to colleagues, employees as well as social justice. Respecting multiculturalism as well as knowing to listen, record and analyze critical opinions, adverse voice in the organization.	**3**
		2.5.7	Analyzing the scientific basis, assessing the reasonableness of decision making, orientation based on scientific arguments, loyalty to dialectical sciences and the interests of the collective	**3**
		2.5.8	Having love for the nature, occupation and knowledgeable about the relationship between the job and career path	**3**
3	Teamwork and communication skills			
	3.1	Teamwolk		
		3.1.1	Having ability to analyze, evaluate to select, gather and mobilize personnel, colleagues and stakeholders to form learning groups, and groups to develop / implement researches and professional activities relating to biology, biotechnology	**3**
		3.1.2	Having ability to analyze and evaluate to organize the followings: assignment of work, scheduling group working activities and implementation of projects in the field of professional expertise	**3**
		3.1.3	Having ability to maintain and develop working groups and implement projects in the field of	**3**

			biotechnology, especially in specialized areas	
		3.1.4	Having leadership skills, leading team to work and implement projects in the field of biotechnology, especially in the fields of specialization through promoting analytical, practical evaluation and creativity.	**3**
		3.1.5	Having ability to collaborate well with team members of same biotechnology expertise and groups that coordinate biotechnology expertise with others	**3**
	3.2	Communication		
		3.2.1	Analyzing and evaluating partners to choose communication strategies to present and negotiate issues of biotechnology expertise as well as related issues.	**3**
		3.2.2	Have analytical skills to learn and understand the communicating partner, systematize issues related to biotechnology to share, discuss, present, and negotiate to build communication structures, effectively conveying information and ideas.	**3**
		3.2.3	Having skills of establishing / building suitable documents that match the content and the level of orthodoxy to communicate in order to communicate effectively in writing.	**3**
		3.2.4	Being capable of multimedia communication	**3**
		3.2.5	Being capable of setting up graphics to present biotech problems effectively, understandably and convincingly	**3**
		3.2.6	Being capable of presenting clearly, concisely, convincingly and effectively issues, researches and applications in the field of biotechnology	**3**
		3.2.7	Having ability to analyze practices to request information, active listening and effective dialogue on issues that need to be communicated, discussed, and debated in the fields of biology and biotechnology	**3**
		3.2.8	Having ability to analyze and evaluate problems to negotiate, compromise and resolve conflicts and disagreements in scientific perspectives as	**3**

			well as conditions for the implementation of biotechnology research and application in practice.	
		3.2.9	Having ability to analyze and evaluate problems to mobilize and persuade partners about issues related to the field of biotechnology	**3**
		3.2.10	Being able to set up diversified links and network links to communicate effectively	**3**
	3.3	Communications in foreign languages		
		3.3.1	Having ability to communicate commonly in English at level 3/6 according to Vietnamese language capability scheme	**3**
		3.3.2	Having the skills to use specialized tools to look up and understand words, read and understand biotechnology specialized documents, exchanging with partners, and drafting simple articles in the field of expertise in English	**3**
4	Ability to be aware and practice professionally			
	4.1	Social context		
		4.1.1	Understanding the role and responsibilities of biology bachelors to society and the community	**4**
		4.1.2	To recognize and analyze the advantages/disadvantages in terms of geographical conditions, resources, facilities, and trades of the locality, thereby identifying the needs of that locality as well as the country for biotechnology in general and the specialized fields/fields of biotechnology in particular in the immediate and long term.	**4**
		4.1.3	Understanding the benefits of applying for scientific and technical advances in the field of biotechnology to life practice. The spearhead role and influence of Biotechnology in the 4.0 era	**4**
		4.1.4	Understanding and applying state regulations on biotechnology, understanding the levels of laboratory safety and corresponding biotechnology fields, Vietnam's participating biotechnology conventions, GMO regulations, prohibited/restricted areas of biotechnology application in Vietnam, regulatory understanding, and limitation of nuclear engineering application in biology	**4**
		4.1.5	Understanding and applying specific legal knowledge related to biotechnology and life	**4**

			sciences, history of formation, development, and cultural identity, specifically in the fields of biotechnology	
		4.1.6	Ability to analyze and evaluate to grasp the news-related issues of scientific and technical advances in the field of biotechnology and their application to ensure weeds, promote socio-economic development; on significant achievements in biology, medicine, agriculture, and life sciences in general in Vietnam and the world	**4**
		4.1.7	Have the ability to analyze to detect practical problems flexibly, current problems or general trends of society related to biology: exploitation of biological resources; change/change of plant variety structure; demand for natural products, organic agricultural products; environmental pollution; epidemics on humans, plants and livestock; high-tech agriculture; Application of IoT, AI combined with automation of applications in agriculture and the production of products related to biotechnology. Thereby forming ideas and choosing solutions to apply biotechnology in particular or in combination with other industries to implement practical jobs for society and the community.	**4**
		4.1.8	Ability to analyze and evaluate to grasp the change, rapid progress in science and technology in biotechnology, information technology, automation, and intersections fields of these three industries and their comprehensive influence on the professional structure, production methods, domestic and global society.	**4**
		4.1.9	Ability to analyze and evaluate to guide, propose and preside over research topics, implement and apply advances in plant biotechnology, microbiology and food technology, agricultural biotechnology to life.	**4**
		4.1.10	Ability to analyze and evaluate in combination with a sense of start-up creatively based on knowledge and skills in biotechnology and but understanding the context and needs of society.	**4**
	4.2	Career context		
		4.2.1	Ability to assess practical circumstances to understand cultural diversity in enterprises, production facilities, research institutes, and educational institutions is operating in the field of biotechnology and biotechnology application.	**4**
		4.2.2	Ability to analyze and evaluate to catch the level	**4**

			of technology and scientific and technical advances in the field of biotechnology as well as the context and problems to be solved by enterprises related to the fields of biotechnology, the idea of the business owner/employer to come up with technical solutions and implementation methods to solve problems, improve the efficiency of the business.	
		4.2.3	Have the analytical ability to grasp the strategies, goals, and business plans of the employer or business to develop strategies, goals, and business plans in the biotechnology-related work they (expected) undertake and show their abilities appropriately.	**4**
		4.2.4	Assess the value of the product and the ability to commercialize biotechnology products.	**4**
		4.2.5	Ability to analyze and evaluate technical solutions related to biotechnology for production, improve production process efficiency and quality of specific products.	**4**
		4.2.6	Ability to observe and analyze flexibly at work to quickly grasp problems arising or newly approached, thereby adapting in different working environments, including high-pressure environments.	**4**
		4.2.7	Ability to observe, apply knowledge, analysis, and evaluation to propose methods/solutions to practical problems for business.	**4**
	4.3	Forming ideas, formulating plans, implementing professional activities		
		4.3.1	Having the ability to analyze to detect biological problems, biotechnology from phenomena around us, grasp problems related to biotechnology in real life and work, thereby forming ideas to exploit and solve problems.	**4**
		4.3.2	Ability to apply knowledge, practical analysis to outline the objectives and requirements of the system to solve problems related to biotechnology.	**4**
		4.3.3	Ability to analyze and evaluate to select and establish the functions and structure of the system (human resources, location, equipment, technology solutions, financial, etc.) To solve problems related to biotechnology or production, business, service deployment based on biotechnology.	**4**
		4.3.4	Ability to use tools to model the system to solve biotechnology or production, business, service	**4**

			deployment based on biotechnology to verify that goals can be achieved.	
		4.3.5	Ability to analyze and evaluate to plan the implementation of projects in biotechnology in an innovative way.	**4**
		4.3.6	Ability to build and analyze technology design processes, projects, research projects, and biotechnology applications.	**4**
		4.3.7	Ability to analyze and evaluate to choose the appropriate approach to analyze designing projects, research projects, and biotechnology.	**4**
		4.3.8	Ability to effectively apply specialized knowledge and analytical thinking, reasoning in the design of work, projects, research projects, and application of biotechnology.	**4**
		4.3.9	Ability to use specialized tools in the design of work, projects, research projects, and application of biotechnology.	**4**
		4.3.10	Have the ability to analyze and evaluate to design a working group with biotechnology majors and multidisciplinary teams to research and solve problems related to biotechnology.	**4**
		4.3.11	Understanding and applying multi-objective design methods and applying them to the process of operation in the field of biotechnology.	**4**
		4.3.12	Ability to analyze and evaluate to plan the implementation of work, projects, research projects, and biotechnology innovatively.	**4**
		4.3.13	Ability to analyze, evaluate, build, and deploy a system to solve biotechnology or production, business, and service deployment based on biotechnology.	**4**
		4.3.14	We are applying knowledge about control, automation, AI, IoT in implementing a system to solve biotechnology or production, business, and deployment of services based on biotechnology.	**4**
		4.3.15	Have the ability to analyze and synthesize to integrate knowledge and skills in biotechnology and other fields to deploy a system to solve biotechnology or technology lines/processes in production, business, and deployment of services based on biotechnology.	**4**
		4.3.16	Ability to apply knowledge and practical analysis to apply methods, processes for the prediction, diagnosis, and testing in biotechnology to deploy technological lines/processes in production, business, and deployment of services based on a	**4**

			biological foundation.	
		4.3.17	Ability to apply knowledge to understand the standards of testing, testing, analysis, and certification in plant biotechnology, microbiology technology, food, agriculture.	**4**
		4.3.18	Have the ability to analyze and evaluate practically to plan the management of work, projects, research projects, and biotechnology.	**4**
		4.3.19	Ability to analyze and evaluate practices to select operation plans and optimize biotechnology work, projects, research projects, and applications.	**4**
		4.3.20	Ability to use knowledge to understand and implement support activities such as maintenance and maintenance of equipment; also try human resources to operate the system to solve biotechnology or technology lines/processes in production, business, service deployment based on biotechnology.	**4**
		4.3.21	Ability to analyze, evaluate practically and creatively at work to apply in improving and developing systems to solve problems related to biotechnology or technological lines/processes in production, business, deployment of services based on biotechnology such as strengthening and upgrading equipment; training, supplementing human resources; technical/technological improvements.	**4**
		4.3.22	Ability to analyze and evaluate technological techniques and creativity to apply in improving methods, building processes of prediction, diagnosis, and testing in biotechnology in technological lines/processes in production, business, and service deployment based on biotechnology.	**4**
		4.3.23	Applying the understanding of post-life processing systems to solve biotechnology or technology lines/processes in production, business, and service deployment based on biotechnology: leverage, liquidity, available transfer, etc.	**4**
		4.3.24	Ability to analyze and evaluate experimental conditions to plan management and operation of technological lines/processes in production, business, and service deployment based on biotechnology.	**4**
		4.3.25	Having the professional capacity, implementing critical applications in Plant Biotechnology:	**4**

			selection, exploitation, and sustainable development of plant resources; plant breeding, improving productivity with gene technology and cellular technology.	
		4.3.26	Having the professional capacity, implementing critical applications in micro-technology and food: selection, exploitation and sustainable development of micro-resources, production of micro-products used in agriculture and environment; processing and preserving food and food.	**4**
		4.3.27	Having the professional capacity, implementing essential applications in biotechnology: selecting, creating, and breeding crops using gene technology and cell technology; diagnosis of the disease by molecular methods; application of farming techniques and automation in high-tech agricultural production.	**4**

There are 16 competency-based expected learning outcomes for the current program:

EXPECTED LEARNING OUTCOME 1: Learners are equipped and able to apply their knowledge of revolutionary moral thought of the Communist Party of Vietnam and Ho Chi Minh's thoughts in career and life; aware of national security and defense issues.

EXPECTED LEARNING OUTCOME 2: Learners are physically trained, equipped with knowledge about professional ethical standards, rules and regulations, and national and international laws; responsible to the community and society.

EXPECTED LEARNING OUTCOME 3: Learners possess basic knowledge of natural and social sciences as a basis for accessing, acquiring, and applying knowledge in the field of Biology and Biotechnology.

EXPECTED LEARNING OUTCOME 4: Learners understand the nature of biological processes at the levels of biological organization, biological resources, and biodiversity.

EXPECTED LEARNING OUTCOME 5: Learners understand the principles, methods, techniques, and application orientation in the fields related to cells, biochemistry, genetics, molecular biology, microbiology, animal and plant physiology, ecological ecology,….

EXPECTED LEARNING OUTCOME 6: Learners can apply knowledge of foreign languages and informatics in learning and research.

EXPECTED LEARNING OUTCOME 7: Learners have the ability to use equipment and technology to analyze and evaluate for research and production deployment in biotechnology and related fields.

EXPECTED LEARNING OUTCOME 8: Learners have the ability to apply and improve methods, and build predictive, diagnostic, and testing processes in the field of biotechnology.

EXPECTED LEARNING OUTCOME 9: Learners have the skills to propose methods of solving practical problems arising by using knowledge, techniques, and tools in the field of biotechnology.

EXPECTED LEARNING OUTCOME 10: Learners possess skills to organize, manage working groups, and cooperate to other group member to solve/implement problems posed in their professional fields.

EXPECTED LEARNING OUTCOME 11: Learners have the ability to assemble data and information, analyze, evaluate, predict and implement research related to the field of biology to meet the needs of employers and social practice.

EXPECTED LEARNING OUTCOME 12: Learners can be able to orientate to a major suitable for themselves in accordance with the condition of the locality, and society.

EXPECTED LEARNING OUTCOME 13: Learners can self-orient, propose and lead research projects, deploy and apply advances in plant biotechnology, microbial and food technology, and agricultural biotechnology in life; having a sense of starting a business, offering technology solutions to improve efficiency, saving time and money, in accordance with practical conditions.

EXPECTED LEARNING OUTCOME 14: Learners have professional expertise and competence to deploy important applications in Plant Biotechnology: selection, exploitation, and sustainable development of plant resources; Breeding plants, improving yield by gene and cell technologies.

EXPECTED LEARNING OUTCOME 15: Learners have professional expertise and competence to deploy important applications in microbial and food technology: selection, exploitation, and sustainable development of microbial resources, production of microbial products used in the field of agriculture and the environment; food processing and preservation.

EXPECTED LEARNING OUTCOME 16: Learners have professional expertise and competence to deploy important applications in Agricultural Biotechnology: selecting, creating, and propagating plants by gene technology and cell technology; diagnosis by molecular methods; application of farming techniques and automation in high-tech agricultural production.

Matching matrix between Expected learning outcomes and competency-based Expected learning outcomes.

Expected learning outcome	Competency-based Expected learning outcome															
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
1.1.1	X	X														
1.1.2	X															
1.1.3	X	X														
1.1.4		X														
1.1.5			X													
1.1.6	X	X														

1.1.7			X													
1.1.8			X		X											
1.1.9				X	X											
1.1.10				X												
1.1.11			X	X	X											
1.1.12				X	X											
1.1.13					X											
1.1.14			X		X											
1.1.15			X													
1.1.16				X	X											
1.1.17						X										
1.1.18				X	X											
1.2.1				X												
1.2.2				X												
1.2.3				X												
1.2.4				X	X											
1.2.5				X												
1.2.6				X												
1.2.7				X												
1.2.8				X												
1.2.9				X												
1.2.10				X	X											
1.2.11				X	X											
1.2.12				X	X											
1.3.1				X												
1.3.2					X											

1.3.3				X												
1.3.4				X	X											
1.3.5				X	X											
1.3.6					X											
1.3.7				X		X										
1.3.8				X	X											
1.3.9					X											
1.3.10					X											
1.3.11				X	X											
1.3.12				X	X											
1.3.13				X												
1.3.14				X												
1.3.15				X	X											
1.3.16				X	X											
1.3.17				X	X											
1.3.18					X											
1.3.19					X											
1.3.20					X											
1.3.21				X												
1.3.22				X												
1.3.23				X	X											
1.3.24					X											
1.3.25				X												
1.3.26				X												
1.3.27					X											
1.3.28					X											

1.3.29					X	X										
1.3.30					X											
1.3.31					X											
1.3.32					X											
1.3.33					X											
1.3.34					X											
1.3.35				X	X											
1.3.36					X											
1.4.1					X											
1.4.2				X	X											
1.4.3					X											
1.4.4					X											
1.4.5				X	X											
1.4.6				X												
1.4.7				X	X											
1.4.8					X											
1.4.9					X											
2.1.1			X				X				X					
2.1.2							X				X					
2.1.3							X				X					
2.1.4							X				X					
2.1.5							X									
2.1.6								X								
2.1.7							X				X					
2.1.8							X									
2.1.9							X	X								

2.2.1							X									
2.2.2							X									
2.2.3						X	X									
2.2.4							X									
2.2.5			X				X									
2.2.6			X			X	X									
2.2.7			X				X									
2.2.8			X				X									
2.3.1									X		X					
2.3.2									X		X					
2.3.3							X	X			X					
2.3.4							X									
2.3.5							X									
2.3.6							X	X								
2.4.1											X					
2.4.2								X			X					
2.4.3								X			X					
2.4.4							X	X			X					
2.4.5							X				X					
2.4.6								X			X					
2.4.7											X					
2.4.8								X	X		X					
2.5.1							X				X					
2.5.2											X					
2.5.3										X		X				
2.5.4											X					

2.5.5												X				
2.5.6										X						
2.5.7											X					
2.5.8										X		X				
3.1.1										X						
3.1.2										X						
3.1.3										X						
3.1.4										X						
3.1.5										X						
3.2.1										X						
3.2.2										X						
3.2.3										X						
3.2.4										X						
3.2.5										X						
3.2.6										X						
3.2.7										X						
3.2.8										X						
3.2.9										X						
3.2.10										X						
3.3.1						X				X						
3.3.2						X				X						
4.1.1											X	X				
4.1.2										X	X					
4.1.3						X	X									
4.1.4		X	X				X				X					
4.1.5		X	X													

4.1.6							X	X								
4.1.7							X				X					
4.1.8						X	X					X				
4.1.9								X				X				
4.1.10								X				X				
4.2.1											X	X				
4.2.2											X	X				
4.2.3											X	X				
4.2.4											X	X				
4.2.5											X	X				
4.2.6											X	X				
4.2.7											X					
4.3.1											X					
4.3.2											X					
4.3.3											X					
4.3.4											X					
4.3.5											X					
4.3.6											X					
4.3.7											X					
4.3.8											X					
4.3.9											X					
4.3.10											X					
4.3.11											X					
4.3.12											X					
4.3.13											X					
4.3.14											X					

4.3.15											X					
4.3.16											X					
4.3.17											X					
4.3.18											X					
4.3.19								X			X					
4.3.20											X					
4.3.21								X			X					
4.3.22												X				
4.3.23											X					
4.3.24											X					
4.3.25														X		
4.3.26													X		X	
4.3.27																X

6. FRAMEWORK OF TRAINING PROGRAM

The training program of Biotechnology discipline is designed the entire course wich is 131 credits (excluding the credits of the Physical Education and Defense Education courses). The structure knowledge is follows:

Knowledge block		Quantity of Credit		
		Total	**Compelled**	**Elective**
A - General education knowledge		**40**	**28**	**12**
A1	Political theory	11	11	0
A2	Physical Education	(3)	(3)	(0)
A3	Military Education	(8.5)	(8.5)	(0)
A4	Overview Industry	2	2	0
A5	Specialized foreign language	3	3	0
A6	Mathematics and natural sciences	18	9	9
A7	Social and humanities sciences	6	3	3

B - Professional education knowledge		**91**	**63**	**28**
B1	Foundational knowledge	36	36	0
B2	Academic discipline knowledge	46	27	19
B3	Complementary knowledge	9	0	9
	Total	**131**	**91**	**40**

7. TRAINING PROGRAM CONTENTS

7.1 General education knowledge (40 credits)

No	Course code	Course name	Quantity of credit		
			Total	**Theory**	**Practice**
	Compelled knowledge		**28**		
	A1	**Political theory**	**11**		
1	LC1101D	Marxist-Leninist Phylosophy	3	3	0
2	LC1102D	Marxist-Leninist Political Economy	2	2	0
3	LC2101D	Social Science	2	2	0
4	LC2102D	Vietnamese Communist Party History	2	2	0
5	LC3101D	HoChiMinh thought	2	2	0
	A2	**Physical Education**	**(3)**		
6	TC1001D	Physical Education 1	1	0	1
7	TC100XD	Physical Education 2	1	0	1
8	TC2003D	Physical Education 3	1	0	1
	A3	**Military Education**	**(8.5)**	**(6)**	**(2.5)**
9	QP2101D	Military Education 1	(3)	(3)	(0)
10	QP2102D	Military Education 2	(2)	(2)	(0)
11	QP2103D	Military Education 3	(1,5)	(1)	(0,5)
12	QP2104D	Military Education 4	(2)	(0)	(2)
	A4	**Academic discipline overview**	**2**		
13	20CS1102	Overview of Biotechnology	2	1	1
	A5	**Specialized foreign language**	**3**		
14	20CS2203	English in Biology	3	3	0
	A6	**Mathematics and natural sciences**	**9**		
15	20TN0001	Caculus C1	3	2	1(Exc.)
16	20CS2103	Experiment design and Data analysis in Biology	3	2	1
17	20HH0001	Organic chemistry	3	2	1
	A7	**Social and humanities sciences**	**3**		
18	20LH0001	Introduction to laws	3	3	0
	Elective knowledge		**12**		
		Natural sciences	**9**		
		Choosing at least 9 credits from listed			

		belows:			
19	20CS2206	Bioenergy	3	3	0
20	20CS2205	Biophysics	3	2	1
21	20VL0001	Fundamental Physics B1	3	3	0
22	20HH0002	Analytical chemistry	3	2	1
23	20CS1205	Laboratory Techniques	3	2	1
24	20CS2104	Environmental Sciences	3	2	1
	A6	**Social and humanities sciences**	**3**		
		Choosing at least 3 credits from listed belows:			
25	20QT0001	Introduction to economics	3	2	1(exc.)
26	20CP0001	Methodology for scientific research	3	3	0
27	20QT0002	Project management	3	2	1

7.2 Professional education knowledge (91 credits)

No	Course code	Course name	Quantity of credit		
			Total	**Compelled**	**Elective**
	B1	**Foundational knowledge**	**36**	36	0
	B2	**Academic discipline knowledge**	**46**	27	19
	B3	**Complementary knowledge**	**9**	0	9

7.2.1 Foundational knowledge generally applied in three majors

No	Course code	Course name	Quantity of credit		
			Total	**Theory**	**Practice**
Compelled knowledge					
	B1	**Foundational knowledge**	**36**	24	12
	Compelled knowledge				
1	20CS1101	Cytology	3	2	1
2	20CS1204	Botany	3	2	1
3	20CS1203	Zoology	3	2	1
4	20CS1201	Microbiology	3	2	1
5	20CS1202	Mycology	3	2	1
6	20CS2202	Ecology	3	2	1
7	20CS2101	Biochemistry	3	2	1
8	20CS2102	Genetics	3	2	1
9	20CS2201	Molecular Biology	3	2	1
10	20CS3101	Plant Physiology	3	2	1
11	20CS3102	Physiology of Animal	3	2	1
12	20CS2204	Evolution and Biodiversity	3	2	1

7.2.2. Academic discipline and complementary knowledge for Plant Biotechnology major

No	Course code	Course name	Quantity of credit		
			Total	**Theory**	**Practice**
	B2	**Specialized knowledge**	**46**		
		Compelled knowledge	**27**	13	14
13	20CS3201	Sustainable development of Plant resources	3	2	1
14	20CS4102	Plant chemistry and application	3	2	1
15	20CS3204	Plant propagation and conservation technology	3	2	1
16	20CS4101	Genetic Breeding	3	2	1
17	20CS4103	Plant Protection	3	2	1
18	20CS3202	Genetic engineering and application	3	2	1
19	20CS3203	Bioinformatics	3	1	2
20	20CS3103	Professional Practices	3	0	3
21	20CS4104	Professional Practices for Plant Biotechnology major	3	0	3
Elective knowledge			**19**		
Choosing at least 9 credits from listed belows:					
22	20CS3104	Microorganism and fungi resources	3	2	1
23	20CS3205	Soil-Agrochemistry	3	2	1
24	20CS4108	Applied biochemistry	3	2	1
25	20CS3205	Microbial Technology	3	1	2
26	20CS3206	Protein and Enzyme Technology	3	2	1
27	20CS4106	Edible and medicinal Mushrooms Cultivation	3	2	1
28	20CS4107	Postharvest Technology	3	2	1
29	20CS3105	Environmental Biotechnology	3	2	1
30	20CS3207	Cultivation engineering	3	2	1
31	20CS4203	Diagnosis of Plant Pathology	3	2	1
32	20CS4204	Entomology and Application	3	2	1
33	20CS4205	Agricultural microbiological technology	2	1	1
34	20CS4207	Thesis	7	0	7
35	20CS4206	Thematic Internship for Plant biotechnology major Graduation	5	0	5
	B3	**Complementary knowledge**	**9**		

Choosing at least 9 credits from listed belows:					
Microorganism and fungi resources	20CS3106	Nutrition and Food Safety	3	2	1
2	20CS4201	Application of radiation in Biology	3	2	1
3	20CS3208	Blue Technology	3	2	1
4	20CS3209	Processes and Equipments in Biotechnology	3	2	1
5	20CS3107	Quality Management of Bioproducts	3	2	1
6	20CS4202	Ethnic botany	3	2	1

7.2.3. Academic discipline and complementary knowledge for Microbiology & Food technology major

No	**Course code**	**Course name**	**Quantity of credit**		
			Total	**Theory**	**Practice**
	B2	**Specialized knowledge**	**46**		
		Compelled knowledge	**27**	12	15
13	20CS3205	Microbial Technology	3	2	1
14	20CS3210	Food Processing Technology	3	2	1
15	20CS4109	Food Testing	3	2	1
16	20CS4108	Applied Biochemistry	3	2	1
17	20CS4106	Edible and medicinal Mushrooms Cultivation	3	2	1
18	20CS3202	Genetic engineering and application	3	2	1
19	20CS3203	Bioinformatics	3	1	2
20	20CS3103	Professional Practices	3	0	3
21	20CS4110	Professional Practices for Microbiology & food technology major	3	0	3
Elective knowledge			**19**		
Choosing at least 9 credits from listed belows:					
22	20CS3104	Microorganism and fungi resources	3	2	1
23	20CS3206	Protein and Enzyme Technology	3	2	1
24	20CS4111	Fermentation and Post-fermentation Technology	3	2	1
25	20CS4101	Genetic Breeding	3	2	1
26	20CS3212	Applied Food chemistry	3	2	1
27	20CS4205	Agricultural microbiological technology	2	1	1
28	20CS4107	Postharvest Technology	3	2	1
29	20CS3105	Environmental Biotechnology	3	2	1
30	20CS4209	Drink and milk engineering	3	2	1

31	20CS4203	Diagnosis of Plant Pathology	3	2	1
32	20CS4207	Thesis	7	0	7
33	20CS4210	Thematic Internship Microbiology & food technology major Graduation	5	0	5
	B3	Complementary knowledge	**9**		
Choosing at least 9 credits from listed belows:					
1	20CS3106	Nutrition and Food Safety	3	2	1
2	20CS4201	Application of radiation in Biology	3	2	1
3	20CS3208	Blue Technology	3	2	1
4	20CS3209	Processes and Equipments in Biotechnology	3	2	1
5	20CS3107	Quality Management systems for Bioproducts	3	2	1
6	20CS4208	Immunology and Applications	3	2	1

7.2.4. Academic discipline and complementary knowledge for Agricultural Biotechnology major

No	**Course code**	**Course name**	**Quantity of credit**		
			Total	**Theory**	**Practice**
	B2	**Specialized knowledge**	**46**		
		Compelled knowledge	**27**	13	14
13	20CS3212	Nutritions for crops	3	2	1
14	20CS3213	Plant Biotechnology	3	2	1
15	20CS4101	Genetic Breeding	3	2	1
16	20CS4103	Plant Protection	3	2	1
17	20CS4107	Postharvest Technology	3	2	1
18	20CS3207	Cultivation engineering	3	2	1
19	20CS3203	Bioinformatics	3	1	2
20	20CS3103	Professional Practices	3	0	3
21	20CS4112	Professional Practices for Agricultural biotechnology major	3	0	3
Elective knowledge			**19**		
Choosing at least 9 credits from listed belows:					
22	20CS3104	Microorganism and fungi resources	3	2	1
23	20CS4205	Agricultural microbiological technology	2	1	1
24	20CS3214	Animal Biotechnology	3	2	1
25	20CS3205	Soil-Agrochemistry	3	2	1
26	20CS4102	Plant chemistry and application	3	2	1
27	20CS3202	Genetic engineering and application	3	2	1
28	20CS4203	Diagnosis of Plant Pathology	3	2	1

29	20CS3105	Environmental Biotechnology	3	2	1
30	20CS3206	Protein and Enzyme Technology	3	2	1
31	20CS3215	Vegetable and flower cultivation techniques	3	2	1
32	20CS4106	Edible and medicinal Mushrooms Cultivation	3	2	1
33	20CS4204	Entomology and Application	3	2	1
34	20CS4207	Thesis	7	0	7
35	20CS4211	Thematic Internship for Agricultural biotechnology major Graduation	5	0	5
	B3	**Complementary knowledge**	**9**		
Choosing at least 9 credits from listed belows:					
1	20CS3106	Nutrition and Food Safety	3	2	1
2	20CS4201	Application of radiation in Biology	3	2	1
3	20CS3107	Quality Management systems for Bioproducts	3	2	1
4	20CS4113	Automation in agriculture	3	2	1
5	20CS4202	Ethnic botany	3	2	1
6	20CS4114	Ecology in agriculture and sustainable development	3	2	1

8. TEACHING PLAN

8.1 Combination of General education and Professional education

S1	S2	S3	S4	S5	S6	S7	S8
General education							
	Professional education						
				Foundational Practice		Professional Practices	Thematic Internship Graduation
							Graduation Thesis

8.2 Teaching plan by semesters

1st SEMESTER						
No	**Course code**	**Course name**	**Quantity of credit**	**Theory**	**Practice**	**Note**
Compelled courses			**17**	**15**	**2**	
1	LC1101D	Marxist-Leninist Phylosophy	3	3	0	
2	TC1001D	Physical Education 1	(1)		(1)	
3	20CS1102	Overview of Biotechnology	2	1	1	
4	20CS1101	Cytology	3	2	1	
5	20TN0001	Caculus C1	3	2	1(Exc.)	

6	20HH0001	Organic Chemistry	3	2	1	
7	20LH0001	Introduction to Laws	3	3	0	
		Total	**17**			

2nd SEMESTER						
No	**Course code**	**Course name**	**Quantity of credit**	**Theory**	**Practice**	**Note**
Compelled courses			**14**	**10**	**4**	
1	LC1102D	Marxist-Leninist Political Economy	2	2	0	
2	TC1002	Physical Education 2	(1)		(1)	
3	20CS1201	Microbiology	3	2	1	
4	20CS1202	Fungiology	3	2	1	
5	20CS1203	Zoology	3	2	1	
6	20CS1204	Botany	3	2	1	
Elective courses			**3**			
7	20VL0001	Fundamental Physics B1	3	3	0	
8	20CS1205	Laboratory Techniques	3	2	1	
		Total	**17**			

Student choose at least 3 Natural Sciences credits.

3rd SEMESTER						
No	**Course code**	**Course name**	**Quantity of credit**	**Theory**	**Practice**	**Note**
	Compelled courses		**11**			
1	LC2101D	Social Science	2	2	0	
2	TC2003D	Physical Education 3	(1)		(1)	
3	20CS2101	Biochemistry	3	2	1	
4	20CS2102	Genetics	3	2	1	
5	20CS2103	Experiment design and Data analysis in Biology	3	2	1	
6	QP2101D	Military Education 1	(3)	(3)	(0)	
7	QP2102D	Military Education 2	(2)	(2)	(0)	
8	QP2103D	Military Education 3	(1,5)	(1)	(0,5)	
9	QP2104D	Military Education 4	(2)	(0)	(2)	
	Elective courses		**3**			
10	20HH0002	Analytical Chemistry	3	2	1	
11	20CS2104	Environmental Science	3	2	1	
		Total	**14**			

Student choose at least 3/6 Natural Sciences credits

4th SEMESTER						
No	**Course code**	**Course name**	**Quantity of credit**	**Theory**	**Practice**	**Note**
Compelled courses			**14**			
1	20CS2201	Molecular Biology	3	2	1	
2	20CS2202	Ecology	3	2	1	
3	20CS2203	English in Biology	3	3	0	
4	LC2102D	Vietnamese Communist Party History	2	2	0	
5	20CS2204	Evolution and Biodiversity	3	2	1	
Elective courses (choosing from the listed belows)			**6**			
6	20CP0001	Methodology for Scientific Research	3	3	0	
7	20QT0001	Introduction to Economics	3	2	1(Exc.)	
8	20QT0002	Project Managerment	3	2	1	
9	20CS2205	Biophysics	3	2	1	
10	20CS2206	Bioenergy	3	3	0	
Total			**20**			

Student choose at least 6/15 Elective Credits, include 3/6 Natural Sciences credits and 3/9 Social Science and Humanities credits

5th SEMESTER						
No	**Course code**	**Course name**	**Quantity of credit**	**Theory**	**Practice**	**Note**
Compelled courses			**11**			
1	LC3101D	Ho Chi Minh Thought	2	2	0	
2	20CS3101	Plant Physiology	3	2	1	
3	20CS3102	Animal Physiology	3	2	1	
4	20CS3103	Professional Practices	3	0	3	
Elective courses (choosing from the listed belows			**6**			
5	20CS3104	Microorganism and Fungi Resources	3	2	1	
6	20CS3105	Enviromental Biotechnology	3	2	1	
7	20CS3106	Nutrition and Food Safety (*)	3	3	0	
8	20CS3107	Quality Management of Biological Products (*)	3	2	1	
Total			**17**			

Student choose at least 6/12 Elective credits, includes 3/6 Specialised credits and 3/6 Complementary credits (*)

PLANT BIOTECHNOLOGY MAJOR

6th SEMESTER						
No	**Course code**	**Course name**	**Quantity of credit**	**Theory**	**Practice**	**Note**
Compelled courses			**12**			
1	20CS3201	Sustainable Development of Plant Resources	3	2	1	
2	20CS3202	Genetic Engineering and Application	3	2	1	
3	20CS3203	Bioinformatics	3	2	1	
4	20CS3204	Plant Propagation and Conservation Technology	3	2	1	
Elective courses (choosing from the listed belows)			**6**			
5	20CS3205	Microbial Technology	3	1	2	
6	20CS3206	Protein and Enzyme Technology	3	2	1	
7	20CS3207	Cultivation Engineering	3	2	1	
8	20CS3208	Blue Technology (*)	3	2	1	
9	20CS3209	Processes and Equipments in Biotechnology (*)	3	2	1	
		Total	**18**			

StudentS choose at least 6/15 Elective credits, includes 3/9 Specialised credits và 3/6 Complementary credits (*)

7th SEMESTER						
No	**Course code**	**Course name**	**Quantity of credit**	**Theory**	**Practice**	**Note**
Compelled courses			**12**			
1	20CS4101	Genetis in Breeding	3	2	1	
2	20CS4102	Plant chemistry and application	3	2	1	
3	20CS4103	Plant Protection	3	2	1	
4	20CS4104	Professional Practices for Plant Biotechnology Major	3	0	3	
Elective courses (choosing from the listed belows)			**6**			

5	20CS3205	Soil-Agrochemistry	3	2	1	
6	20CS4106	Edible and medicinal Mushrooms Cultivation	3	2	1	
7	20CS4107	Postharvest Technology	3	2	1	
8	20CS4108	Applied Biochemistry	3	2	1	
Total			**18**			

Student choose at least 6/12 Elective Specialised credits

8th SEMESTER						
No	**Course code**	**Course name**	**Quantity of credit**	**Theory**	**Practice**	**Note**
Elective courses (choosing from the listed belows)			**10**			
1	20CS4201	Application of Radiation in Biology (*)	3	2	1	
2	20CS4202	Ethnic botany (*)	3	2	1	
3	20CS4203	Diagnosis of Plant Pathology	3	2	1	
4	20CS4204	Entomology and Application	3	2	1	
5	20CS4205	Agricultural microbiological technology	2	1	1	
6	20CS4206	Thematic Internship for Plant biotechnology Major Graduation	5	0	5	
7	20CS4207	Thesis (**)	7	0	7	

Student choose at least 10 Elective credits, includes 7 Specialised credits and 3 Supplementary credits (*); Conditional Element credits (**).

MICROBIOLOGY AND FOOD TECHNOLOGY MAJOR

6th SEMESTER						
No	**Course code**	**Course name**	**Quantity of credit**	**Theory**	**Practice**	**Note**
Compelled courses			**12**			
1	20CS3205	Microbial Technology	3	1	2	
2	20CS3202	Genetic engineering and application	3	2	1	
3	20CS3203	Bioinformatics	3	1	2	

4	20CS3210	Food Processing Technology	3	2	1	
Elective courses (choosing from the listed belows)			**6**			
5	20CS3212	Applied Food chemistry	3	2	1	
6	20CS3206	Protein and Enzyme Technology	3	2	1	
7	20CS3208	Blue Technology (*)	3	2	1	
8	20CS3209	Processes and Equipments in Biotechnology (*)	3	2	1	
Total			**18**			

Student choose at least 6/12 Elective credits, includes 3/6 Specialised credits và 3/6 Complementary credits (*)

7th SEMESTER						
No	**Course code**	**Course name**	**Quantity of credit**	**Theory**	**Practice**	**Note**
Compelled courses			**12**			
1	20CS4106	Edible and medicinal Mushrooms Cultivation	3	2	1	
2	20CS4108	Aplied Biochemistry	3	2	1	
3	20CS4109	Food Testing	3	2	1	
4	20CS4110	Professional Practices for Microbiology and Food Technology Major	3	0	3	
Elective courses (choosing from the listed belows)			**6**			
5	20CS4101	Genetic Breeding	3	2	1	
6	20CS4111	Fermentation and Post-FermentationTechnology	3	2	1	
7	20CS4107	Postharvest Technology	3	2	1	
		Total	**18**			

Students choose at least 6/9 Elective Specialized credits

8th SEMESTER						
No	**Course code**	**Course name**	**Quantity of credit**	**Theory**	**Practice**	**Note**
Elective courses (choosing from the listed belows)			**10**			
1	20CS4208	Immunology and Applications (*)	3	2	1	
2	20CS4201	Application of Radiation in Biology (*)	3	2	1	

3	20CS4209	Drink and milk engineering	3	2	1	
4	20CS4203	Diagnosis of Plant Pathology	3	2	1	
5	20CS4205	Agricultural microbiological technology	2	1	1	
6	20CS4210	Thematic Internship Microbiology & food technology Major Graduation	5	0	5	
7	20CS4207	Thesis (**)	7	0	7	

Students choose at least 10 Elective credits, includes 7 Specialized credits and 3 Complementary credits (*); Conditional Element credits (**).

AGRICULTURAL BIOTECHNOLOGY MAJOR

6th SEMESTER						
No	**Course code**	**Course name**	**Quantity of credit**	**Theory**	**Practice**	**Note**
Compelled courses			**12**			
1	20CS3212	Nutritions for crops	3	2	1	
2	20CS3213	Plant Biotechnology	3	2	1	
3	20CS3203	Bioinformatics	3	1	2	
4	20CS3207	Cultvation engineering	3	2	1	
Elective courses (choosing from the listed belows)			**6**			
5	20CS3202	Genetic Engineering and Application	3	2	1	
6	20CS3214	Animal Biotechnology	3	2	1	
7	20CS3215	Vegetable and flower cultivation techniques	3	2	1	
8	20CS3206	Protein and Enzyme Technology	3	2	1	
		Total	**18**			

Students choose at least 6/12 Elective Specialized credits.

7th SEMESTER						
No	**Course code**	**Course name**	**Quantity of credit**	**Theory**	**Practice**	**Note**
Compelled courses			**12**			
1	20CS4101	Genetics in Breeding	3	2	1	
2	20CS4107	Postharvest Technology	3	2	1	
3	20CS4103	Plant Protection	3	2	1	
4	20CS4112	Professional Practices for	3	0	3	

		Agricultural Biotechnology Major				
Elective courses (choosing from the listed belows)			**6**			
5	20CS3205	Soil-Agrochemistry	3	2	1	
6	20CS4102	Plant chemistry and application	3	2	1	
7	20CS4106	Edible and medicinal Mushrooms Cultivation	3	2	1	
8	20CS4113	Automation in agriculture (*)	3	2	1	
9	20CS4114	Ecology in Agriculture and Sustainable Development (*)	3	2	1	
		Total	**18**			

Students choose at least 6/15 Elective credits, includes 3/9 Specialized credits and 3/6 Complementary credits (*)

8th SEMESTER						
No	**Course code**	**Course name**	**Quantity of credit**	**Theory**	**Practice**	**Note**
Elective courses (choosing from the listed belows)			**10**			
1	20CS4202	Ethnic botany (*)	3	2	1	
2	20CS4201	Application of radiation in Biology (*)	3	2	1	
3	20CS4203	Diagnosis of Plant Pathology	3	2	1	
4	20CS4204	Entomology and Application	3	2	1	
5	20CS4205	Agricultural microbiological technology	2	1	1	
6	20CS4211	Thematic Internship Agricultural Biotechnology Major Graduation	5	0	5	
7	20CS4207	Thesis (**)	7	0	7	

Students choose at least 10 Elective credits, includes 7 Specialized credits and 3 Complementary credits (*); Conditional Element credits (**).

9. LIST OF LECTURERS IMPLEMENTING THE PROGRAM

9.1. List of Formal available lecturers

(*): Experience of teaching in foreign languages: teaching place, teaching experience, type of language

No.	FULL NAME	YEAR OF BIRTH	DIPLOMA, TRAINING ACADEMIC DISCIPLINE	TEACHING EXPERIENCE (*)	COURSE(S) IN CHARGE
1	Le Ba Dung	1955	Bachelor: Biology PhD: Botany	42 years Da Lat University	Ecology Ecology in agriculture and sustainable development
2	Tran Van Tien	1971	Bachelor: Biology MSc: Biology PhD: Botany	07 years Da Lat University	Overview of Biotechnology Methodology for scientific research Ecology Evolution and Biodiversity Ecology in agriculture and sustainable development
3	Hoang Viet Hau	1962	Bachelor: Biology MSc: Experimental Biology	36 years Da Lat University	Genetics Genetic Breeding
4	Truong Binh Nguyen	1966	Bachelor: Biology MSc: Enviromental Resource Management PhD: Mycology	05 years Ho Chi Minh Open University 07 years Da Lat University	Overview of Biotechnology Experimental design and Data analysis in Biology Methodology for scientific research Mycology Food Processing Technology Edible and medicinal Mushrooms Cultivation Processes and Equipments in Biotechnology
5	Nguyen Khoa Truong	1979	Bachelor: Biology MSc: Biology	19 years Da Lat University	Microbiology Microbial Technology Microorganism and fungi resources Lên men Agricultural microbiological technology Immunology and Applications
6	Hoang Thi Nhu Phuong	1983	Bachelor: Experimental Biology MSc: Experimental Biology PhD: Plant Biotechnology	15 years Da Lat University	Plant propagation and conservation technology Plant Physiology Genetic engineering and application Plant Biotechnology
7	Nguyen Van Ngoc	1984	Bachelor: Biology MSc: Ecology PhD: Life Science	8 years Da Lat University	Experiment design and Data analysis in Biology Bioinformatics Botany Evolution and Biodiversity

8	Pham Thi Thanh Thao	1988	Bachelor: Biotechnology MSc: Experimental Biology PhD: Animal Breeding	8,5 years Da Lat University	Nutrition and Food Safety Quality Management systems for Bioproducts Drink and milk engineering Postharvest Technology Food Processing Technology Food Testing Applied Food chemistry
9	Hoang Thi Binh	1984	Bachelor: Biology MSc: Biology PhD: Life Science	14 years Da Lat University	Laboratory Techniques Environmental Sciences Plant chemistry and application Ecology Biochemistry Applied biochemistry
10	Nguyen Thi Huynh Nga	1984	Bachelor: Microbiology – Biochemistry MSc: Medical PhD: Biochemistry and Molecular and Cell Biology	11 years Da Lat University	Animal Biotechnology Cytology English in Biology
11	Le Thi Anh Tu	1983	Bachelor: Biology MSc: Biology PhD: Environmental conservation – subsector Microbiology technology	15 years Da Lat University	Environmental Biotechnology Microbial Technology Blue Technology English in Biology Microbiology
12	Do Thi Cat Tuong	1993	Bachelor: Biology MSc: Ecology	5 years Da Lat University	Zoology Physiology of Animal Blue Technology Environmental Biotechnology
13	Luong Van Dung	1972	Bachelor: Biology MSc: Biology PhD: Biology	19 years Da Lat University	Botany Sustainable development of Plant resources Ethnic botany
14	Nguyen Van Binh	1980	Bachelor: Biology MSc: Experimental Biology Tiến sĩ: Seed Science and Technology		Bioenergy Molecular Biology Bioinformatics Cultivation engineering Biophysics Vegetable and flower cultivation techniques Diagnosis of Plant Pathology Automation in agriculture
15	Le Ngoc Trieu	1974	Bachelor: Biology MSc: Biology PhD: Biotechnology	05 years Da Lat University	Overview of Biotechnology Genetics Molecular Biology Genetics in Breeding Genetic engineering and application Diagnosis of Plant Pathology Application of radiation in Biology Processes and Equipments in Biotechnology

16	Nguyen Thanh Thuy Tien	1973	Bachelor: Biology MSc: Biology	20 years Da Lat University	Zoology Entomology and Application Plant Protection
17	Le Viet Ngoc	1975	Bachelor: Biology MSc: Biology	14 years Da Lat University	Mycology Edible and medicinal Mushrooms Cultivation Biophysics Microorganism and fungi resources Protein and Enzyme Technology
18	Nguyen Ba Nam	1985	Bachelor: Biology MSc: Biology PhD: Plant biotechnology	04 years Da Lat University	Nutritions for crops Cultivation engineering Vegetable and flower cultivation techniques
19	Nguyen Thi Thuy Linh	1979	Bachelor: Biology Education MSc: Biology PhD: Biotechnology	19 years Thang Long High school Da Lat University	Plant Protection Microbial Technology Food Testing Agricultural microbiological technology Nutrition and Food Safety Application of radiation in Biology
20	Nguyen Minh Tri	1991	Bachelor: Biotechnology MSc: Biotechnology	03 years Da Lat University	Biochemistry Plant chemistry and application Applied biochemistry Protein and Enzyme Technology Fermentation and Post-fermentation Technology Quality Management of Bioproducts
21	Nguyen Thi Lieu	1978	Bachelor: Biology Education MSc: Biology	19 years Bao Loc High scholl Da Lat University	Plant physiology Sustainable development of Plant resources Plant propagation and conservation technology Nutritions for crops Plant Biotechnology Postharvest Technology Soil-Agrochemistry

9.2. List of Invited lecturers

No.	FULL NAME	YEAR OF BIRTH	DIPLOMA, TRAINING ACADEMIC DISCIPLINE	TEACHING EXPERIENCE (*)	COURSE(S) IN CHARGE
1	Nguyen Xuan Tung	1959	Bachelor: Biology PhD: Medical Molecular Biology	39 years Da Lat University Yersin	Biophysics

				University University of Science	
2	Le Thi Loan	1957	Bachelor: Biology MSc: Experimental Biology PhD: Microbiology	30 years Da Lat University Yersin University	Immunology and Applications

9.3 List of Learning Consultants:

No.	FULL NAME	YEAR OF BIRTH	DIPLOMA, TRAINING ACADEMIC DISCIPLINE	TEACHING EXPERIENCE (*)	COURSE(S) IN CHARGE
1	Nguyen Thi Huynh Nga	1984	Bachelor: Microbiology – Biochemistry MSc: Medical PhD: Biochemistry and Molecular and Cell Biology	11 years: Faculty of Biology - Da Lat University	Animal Biotechnology Cytology English in Biology
2	Pham Thi Thanh Thao	1988	Bachelor: Biotechnology MSc: Experimental Biology PhD: Animal Breeding	8,5 years: Faculty of Biology - Da Lat University	Nutrition and Food Safety Quality Management systems for Bioproducts Drink and milk engineering Postharvest Technology Food Processing Technology Food Testing Applied Food chemistry
3	Hoang Thi Nhu Phuong	1983	Bachelor: Experimental Biology MSc: Experimental Biology PhD: Plant Biotechnology	15 years: Faculty of Biology - Da Lat University	Plant propagation and conservation technology Plant Physiology Genetic engineering and application Plant Biotechnology
4	Do Thi Cat Tuong	1993	Bachelor: Biology MSc: Ecology	5 years: Faculty of Biology - Da Lat University	Zoology Physiology of Animal Blue Technology Environmental Biotechnology
5	Nguyen Thanh Thuy Tien	1973	Bachelor: Biology MSc: Biology	20 years: Faculty of Biology - Da Lat University	Zoology Entomology and Application Plant Protection

10. INFRASTRUCTURES FOR LEARNING

10.1. Laboratory and main laboratory equipment system:

TT	Laboratory/Factory	MANAGEMENT UNIT	Note
1	Lab. of Biotechnology	Faculty of Biology	
2	Lab. of Biochemistry	Faculty of Biology	
3	Lab. of Plant cell tissue culture	Faculty of Biology	
4	Lab. of plant resources	Faculty of Biology	
5	Lab. of Animal	Faculty of Biology	
6	Lab. of Plant	Faculty of Biology	
7	Lab. of Mycology	Faculty of Biology	
8	Lab. of Microbiology	Faculty of Biology	
9	Lab. of Microbiological technology	Faculty of Biology	
10	Lab. of Mushroom technology	Faculty of Biology	
11	Experimental area A12	Faculty of Biology	
12	Lab. of gereral	Faculty of Biology	
13	Lab. of Crop Breeding Technology	Faculty of Biology	
14	Greenhouse	Faculty of Biology	
15	Insect museum	Faculty of Biology	
16	Lab. of Physical	Faculty of Physics	
17	Lab. of Analytical Chemistry	Faculty of Chemistry	
18	Computer room	Faculty of Information Technology	

10.2. Library:

School library, electronic library of faculty.

10.3. Textbook, Lesson (In the detailed outline of each course)

11. INSTRUCTIONS FOR THE PROGRAMME IMPLEMENTATION

The academic curriculum of Biotechnology is based on the Regulations on higher education training in the academic credit system of Da Lat University, the reference to the domestic and international Biotechnology programmes and the access of CDIO standards. The programme is designed for a total of 4 years of study of the credit based system.

The curriculum comprises of General knowledge and Professional knowledge. To complete this programme, students must accumulate at least 131 credits, excluding Physical education and Military training. Of 131 credits, 91 credits are compulsory (including 28 credits for General knowledge and 63 credits for Professional knowledge) and 40 credits are elective (including 12 credits for General knowledge and 28 credits for Professional knowledge).

General courses comprises of Political theory, Physical education and Military training courses for the whole school. Besides, students also get courses of Introduction of Biotechnology, English for Biotechnology, natural sciences, social sciences & humanities. Particularly, standard English and Applied informatics skills must be obtained following the school regulations.

In the Professional courses, for the Fundamental knowledge, students are well-equipped with the most basic fields of biology. These are fundamental theoretical parts to deploy learning and researching on technologies and applications in future jobs. For the Professional knowledge, students are equipped with courses related to career theory and practice. Professional courses includes specialized knowledge divided into 3 majors corresponding to 3 applications and practical implementations of biotechnology: Plant biotechnology, Microbial and food technology and Agricultural biotechnology. Professional elective courses are quite abundant. Students are able to choose self-determination courses for improving their knowledge and skills in intersectional specialities as well as in intersectional majors. In addition, in the supplementary knowledge, students are able to expand their understanding by choosing specialized courses to support research fields, specialized applications as well as professional activities.

To fulfill the academic curriculum, in addition to courses at school, students need to complete 2 important internships including professional internship for Fundamental knowledge and professional internship according to specific majors. In addition, students are able to increase their practice effectiveness through the elective course “Thematic internship”. These courses provide students with opportunities to apply what they have

learned into the real life, research and apply knowledge and skills to production activities, businesses and services. Through these activities, professional practice capacity in the field of biotechnology is formed. During internship, students get guidance, supervision and support from the academic staff of the Faculty of Biology as well as the experts and experienced technical staff from the companies.

Students with great academic achievements are able to apply Thesis. In this course, students have the opportunity to apply all the knowledge and skills equipped from the curriculum to form ideas and plans to implement a research project in the field of biotechnology.

The academic curriculum of Biotechnology was designed based on the access of CDIO standards and the balance of theoretical and practical courses. The programme focuses on the accumulation of all the three domains of learning including knowledge, skills and attitudes. Thereby, when implemented, the programme provides students with professional competencies in the field of biotechnology for social needs and for employers' requirements. The programme also compiled innovative higher education teaching and learning techniques.

On condition that they meet other requirements for graduation, students who have successfully completed at least 131 credits including General knowledge and Professional knowledge, Physical education, Military training as well as standard English and Applied informatics skills are eligible to receive Bachelor of Biotechnology degrees.

RECTOR	HEAD OF TRAINING MANAGEMENT DEPARTMENT	DEAN OF FACULTY
PhD. Lê Minh Chiến	PhD. Trần Hữu Duy	Assoc. Trần Văn Tiến

APPENDIX OF COURSES

COURSES BELONG TO THE GENERAL KNOWLEDGE BLOCK

LC1101 – Marxist-Leninist Phylosophy

Number of credits: 3 (Theory: 3 – Practice: 0)

Course: Compelled ☑ Elective ☐

Prerequisite courses: No

This course equips students with a worldview and methodology of Marxist-Leninist. The course content includes an introductory chapter introducing a brief description of Marxism-Leninism and some general problems of the course. The rest is structured into three chapters covering the basic contents of the Marxist-Leninist worldview and methodology. That is materialism, materialistic dialectic, and historical materialism.

LC1102 – Marxist-Leninist Political Economy

Number of credits: 2 (Theory: 2 – Practice: 0)

Course: Compelled ☑ Elective ☐

Prerequisite courses: Marxist-Leninist Phylosophy

This course provides students with a Marxist-Leninist worldview and methodology, which introduces three central contents of the economic theory of Marxism-Leninism about the capitalist mode of production.

LC2101 – Social Science

Number of credits: 2 (Theory: 2 – Practice: 0)

Course: Compelled ☑ Elective ☐

Prerequisite courses: Marxist-Leninist Political Economy

This course continues to equip students with a Marxist-Leninist worldview and methodology, presenting basic contents of the theory of Marxism-Leninism about socialism and realism and prospect socialism.

LC2102 – Vietnamese Communist Party History

Number of credits: 2 (Theory: 2 – Practice: 0)

Course: Compelled ☑ Elective ☐

Prerequisite courses:

The course equips students with a basic understanding of the Party's line during the national revolution, people's democracy, and the construction of socialism. The course aims at fostering students to believe in the Party’s leadership according to the Party's goals and

ideals and raise students' sense of responsibility in the face of important national tasks. The course also helps students apply theoretical political knowledge to proactively and actively solve economic, political, cultural, and social problems according to the Party's lines and policies.

LC3101 – HoChiMinh thought

Number of credits: 2 (Theory: 2 – Practice: 0)

Course: Compelled ☑ Elective ☐

Prerequisite courses:

The course equips students with basic knowledge about life, career, and thought of Ho Chi Minh President. Through the course, students have the opportunity to realize the fundamental role of Ho Chi Minh's ideology, theory of thought, and the application of the Party in the Vietnamese revolution. The course is also aimed at fostering students for a revolutionary perspective stance on the foundation of Marxism-Leninism, Ho Chi Minh's thought; persistently national independence goal associated with socialism; actively fight against wrong views to protect Marxism-Leninism and Ho Chi Minh's thoughts, guidelines, and lines of the Party, laws of the State. Based on the learned knowledge, students apply them in their lives, study, cultivate, train themselves, fulfill their duties, and make a positive and effective contribution to the revolutionary cause following the path chosen by Ho Chi Minh and the Party.

TC1001 – Physical Education 1

Number of credits: 1 (Theory: 0 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite courses: non

This course equips students with basic knowledge and skills in athletics, including a history of athletics development; some of the basic techniques of athletics like run small steps, running thigh elevation, cycling after, run 100m at the start. Simultaneously, the course also helps students understand the competition rules, the method of organizing the tournament, and being an athletic referee. Through the practice of the athletic exercises designed in the course, students can apply to develop their physical health and improve their motor skills in all aspects, including fastness, power, endurance, finesse, and flexibility.

TC1002 – Physical Education 2

Number of credits: 1 (Theory: 0 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite courses: non

For Physical Education 2, students can choose one among badminton, table tennis, soccer, or handball. For badminton, the course equips students with basic badminton knowledge and skills, including position, effect, and history of badminton development; the badminton basic principles and techniques. Simultaneously, the module also helps students understand the rules of the competition, the method of organizing the tournament, and being a badminton referee. At the same time, the course also helps students understand the competition rules, the method of organizing the tournament, and being a badminton referee. For table tennis, the course equips students with basic knowledge and skills about table tennis, including history of formation and table tennis development, basic techniques, and tactics. Simultaneously, the module also helps students understand the rules of the competition, methods of organizing the tournament, and being a table tennis referee. For handball, the course equips students with basic knowledge and skills of handball, including the history of formation and development of handball, basic handball attack, and defense tactics. At the same time, the course also helps students understand the competition rules, the method of organizing the tournament, and being a handball referee. Through practicing exercises in the badminton, table tennis, soccer, and handball disciplines designed in the course, students can apply them to develop their physical health and improve their athletic abilities in all aspects, including fastness, power, endurance, finesse, and flexibility.

TC2003 – Physical Education 3

Number of credits: 1 (Theory: 0 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite courses: non

The course equips students with basic knowledge and skills on volleyball, including a history of volleyball development; technical principles; basic techniques such as preparing and moving, rolling over to save the ball; basic techniques such as high-hand passes, low-hand passes, smashing and blocking; basic offensive and defensive tactics. At the same time, the module also helps students understand the competition rules, the method of organizing the tournament, and being a volleyball referee. Through the practice of volleyball exercises designed in the module, students can apply to develop their physical health and improve their motor skills in all aspects, including fastness, power, endurance, finesse, and flexibility.

QP2101 – Military Education 1

Number of credits: 3 (Theory: 3 – Practice: 0)

Course: Compelled ☑ Elective ☐

Prerequisite courses: non

The course equips students with the Party's basic theoretical knowledge system on the military policy, including the basic issues of Marxist-Leninist doctrine; Ho Chi Minh's

thought on war, the military and protect the country; Party's views on the people war, building the armed forces, the all-people defense, the people's security; the Party's views on combining socio-economic development with strengthening national defense and security. In addition, the module introduces some basic contents about the history of Vietnamese military art through many periods.

QP2102 – Military Education 2

Number of credits: 2 (Theory: 2 – Practice: 0)

Course: Compelled ☑ Elective ☐

Prerequisite courses: Military Education 1

The module introduces the theory combined with practice to equip students with basic knowledge of maps, military topography, command facilities to serve the mission of learning tactics and commanding combat; features, effects, structure, use, and preservation of infantry weapons including AK, CKC, RPD, RPK, B40, B41; feature characteristics, and techniques of using explosives; prevention of nuclear, chemical, biological, fire weapons; war wounds and methods of handling; practice the formation of classes and blocks. In addition, the course also introduces three military coordination subjects so that students can participate in athletics and defense sports.

QP2103 – Military Education 3

Number of credits: 1.5 (Theory: 1 – Practice: 0.5)

Course: Compelled ☑ Elective ☐

Prerequisite courses: Military Education 2

The course helps students to comprehend the basics of the defense and security tasks of the Party and State in the new situation, including building the militia, self-defense, and reserve force to increase the potentials of infrastructure, defense techniques, and high-tech war prevention to defeat the strategy of "peaceful evolution" and the overthrow of the hostile forces toward the Vietnamese revolution. In addition, this course also mentions several issues: ethnicity, religion, and the struggle to prevent the enemy from taking advantage of the problem of ethnicity, religion against the Vietnamese revolution; building and protecting border sovereignty, sea and island sovereignty, national security, fighting against crime and maintaining social order and safety.

QP2104 – Military Education 4

Number of credits: 2 (Theory: 0 – Practice: 2)

Course: Compelled ☑ Elective ☐

Prerequisite courses: Military Education 2

According to the regulations of Da Lat University on teaching the common courses for all students.

20CS1102 – Overview of Biotechnology

Number of credits: 2 (Theory: 1 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite courses: Non

Overview of Biotechnology is the course in The General knowledge block of Bachelor of Biotechnology training program, is the basis to obtain knowledge from courses of the foundational, specialization and supplementary knowledge blocks. This course equips learners with overview knowledge as well as some essential skills in learning, research and application related to biotechnology.

The main contents of the course include: Concepts, objects, focus issues, development history and achievements of biotechnology; Introduction to the main areas of Biotechnology, the issue of Bioethics and legal regulations in the field of Biotechnology; Study orientation and basic skills for learning, research and application of biotechnology.

20CS2203 – English in Biology

Number of credits: 3 (Theory: 3 – Practice: 0)

Course: Compelled ☑ Elective ☐

Prerequisite courses: non

The course provides skills in using specialized tools to look up and understand English words, in reading and understanding specialized biotechology materials, in discussing with partners, and in compiling simple articles in specialized fields by English.

20CS2103 - Experimental design and Data analysis in Biology

Number of credits: 3 (Theory: 3 – Practice: 0)

Course: Compelled ☑ Elective ☐

Prerequisite courses: Overview of Biotechnology

The course provides skills for using specialized tools to look up and understand words, reading biotechnology documents. The course helps students to communicate with partners and write simple speciality articles in English.

20TN0001- Caculus C1

Number of credits: 3 (Theory: 2 – Exercise: 0)

Course: Compelled ☑ Elective ☐

Prerequisite courses: non

According to the regulations of Da Lat University on teaching the common courses for all students.

20CS2103 - Experimental design and Data analysis in Biology

Number of credits: 2 (Theory: 1 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite course: Overview of Biotechnology, Laboratory Techniques, Caculus C1

Experimental design and Data analysis in Biology plays an important subject in the Biotechnology program. This subject will provide basic knowledge about experimental design and data analysis in biology science. After finish this subject, the students will have the ability to understand and known how to design a specific experiment course in biology. Also, the students will gain statistics knowledge and the skill for data analysis and visualization in biology. The student will have the ability to describe, explain, and visualize the results of the data analysis process; and can write a high-quality scientific report or scientific article.

20HH0001- Organic chemistry

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite courses: non

According to the regulations of Da Lat University on teaching the common courses for all students.

20LH0001 – Introduction to laws

Number of credits: 3 (Theory: 3 – Practice: 0)

Course: Compelled ☑ Elective ☐

Prerequisite courses: non

This course introduces students to the overview of the state origin, general law and introduces basic issues of the State of the Socialist Republic of Vietnam. In addition, the course also mentions legal relations, legal regulations, violations of the law, and legal

responsibility. The course also helps students learn the basic provisions of the legal system of Vietnam, such as Criminal law and criminal procedure, Civil law and civil procedure, Constitutional law, Administrative law and administrative procedure, Marriage and Family law, Commercial law, and Labor law.

20CS2206 - Bioenergy

Number of credits: 2 (Theory: 1 – Practice: 1)

Course: Compelled ☐ Elective ☑

Prerequisite courses: Overview of Biotechnology

The course introduces raw materials and energy that have been exploited and used, the role and exploitation potential of renewable energy sources and especially biomass energy (green energy). The course will help learners understand the value of biomass resources, regenerative resources and grasp methods to turn them into energy used in life to increase socio-economic value and contribute to the necessary energy source for the country.

20CS2205 - Biophysics

Number of credits: 2 (Theory: 1 – Practice: 1)

Course: Compelled ☐ Elective ☑

Prerequisite courses: Overview of Biotechnology, Fundamental Physics B1

The course introduces the basic principles and basic rules of physics / physical chemistry relating to biological processes, their interactions and their application in the interpretation of phenomena and related processes take place in the living system as the basic physicochemical characteristics of biological macromolecules, thermodynamics, kinetics, electrical, optical and radioactive processes and specific applications in real life.

20VL0001- Fundamental Physics B1

Number of credits: 3 (Theory: 3 – Practice: 0)

Course: Compelled ☐ Elective ☑

Prerequisite courses: non

This course consists of the following main parts: Mechanics, Thermodynamics, Electricity and Magnetism. The Mechanics section introduces the motions and causes of motion of points and solids and their energy transformation in an inertial frame of reference. The theory of relativity, universal gravitation and oscillation are also presented. The Thermodynamics section introduces the principles of thermodynamics, the kinetic theory of gases, and thermal motion in macroscopic systems. Students know how to apply rules to

explain some common phenomena and do exercises according to the content of the chapters in the program. The electrical section equips with basic knowledge about the quantities of electrostatic field (charge, electric field, potential, capacitor, capacitance), electric circuit, current, magnetic field, electromagnetic induction phenomena, magnetic fields in the matter...

20HH0002 - Analytical chemistry

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑

Prerequisite courses: non

This course introduces the basic knowledge of analytical chemistry, the theoretical basis of chemical analytical methods (mass analysis method, volumetric analysis method) and physicochemical analytical methods. (optical analysis methods, separation and enrichment methods, etc.). The content presented in each method includes general principles, equipment, analytical techniques and methods of calculating the content of substances. In addition to theory, the course also introduces basic exercises on determining the concentration and content of substances by chemical and physicochemical analytical methods.

20CS1205 - Laboratory techniques

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑

Prerequisite courses: Courses of Overview of Biotechnology

Laboratory techniques are an important course in the curriculum of the biotechnology, and it is classified in the general education knowledge block. The course provides basic knowledge about the principles of the laboratory work and general regulations related to the operation of the laboratory for students. To make it easier for students to locate the content relevant to their experiment including principles, construction and use of instruments as well as equipment; the properties of chemicals and their preparation methods; some techniques commonly used in the biological field; management methods in Laboratory. In addition, the course also help to build some skills for student comprising practice experiment, and used instruments, equipment, chemicals skills; skill of searching for information and processing information on subject-related knowledge, teamwork skill.

20CS2104 - Environmental science

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑

Prerequisite courses: non

Environmental science has a crucial role in the curriculum of the Biotechnology. The course provides students definition of the environment and issues related to the environment such as subjects and methods of environmental research; natural resources; major issues of the environment such as: basic environmental components, characteristics of the environmental components, environmental pollution; applying basic principles of ecology to research and solve environmental problems; environmental impact assessment, environmental management and sustainable development. Moreover, the course also explains some other issues related to environmental issues such as population, development etc. In addition, the course also helps students to acquire skills such as analytical and evaluation skills to organize and identify key factors that need to be addressed in relation to environment, presentation and teamwork skills.

20QT0001- Introduction to economics

Number of credits: 3 (Theory: 2 – Exercise: 1)

Course: Compelled ☐ Elective ☑

Prerequisite courses: non

Introduction to Economics is an elective course in the basic knowledge block, taught in the first semester of the first school year. This subject covers the principles of economics, including the fundamental laws of the market economy such as the law of supply and demand, the law of competition, and presents the concepts and methods of calculating the macroeconomic indicators as well as the impacts of macroeconomic policies of the government on markets and the economy.

20CP0001- Methodology for scientific research

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑

Prerequisite courses: non

Methodology for scientific research is an elective credit that plays an important role in the curriculum of the Biotechnology, and alignment in the general knowledge, and alignment in the general knowledge block. The course consists of 6 chapters, with are as follow:

Methodological theory and systems of overviews; Category of methodology (Research to clarify the nature of science and scientific research activities; Research to clarify the mechanism of creative thinking in receiving scientists consciousness and their creative practical skills; Study general perspectives, cognitive object approaches, and build the theoretical system of scientific research methods, Specific research methods and techniques; Methodology for scientific research is not only in cognitive logic but also in the content structure of a scientific work; Scientific research methodology also notes pay attention to the method of organizing and managing research activities and technology, considering it as a main application stage of scientific achievements, in order to improve the scientific potentials and organize the scientific research process. study with high efficiency). Achievements study: students will be able to achieve success: System of concepts, categories, theories, scientific theories; The applied intellectual system brings scientific achievements into production and social management; Besides, students are also equipped with real skills, searching and processing information related to the subject, skills in presentations and teamwork.

20QT0002- Project management

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑

Prerequisite courses: non

According to the regulations of Da Lat University on teaching the common courses for all students.

COURSES BELONG TO THE PROFESSIONAL EDUCATION KNOWLEDGE BLOCK

FOUNDATIONAL KNOWLEDGE

20CS1101 - Cytology

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite courses: Courses of Overview of Biotechnology

The course is designed as an introduction to the structure, function of the cells, organelles and the principles of metabolism and energy transport across membranes. This course also introduce mitosis, meiosis in prokaryotic and eukaryotic cells, the differences of cell

structures in organisms. The course provides basic principles, methods and techniques used in cell research.

20CS1204 - Botany

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite courses: No

This course introduces the basic knowledge of plant morphology and anatomy and the basis of plant taxonomy, helping students master the comparative morphological classification method and recognize the characteristic features of large plant taxa in the taxonomy.

20CS1203 - Zoology

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite courses: Non

The course provides basic knowledge about animal kingdom: common traits; appearance, internal structures; classification system of animal groups; at the same time present the origins and relatives of animal groups, biological and ecological characteristics, and structural and functional adaptations.

20CS1201 - The Microbiology

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite courses: Courses of Overview of Biotechnology, Cytology, Laboratory techniques

This course provides students with basic knowledge about microorganisms such as the history of microbial development, morphological characteristics, structure, nutrition, growth, development, and life activities of bacteria, bacteriophages, cyanobacteria, fungi, viruses as well as their important role in the basic metabolism of compounds in nature, and food. In addition, the course also provides students with knowledge about microorganisms in the environment, the applications of beneficial microorganisms, and methods of inhibiting harmful microorganisms for agriculture, food, harming the health of humans, plants, animals, and polluting the environment. This is a basic subject that helps students to easily acquire knowledge of specialized subjects as well as help students firmly apply in

their careers in the future. Rational application of microbiological processes in the field of industrial microbiology, agriculture-forestry, health, and environmental protection.

20CS1202 - Mycology

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite courses: non

Mycology is a course that is included in the foundational knowledge block in in the Bachelor of Biotechnology training program with 2 theoretical credits and 1 practical credit. The content of this course covers the basic knowledge fungi kingdom. This course includes knowledge such as the role, function, relationship between fungi and other organisms in nature; knowledge of systematics, taxonomy as well as biological characteristics, body organization, cell structure..., special attention is paid to the differences of fungi compared with other biological objects in the biosphere. Thus, in addition to providing basic knowledge about fungal organisms to learners, it can also help learners to achieve suitable thinking and establish research directions on fungi/mushroom technology as well as applications in agricultural production.

20CS2202 - Ecology

Number of credits: 3 (Theory: 2 – Practical: 1)

Courses: compelled ☑ Elective ☐

Prerequisite courses: None

The course addresses the discipline of ecology including interaction between organisms and physical and biological environment, struture and function of different types of ecosystems, and techniques for gathering data in the field.

20CS2101 - Biochemistry

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite courses: None

Biochemistry provides students with basic knowledge about structure and function of biology molecules such as proteins, nucleic acids, carbohydrates and lipids, and the interactions between them to form macromolecules and cells. Biochemistry also deal with

about the transformation and the laws governing the change of biological molecules in the cell. Besides, Biochemistry supplied importance of energy changes from nutrient to energy of ATP, photosynthesis, electron transport and oxidative phosphorylation…

20CS2102 - Genetics

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite courses: Courses of Overview of Biotechnology, Cytology, Laboratory techniques

Genetics is the foundational course in the Bachelor of Biotechnology training program, is the basis to obtain knowledge from other foundational and specialization courses. This course equips learners with the basic knowledge about genetics and nessesary skills for learning, reseach and applying these.

The main contents of the course include: The nature of matter carries genetic information, and mechanisms ensure that the genetic apparatus is maintained through cell and organism generations; genetic laws, nature of genetic recombination by chromosomal crossovers, gene interactions; phenomenon of genetic mutation and variation.

20CS2201 – Molecular biology

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite courses: Courses of Overview of Biotechnology, Genetics, Biochemistry, Laboratory techniques, Experiment design and Data analysis in Biology

Genetics is the foundational course in the Bachelor of Biotechnology training program implemented in 4^{th} semester (2^{nd} year), is the basis to achieve knowledge from other foundational and specialization courses.

Purpose: This course equips learners with the basic knowledge about molecular biology and necessary skills for learning, research and applying these.

The main contents of the course include: The nature, chemical structure and function of the important macromolecules in biology and their relationship through the central dogma; structure, function, biological classification of genes, genome and natural variation in genome; molecular mechanisms of gene expression/regulation, the organism's response to the invasion of foreign factors, DNA damage and repair; the nature of DNA recombinant and gene transfering; the principles of basic techniques; Vietnamese and international legal

regulations on research and application of GMOs, safety of molecular biology labs. Basic application directions of molecular biology.

20CS3101- The Plant Physiology

Curriculums: 3 (2 learning theories: 1 Practice)

Compulsory credit

Courses prerequisite: no

The Plant Physiology course is a compulsory subject that plays an important role in the curriculum of the biotechnology industry, which is classified in the basic knowledge sector. The course provides knowledge of plant physiology such as: water exchange and water balance in plants, basis for proper watering; Physiological role of mineral nutrition, scientific fertilization regime; Photosynthesis and transport of photosynthetic products, factors affecting photosynthesis and photosynthesis with crop yield; Respiratory processes, the factors that influence and apply knowledge of respiration processes in the preservation of agricultural products; Plant growth and development processes, physiological role and application of plant growth regulators; Plant's tolerance to external conditions. In addition, students are also equipped with practical skills, searching and processing information related to the subject, updating new achievements in the world and Vietnam, presentation and teamwork skills.

20CS3102 - Physiology of Animal

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite courses: Non

In the university training program, the Physiology of Animal course is considered the basis of many training disciplines such as Biotechnology, Biology, Animal Breeding, Veterinary Medicine. The course provides students with basic knowledge about the meaning and importance of animal physiology; structure, functions and mechanisms of physiological regulation of organs and systems in the animal body; relationship between organs and body systems with each other and with the environment. Furthermore, the course also helps students to practice experiments and use a number of equipment, tools and chemicals related to animal physiology.

20CS2204 - Evolution and biodiversity

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite courses: non

The course of Evolution and Biodiversity is a compulsory course that plays an important role in the training program of the Biotechnology, and alignment in the basic knowledge block. The course consists of 5 chapters, with are as follow: Evolutionary theories and concepts; Evolution at genetic level and the role of evolutionary factors in the population; Biodiversity, loss of biodiversity in the world and Vietnam; conservation methods: biodiversity evaluates for conservation planning. Achievements study: students will be able to analyze and evaluate the role of evolution and biodiversity for humans and sustainable development, analyze the causes of biodiversity loss, and conservation. In addition, students are equipped with real skills, searching and processing information related to the subject, updating new achievements of research on biodiversity and evolution in the world and in Vietnam, presentation and teamwork skills.

SPECIALIZED KNOWLEDGE

20CS3201 - Sustainable development of Plant resources

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite courses: non

The course introduces the categories of plant resources, research methods of plant resources, how to exploit, process and preserve natural resources. This course also equips the learners knowledge on methods of sustainable exploitation and development of plant resources.

20CS4102 - Plant chemistry and application

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☑ Elective ☑ (depended on the chosen major)

Prerequisite courses: Botany, Biochemistry, Organic chemistry

This course is compelled for Plant Biotechnology major but is complementaty for Agricultural Biotechnology major.

Plant chemistry and application not only is an important course in the curriculum of plant biotechnology major but also is a complementary knowledge for the agricultural biotechnology major. The course provides students knowledge following: concepts, separation, purification, identification of the different secondary compounds in plants, and

the distribution of secondary compound groups in taxon of plants; the function of secondary compounds in plants. Besides, students are provided with knowledge about the application of secondary compounds in the human's life such as pharmaceuticals, foods, cosmetics, plant protection, etc. In addition, the course also helps students to acquire demonstrating a proper attitude and professionalism in the implementation of the work.

20CS3204 - The Plant Conservation and Breeding Technology

Number of credits: 3 (2 learning theories: 1 Practice)

Course: Compelled ☑ Elective ☐

Courses prerequisite: no

The Plant Conservation and Breeding Technology course is a compulsory subject that plays an important role in the curriculum of the plant biotechnology major, which is classified in the sector of knowledge. The course consists of 6 chapters including: The importance of conserving plant genetic resources, the significance of gene banks in the world; Methods of conservation of plant genetic resources (*in situ*, *ex situ*, ...) as well as the role of plant biotechnology in socio-economic development; History of the discipline, basic principles of plant cell culture techniques, principles of tissue culture laboratory layout; Tissue culture methods and applications in plant explant selection and propagation, and recovery of degenerated varieties. In addition, students are equipped with practical skills (from the sterilization of the culture to the stage of bringing the seedlings to the nursery), searching and processing information related to the subject, updating the new achievements in plant biotechnology in the world and in Vietnam, presentation and teamwork skills.

20CS4101 - Genetics in Breeding

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☑ Elective ☑ (depended on choosen major)

Prerequisite courses: Courses of Overview of Biotechnology, Genetics, Molecular Biology, Botany, Zoology, Microbiology, Plant Physiology, Physiology of Animal, Laboratory techniques, Experiment design and Data analysis in Biology, Bioinformatics.

Genetics in Breeding is the compelled course in specialization knowledge block in training program for Plant Biotechnology and Agricultural Biotechnology majors and is the elective course for Microbiological & Food Technology major.

This course is the integration and intensive exploitation of the knowledge of Genetics, Molecular Biology, Microbiology, Plant Physiology, Animal Physiology, Genetic Engineering and Application ... in field of breeding.

The main contents of the course include: Purpose, history, role and legal regulations on breeding work; Role of genetics in the breed's feature/quality; Steps of implementing breeding and application of genetic knowledge and techniques in breeding steps; Traditional and modern breeding methods; Several basic genetic techniques specific to hybridization and evaluation of allele frequencies in populations, in seed production, identification of varieties, and mutant inducing.

20CS4103 – Plant protection

Curriculums: 3 (2 learning theories: 1 Practice)

Compulsory credit

Courses prerequisite: no

The course introduces the causes of damage to plants (insects, plant diseases, other pests), principles of pest control, and pest control measures to protect plants, improve crop yields, and environmental protection. It provides basic knowledge of insect morphology, physiology, and anatomy thereby finding effective control measures for reducing pest population and making favorable conditions for beneficial insects, creating clean green agriculture, protecting the environment and human health. This course also provides more about the diagnosis and control of plant diseases as well as helps students understanding the important role of plant protection in developing sustainable agriculture.

20CS3202 - Genetic engineering and application

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite courses: Courses of Overview of Biotechnology, Genetics, Molecular Biology, Botany, Zoology, Microbiology, Plant Physiology, Physiology of Animal, Laboratory techniques, Experiment design and Data analysis in Biology, Bioinformatics.

Genetic engineering and application is the compelled course in specialization knowledge block in Bachelor of Biotechnology training program for Plant Biotechnology, Agricultural Biotechnology and Microbiological & Food Technology majors.

This is a course that imparts knowledge for application of genetic engineering/molecular biology, and also equips learners with skills and attitudes to be able to apply genetic engineering to research and application fields of biotechnology. This course equips learners with basic knowledge of the principles, methods for genetic techniques implementation and application orientation as well as several professional and soft skills needed in learning, research and development career activities.

The main contents of the course include: Specific laboratory equipment and safety in the field of genetic engineering; Principles, methods and technical solutions for the operation of genetic engineering; Application of knowledge and genetic engineering in steps of breeding; Fields of application of genetic engineering and attached procedures; Practical exercises on using equipment and implementing techniques towards application.

20CS3203 - Bioinformatics

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☑ Elective ☐

Prerequisite courses: Courses of Overview of Biotechnology, Genetics, Biochemistry, Experiment design and Data analysis in Biology, Molecular Biology, Calculus C1

Bioinformatics is an important subject in biology and biotechnology. Along with the high speed of science and technology development, biological data was showed an exponential increase, that demand the student has the ability to use bioinformatics tools for data mining, quality control, analysis, and visualization. After finish this subject, students will gain the knowledge of bioinformatic from basic to advanced. The student could be using bioinformatics tools for analysis and answer the specific question in biology. The student will be provided the knowledge, skill for organization, management, control, exploitation, and analysis of biological data, make a sense from data to information to answer the research question..

20CS3104- Microorganism and fungi resources

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑ (Complementary knowledge)

Prerequisite courses: non

The Microorganism and fungi resources course is a complementary subject that plays an important role in the curriculum of the Biotechnology industry, which is classified in the basic knowledge sector. The course provides knowledge of Microorganism and fungi such as fungi and microbiological resources, knowledge of structural features, reproductive characteristics, physiological - ecological characteristics of valuable fungi and microorganisms; help learners to identify the groups of fungi and microorganisms that are significant in life and the fungal groups that cause diseases in plants, animals and humans. The course also helps learners grasp methods to conserve and develop this resource and awareness of conservation natural resources in general and biological resources in particular

is raised. In addition, students are also equipped with practical skills, searching and processing information related to the subject, presentation and teamwork.

20CS3205 - Soil-Agrochemistry

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑

Prerequisite courses: non

Course of Soil-Agrochemistry is an important course in the Bachelor of Biotechnology training program, which lebongs to the major knowledge. This course provides students with a foundation of knowledge about soils, rocks and minerals; the basic understanding of the soil formation process as well as the continuous processes of changing soil properties. Learners can classify, analyze and evaluate the quality of agricultural soil and through which to propose reasonable solutions in the soil improvement and also select appropriate crops to given types of soil. The course also provides knowledge about fertilizers and how to use them to get the best results. The course also helps students to have practical skills in experimenting and analyzing physicochemical criteria in soil and in fertilizers. Besides, the course also helps students to achieve skills in information search and information processing about related knowledge, and also teamwork skills.

20CS4108 – Applied Biochemistry

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☑ Elective ☑ (depended on chosen major)

Prerequisite courses: none

Biochemistry application describes the basis of biochemistry and its application to the processes of preserving and processing food and food. Application in fermentation processes. Protocol for recovery colorants and aromatics in food processing. The processes of fermentation and the acquisition of metabolic products. Application of metabolic products in life. In addition, the course also helps students with teamwork skills, presentation skills, and document search.

20CS3205 - Microbial Technology

Number of credits: 3 (Theory: 2 – Practical: 1)

Courses: compelled ☑ Elective ☑ (depending on major)

Prerequisite courses: None

This course provides ompact knowledge about how microbes and their metabolic pathways and products can be used in biotechnology including antibiotic, health, food, agricultural and environmental applications. Another main goal is highlighting the roles of molecules techniques on microbial genetic improvement.

20CS3206 - Protein and Enzyme technology

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑

Prerequisite courses: none

Protein and Enzyme technology suppied learners with basic knowledge about the structure, properties and classification of protein-enzymes, kinetic models of enzyme catalyzed reactions, factors affecting protein-enzyme activity. Sources of collection, extraction methods, purification, quality assessment of Protein - Enzyme. Technological process of protein - enzyme production and it's application. Producing immobilized enzymes and it's applications in life. In addition, the course also helps students with teamwork skills, presentation skills, and document search.

20CS4106 - Edible and medicinal fungi cultivation

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑ (Complementary knowledge)

Prerequisite courses: non

The Edible and medicinal fungi cultivation course is a complementary subject that plays an important role in the curriculum of the Biotechnology industry, which is classified in the basic knowledge sector. The course provides knowledge of edible and medicinal fungi cultivation such as structural characteristics, growth, physiological nutrition, ecology and reproduction of cultivated mushrooms, nutritional and medicinal value of the mushroom, design and build laboratory, mushroom farm, mushroom isolation and production techniques, raw material processing techniques, collection, preservation and processing of mushrooms. The course equips learners with the skill of identifying mushroom cultivation, have skills in group activities, document lookup, development and presentation of related content reports. Enthusiastically supporting the community in the development of

mushroom farm. In addition, students are also equipped with practical skills, searching and processing information related to the subject, presentation and teamwork.

20CS4107 - Postharvest technology

Curriculums: 3 (2 learning theories: 1 Practice)

Elective credit or compulsory credit (depending on major)

Courses prerequisite: no

Postharvest technology is part of industry knowledge and complementary sectors of biotechnology. The study aims to equip students with basic knowledge of the factors affecting the process of harvesting, preserving, packaging, and transporting flowers, providing the necessary knowledge about the treatment techniques of postharvest agricultural products. This course also introduces flower preservation methods and postharvest product processing methods.

20CS3105 - Environmental Biotechnology

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑

Prerequisite courses: None

This course aims to introduce the students to various issues related to environments, including various types of environmental pollutants and their effects, the biotechnologies to detect, study, and address these concerns. This unit focues on the utilization of microbial processes and plant in waste and waste treatment, and bioremediation.

20CS3207 - Cultivation engineering

Number of credits: 3 (Theory: 2 – Practical: 1)

Courses: compelled ☑ Elective ☑ (depending on major)

Prerequisite courses: No

Students are provided with basic knowledge about soil, farm water use efficiency, plant varieties, crop nutrition, planting techniques, plant protection and cultivation. Beside, students are provided with practical knowledge about basic cultivation techniques, design, planning, implementation, evaluation as well as orientation to improve farming methods to achieve high economic efficiency.

20CS4203 - Diagnosis of Plant Pathology

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑

Prerequisite courses: Courses of Genetic engineering and application, Botany, Microbiology, Plant Physiology, Ecology, Cultivation engineering, Plant Protection, Laboratory techniques, Experiment design and Data analysis in Biology, Bioinformatics, English in Biology.

Diagnosis of Plant Pathology is the elective course in specialization knowledge block in Bachelor of Biotechnology training program. This course integrates and intensively exploits of the knowledge of Microbiology, Plant Physiology, Ecology, Genetic Engineering and Application, Plant Protection ... in the field of diagnostics of diseases in plants. This course equips learners with necessary knowledge and skills in learning, research and implementing of professional activities related to diagnosis of plant diseases according to social needs.

The main contents of the course include: Diagnosis is based on symptoms, external conditions and vector organisms; Diagnosis of plant diseases is based on the tools of molecular biology and microbiological characteristics; Solution oriented to handle situations according to the group of diseases in plants.

20CS4204 – Entomology and application

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑

Prerequisite courses: non

The subject introduces the meaning and role of insects to humans and to nature (the environment of man and of all living things). The subject provides basic knowledge of morphology, anatomy-physiology, biology, ecology, and classification of insects. Therefrom learners can apply the learned knowledge to carry out applied researches of insects in the fields of agriculture, decoration, food, ...

20CS4205 - The Agricultural Microbiological Technology

Number of credits: 3 (Theory: 1 – Practice: 1)

Course: Compelled ☐ Elective ☑

Prerequisite courses: Microbial Technology

Students grasp the knowledge of agricultural microorganisms, apply conditions for cultivation, propagation, fermentation, and inoculants for use in cultivation (nutritional support, crop protection), applied in the field of animal husbandry, aquaculture, and processing agricultural by-products to minimize ecological environmental pollution.

20CS3106 - Nutrition and Food Safety

Curriculums: 3 (2 learning theories: 1 Practice)

Elective add-ons credit

Courses prerequisite: no

Nutrition and food safety is subjects of industry knowledge and complementary sectors of biotechnology. The section introduces the role, meaning, and connection between nutrition and food safety for disease and public health; the role and impact of energy bio-substances and non-energy production on public health. Besides, nutritional problems, nutritional care as well as principles in therapeutic nutrition are presented. On the other hand, this section outlines the concept, impact of food safety, classification of food safety hazards, risk factors for food poisoning on the economy, society, environment, and community. The student knows how to handle food poisoning, food and water treatment in case of emergency. The diet can be calculated following different subjects, and the nutritional status of the person is evaluated according to the BMI and z-score based on the compassionate indicators.

20CS4201 - Application of radiation in Biology

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑ (complementary)

Prerequisite courses: Courses of Genetics, Molecular Biology, Microbiology, Plant Physiology, Ecology, Cultivation engineering, Plant Protection, Laboratory techniques, Experiment design and Data analysis in Biology, Genetic engineering and application, Genetics in Breeding, Fundamental Physics, Biophysics.

Application of radiation in Biology is the elective course in complementary knowledge block in Bachelor of Biotechnology training program. This is a course that exploits in specific knowledge about the effects of different types of radiation on organisms, biological materials and human to apply in the field of mutant breeding; sterilization and preservation of agricultural products and food; medicine; and manipulation of bio-polymer circuits to create bioactive materials. This course equips learners with necessary knowledge and skills

for learning, researching and implementing professional activities related to the interference between biotechnology and radiation to meet social needs.

The main contents of the course include: Concept and nature and origin of types of radiation, basic knowledge of radiation safety and basic methods in calculating and measuring radiation dose and dose rate and radioactivity; Mechanisms of radiation interactions with matter, with living systems and their consequences; Principle and method of operation and the attached equipment to deploy the application of radiation in mutant breeding; in medicine; in water and air treatment; in bio-polymer circuit manipulation; and in sterilization and preservation of food, supplies, and tools for medical and experiments. Visiting and practicing radiation application in polymer circuit manipulation, investigating the effect of radiation on seeds and radiation sterilization ability.

20CS3208 - Blue Technology

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑ (complementary)

Prerequisite courses: None

Blue technology course belonging to the complementary knowledge of biotechnology aims to strengthen knowledge and practical implement in blue biotechnology industries, including ecology, aquaculture, nutrition, environment, and health sectors

20CS3209 - Processes and Equipments in Biotechnology

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑ (complementary)

Prerequisite courses: non

Course of Processes and Equipments in Biotechnology belongs to major knowledge of Bachelor of Biotechnology training program with 3 credits for theory and practice parts. Based on people's understanding of the characteristics of microorganisms, fungi, algae, plants... the biotechnology and mechanical engineering academic disciplines have researched and developed specific equipment for the culturing them, greatly contributes to the successful production of preparations of biological origin. Therefore, this course is quite important for students of Biotechnology in order to equip students with basic knowledge and how to apply equipment in the production processes. Besides, this course also helps students to achive the ability to design and build production models of products of biological origin.

20CS3107- Quality Management systems for Bioproducts

Curriculums: 3 (2 learning theories: 1 Practice)

Elective add-ons credit

Courses prerequisite: no

Quality management systems for bioproducts belong to the complementary knowledge of biotechnology. This section introduces the definition, rules, contents of GAP, GMP, GHP, HACCP, ISO... GAP, GMP, GHP, and HACCP construction methods for the production processes of biological products, especially vegetables, agricultural products, food, and biological products, are presented systematically. After studying this subject, students can analyze the current situation of applying biological product quality management and have the basis to develop a local product quality management process.

20CS4202 - Ethnic Botany

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑ (complementary)

Prerequisite courses: non

This course introduces research methods on plants associated with indigenous knowledge, the relationship between plant resources and community development.

20CS3210 - Food Processing Technology

Curriculums: 3 (2 learning theories: 1 Practice)

Compulsory credit

Prerequisite courses: no

The food processing technology belongs to the compulsory sectoral knowledge of microbiology and food technology. The study introduces the basic principles of food processing; stages in food processing include the preparation of raw materials, small size, mixing and forming process, separation, and separation of ingredients of food, fermentation and fermentation technology; food processing processes using heat; traditional food processing methods such as drying, parching, freezing and modern technologies such as irradiation, radiofrequency, high pressure ...; finishing stages after processing. Students master and implement the technology of processing some traditional foods.

20CS4109 - Food Testing

Curriculums: 3 (2 learning theories: 1 Practice)

Compulsory credit

Prerequisite courses: no

The food testing section belongs to the compulsory sectoral knowledge of microbiology and food technology. The section introduces concepts related to food quality and food testing; indicators that are the cause of food poisoning; indicators that need to be tested in food are nutritional values, food senses, food microorganisms, food residues, food pollution chemicals, and evaluation methods, processes for analyzing these indicators. From there, students can sample, analyze and evaluate food following the process.

20CS4111 – Fermentation and Post-Fermentation Technology

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑ (complementary)

Prerequisite courses: non

Course of Fermentation and Post-Fermentation Technology equips students with the discipline foundational knowledge for fermentation, methods of microbial strain isolation and improvement to adapt to the standards of strains of microorganisms which are used in fermentation technology. Students are provided the basic knowledge on metabolise and biosynthesis of compounds in microorganisms; knowledge of fermenters and control systems; methods of obtaining and refining post-fermentation products as a scientific basis for building technological processes such as alcohol production, production of organic acids, production of yeast biomass, etc. for creating fermented products as well as improving the quality of products.

20CS3212 – Applied Food Chemistry

Curriculums: 3 (2 learning theories: 1 Practice)

Elective credit

Prerequisite courses: no

Applied food chemistry belongs to the curriculum elective sectoral knowledge of microbiology and food technology. The section introduces the concept, role, structure, properties of water, mineral deposits, food protein systems, food starch systems, food lipids;

the transformation of proteins, starches, lipids in the process of food preservation and processing; The concept, harm, and the formation of toxins in food agricultural products and toxins formed in food processing; Meaning, classification, and the reaction of food aromatics and coloring reactions of food coloring substances; Methods of analyzing the composition of food chemistry. From there, students can apply food chemistry in food preservation and processing.

20CS4209 - Drinks and milk engineering

Curriculums: 3 (2 learning theories: 1 Practice)

Elective credit

Prerequisite courses: no

Learning for drinks and milk engineering belongs to the curriculum elective add-ons sectoral knowledge of microbiology and food technology. This section introduces the properties and factors affecting raw milk and drinks. Then, fundamental processes in the production of milk and wine, beer, and drinks are presented, including measures for processing, using, and preserving milk and drinks. From there, students can use raw milk to create dairy products, use locally available ingredients as drinks, and fix wine "errors" during product preservation.

20CS4208 - Immunology and applications

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑ (complementary)

Prerequisite courses: Biochemistry, Microbiology

The course is designed as an introduction to the main principles and mechanisms of the immune systems of human as well as animal. It is then possible for students to apply acquired knowledge into the real life, including: medical diagnosis in plant and animal, production of vaccines and antibodies.

20CS3212 - Nutrition for crops

Number of credits: 3 (Theory: 2 – Practical: 1)

Courses: compelled ☑ elective ☐

Prerequisite courses: Plant physiology, Cultivation engineering, Laboratory Techniques

The course introduces the basic contents of crops and nutrition, nutrient absorption and crop yield, specifically as follows: History of research on plant nutrition; The role of macro and

micro element nutrients for plants; Absorption and transport of mineral nutrients from the roots to leaves; nutrition and crop yield; diagnose symptoms of mineral deficiencies and toxics; supplying nutrient balance for plants at each stage of growth and development of various plants

20CS3213 - The Plant Biotechnology

Curriculums: 3 (2 learning theories: 1 Practice)

Compulsory credit

The Plant Biotechnology course is a compulsory subject that plays an important role in the curriculum of the agricultural biotechnology major, which is classified in the sector of knowledge. The course consists of 7 chapters including: History of the subject formation, basic principles of plant cell culture technique, principles of tissue culture laboratory layout; Tissue culture methods and applications in plant explant selection and propagation, and recovery of degenerated varieties; Genetically engineered crop generation techniques as well as the role of plant biotechnology in socio-economic development. In addition, students are equipped with practical skills, searching and processing information related to the subject, updating the New achievements in plant biotechnology in the world and in Vietnam, presentation and teamwork skills.

20CS3214 – Animal biotechnology

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compelled ☐ Elective ☑ (complementary)

Prerequisite courses: Courses Cytology, Biochemistry, Molecular Biology, Zoology

The course is designed as an introduction to the main principles and techniques of animal biotechnology (animal cell culture, gene transfer, stem cell technology, assisted reproductive technology, gene therapy, asexual reproduction, genetically modified animals, biomedical materials) to apply to the interpretation, grasping and understanding of problems, commercial products related to animal biotechnology in the real life. It is then possible to find out the most effective application (for health, animal husbandry, etc.).

20CS3215 - Vegetable and flower cultivation techniques

Number of credits: 3 (Theory: 2 – Practical: 1)

Courses: Compelled ☐ Elective ☑

Prerequisite courses: Plant physiology, Cultivation engineering, Laboratory Techniques

Students are provided with general knowledge about biological characteristics, ecology, growth and development of some basic vegetable and flower varieties in Lam Dong. In addition, this course provides students with methods for planting, caring, harvesting, saving varieties and solution to improve productivity and quality of agricultural products. Students are provided with in-depth knowledge on specific farming methods of vegetables and flowers in Lam Dong such as: The process of cultivating tomatoes, peppers, cabbage, artichoke; roses, chrysanthemums, Phalaenopsis, Cymbidium.

20CS4113 - Automation in Agriculture

Number of credits: 3 (Theory: 0 – Practice: 3)

Course: Compelled ☐ Elective ☑

Prerequisite courses: Cultivation engineering, Vegetable and flower cultivation techniques, Nutritions for crops, Plant protection

The course will equip the basics of agricultural automation, smart agriculture and introduce the application of automation technology in smart agriculture 4.0. Help learners understand the benefits of automation technology in production and business activities, and be able to apply automation technologies to practical production activities.

20CS4114- Ecology in agriculture and sustainable development

Number of credits: 3 (Theory: 0 – Practice: 3)

Course: Compelled ☐ Elective ☑ (Complementary)

Prerequisite courses: Ecology

This course aims to explore the interactions between agriculture and natural ecosystems, concentioinal agricuture that impact natural resourses, and discuss present barriers to sustainnability. Another objectives of this unit is focusing on applying ecological concepts to environmentally friendly agriculture.

20CS3103 - Professional Practices

Number of credits: 3 (Theory: 0 – Practice: 3)

Course: Compelled ☑ Elective ☐

Prerequisite courses: Courses of Overview of Biotechnology, Experiment design and Data analysis in Biology, Laboratory techniques, and 12 courses belong to foundational knowledge block.

Professional Practices is the compelled course in specialization knowledge block in Bachelor of Biotechnology training program for Plant Biotechnology, Agricultural Biotechnology and Microbiological & Food Technology majors. This is the course that reinforces the knowledge and practice of professional skills, soft skills of the foundational courses, and enhances the actual experience for learners.

The main contents of the course include: Organize class trips for practical experiences to increase understanding and supplement foundational knowledge background, and arouses inspiration of learning, research, and the love to nature. This course also contributes to professional orientation through nature internships, academic visits and exchanges about research and application results at several research, teaching and production institutions. Create real-world situations to practice career skills, teamwork skills, and individual skills. Practice report writing.

20CS4104 - Professional Practices for Plant Biotechnology major

Number of credits: 3 (Theory: 0 – Practice: 3)

Course: Compelled ☑ Elective ☐

Prerequisite courses: All of courses belong to foundational knowlege block and compelled specialized knowledge block, Professional Practices, Experiment design and Data analysis in Biology, Laboratory techniques, courses belong to elective specialized knowledge block directly related to the expertise contents will be practiced in the institutions or enterprises.

Professional Practices for Plant Biotechnology major is the compelled course in specialization knowledge block in Bachelor of Biotechnology training program for Plant Biotechnology major of Bachelor of Biotechnology training program. This is the course to improve professional skills, personal skills, soft skills in actual context from achievements from compelled specialized courses and courses of “Laboratory techniques”, “Experiment design and Data analysis in Biology” and also from elective courses belong to specialized knowledge block. Internships at facilities implementing biotechnology-related activities also contributes to intensive career orientation for learners.

The main contents of the course include: Students orients the specific areas of expertise and detailed works will practice the profession and organize groups with the same internship orientation, find, contact instructors at the Faculty/University and at the internship facility. Under the guidance of instructors, students continue to perform activities: establish plan for the practice and prepare the necessary knowledge and skills; Learn about the organization, size, functions, duties, internal regulations, method of implementing professional activities in aspects of administration/business, human resource needs, and human resource

qualifications in research, production institutions or enterprises associated with Plant Biotechnology where chosen to practice; Learn about and practice professional activities implementation in the real context; Evaluate internship results and, prepare and present practice report.

20CS4110 - Professional Practices for Microbiological & Food Technology major

Number of credits: 3 (Theory: 0 – Practice: 3)

Course: Compelled ☑ Elective ☐

Prerequisite courses: All of courses belong to foundational knowlege block and compelled specialized knowledge block, Professional Practices, Experiment design and Data analysis in Biology, Laboratory techniques, courses belong to elective specialized knowledge block directly related to the expertise contents will be practiced in the institutions or enterprises.

Professional Practices for Microbiological & Food Technology major is the compelled course in specialization knowledge block in Bachelor of Biotechnology training program for Microbiological & Food Technology major of Bachelor of Biotechnology training program. This is the course to improve professional skills, personal skills, soft skills in actual context from achievements from compelled specialized courses and courses of "Laboratory techniques", "Experiment design and Data analysis in Biology" and also from elective courses belong to specialized knowledge block. Internships at facilities implementing biotechnology-related activities also contributes to intensive career orientation for learners.

The main contents of the course include: Students orients the specific areas of expertise and detailed works will practice the profession and organize groups with the same internship orientation, find, contact instructors at the Faculty/University and at the internship facility. Under the guidance of instructors, students continue to perform activities: establish plan for the practice and prepare the necessary knowledge and skills; Learn about the organization, size, functions, duties, internal regulations, method of implementing professional activities in aspects of administration/business, human resource needs, and human resource qualifications in research, production institutions or enterprises associated with Microbiological & Food Technology where chosen to practice; Learn about and practice professional activities implementation in the real context; Evaluate internship results and, prepare and present practice report.

20CS4112 - Professional Practices for Agricultural Biotechnology major

Number of credits: 3 (Theory: 0 – Practice: 3)

Course: Compelled ☑ Elective ☐

Prerequisite courses: All of courses belong to foundational knowlege block and compelled specialized knowledge block, Professional Practices, Experiment design and Data analysis in Biology, Laboratory techniques, courses belong to elective specialized knowledge block directly related to the expertise contents will be practiced in the institutions or enterprises.

Professional Practices for Agricultural Biotechnology major is the compelled course in specialization knowledge block in Bachelor of Biotechnology training program for Agricultural Biotechnology major of Bachelor of Biotechnology training program. This is the course to improve professional skills, personal skills, soft skills in actual context from achievements from compelled specialized courses and courses of "Laboratory techniques", "Experiment design and Data analysis in Biology" and also from elective courses belong to specialized knowledge block. Internships at facilities implementing biotechnology-related activities also contributes to intensive career orientation for learners.

The main contents of the course include: Students orients the specific areas of expertise and detailed works will practice the profession and organize groups with the same internship orientation, find, contact instructors at the Faculty/University and at the internship facility. Under the guidance of instructors, students continue to perform activities: establish plan for the practice and prepare the necessary knowledge and skills; Learn about the organization, size, functions, duties, internal regulations, method of implementing professional activities in aspects of administration/business, human resource needs, and human resource qualifications in research, production institutions or enterprises associated with Agricultural Biotechnology where chosen to practice; Learn about and practice professional activities implementation in the real context; Evaluate internship results and, prepare and present practice report.

20CS4207 - Thesis

Number of credits: 7 (Theory: 0 – Practice: 7)

Course: Compelled ☐ Elective ☑

Prerequisite courses: All of courses belong to foundational knowlege block and compelled specialized knowledge block, Experiment design and Data analysis in Biology, Laboratory techniques, courses belong to elective specialized knowledge block directly related to the Thesis contents.

Thesis is the elective course belonging to specialized knowledge block for all three major of Bachelor of Biotechnology training program, which is for students who meet the qualifications. This is the course that equips the learners in-depth knowledge about a narrow research field within a specialized major or intersection between other majors and academic disciplines. With this course, students are trained professional skills, personal skills, soft skills in the research field, contributing to intensive career orientation for learners.

The main content of the course: student forms research ideas, find places with conditions to deploy and instructors; Under guidance of instructor(s), student makes the research outlines; conducts research, records results; analyzes results, synthesizes and writes graduation thesis; presents of research results.

20CS4206 - Thematic Internship for Plant biotechnology major Graduation

Number of credits: 5 (Theory: 0 – Practice: 5)

Course: Compelled ☐ Elective ☑

Prerequisite courses: non

The course helps students practice, practice career skills related to the field of plant biotechnology, apply knowledge in research and production practice. Graduates are equipped with basic career skills and can work in agencies and units in the relevant field.

20CS4210 - Thematic Internship for Microbiology and food technology major Graduation

Number of credits: 5 (Theory: 0 – Practice: 5)

Course: Compelled ☐ Elective ☑

Prerequisite courses: non

The course helps students practice and practice career skills related to the field of food microbiology, to apply knowledge in research and production practice. Graduates are equipped with basic career skills and can work in agencies and units in the relevant field.

20CS4211 - Thematic Internship for Agricultural biotechnology major Graduation

Number of credits: 5 (Theory: 0 – Practice: 5)

Course: Compelled ☐ Elective ☑

Prerequisite courses: non

The course helps students practice and practice career skills related to the field of agricultural biotechnology, and apply knowledge in research and production practices. Graduates are equipped with basic career skills and can work in agencies and units in the relevant field.