MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT

VIETNAM NATIONAL UNIVERSITY OF AGRICULTURE

SOCIALIST REPUBLIC OF VIETNAM

Independence - Freedom - Happiness

PROGRAM SPECIFICATION

Program title: Bachelor of Biotechnology

Level: Bachelor degree

Field: Biotechnology

Code: 7420201

Mode of education: on-campus, full-time

Duration: 4 years

Total of credits: 131 credits

Diploma: Bachelor of Biotechnology

Awarding institution: Vietnam National University of Agriculture

1. Program objectives and expected learning outcomes

1.1. Program objectives

Within the first few years after graduation, graduates are able to:

PO1: Professional competencies

Successfully work in the fields of research and technology transfer, product development, technical consulting, management, and sales of biotechnology products.

PO2: Development and international integration

Constantly learning to improve professional capacity, continuously researching, innovating and leading specialized and interdisciplinary teams to perform professional tasks to contribute to the development of Vietnam's biotechnology industry and integration.

PO3: Ethics and responsibility

Demonstrate professional ethics, fulfill the responsibility of improving the quality of life for the community and protecting the environment.

1.2. Expected learning outcomes

ELOs of the Bachelor of Biotechnology program Upon graduation, students would be able to:		**Cognitive level**
General Knowledge	ELO1: **Apply** knowledge of mathematics, social sciences, natural sciences, laws, and contemporary issues into the field of biotechnology.	**Apply**
	ELO 2: **Analyze** the needs and requirements of stakeholders for the purposes of management, production, and sales of biotechnology products.	**Analyze**
Specialized Knowledge	ELO3: **Evaluate** the quality of biotechnology products with regard to biosafety standards, environmental protection, legal, and ethical standards.	**Evaluate**
	ELO4: **Develop** ideas for biotechnology products based on personal knowledge of natural sciences, life sciences, and analysis of social needs.	**Create**
	ELO5: **Design** production models for biotechnology products.	**Create**
General Skills	ELO6: **Apply** critical and creative thinking skills to effectively solve issues related to research, technology transfer, and production in the field of biotechnology**.**	**Adaptation**
	ELO7: **Coordinate** with team members to achieve set goals, either as a team member or team leader.	**Origination**
	ELO8: **Communicate** effectively through various channels in the diverse contexts of the workplace; satisfy English proficiency levels as required by the Ministry of Education and Training.	**Origination**
Specialized Skills	ELO9: **Utilize** information technology and equipment effectively for management, production, and sales in the field of biotechnology**.**	**Adaptation**
	ELO10: **Use** appropriate methods and skills to collect, analyze, and interpret data in scientific research, and examine practical issues at the workplace.	**Adaptation**
	ELO11: **Perform** basic and intensive technical procedures fluently in the field of biotechnology	**Adaptation**
	ELO12: **Advise** customers and partners on biotechnology products with a positive business perspective.	**Adaptation**
Attitude	ELO13: **Comply** with the laws of the biotechnology industry, and conform to occupational safety principles at the workplace.	**Valuing**
	ELO14: **Maintain** professional ethics, fulfill one's duty to improve the well-being of the society and protect the environment.	**Valuing**
	ELO15: **Perform the habits** of updating knowledge and experiences to improve one's professional qualifications.	**Characterizing**

2. Career opportunities after graduation

Graduates of the Bachelor of Biotechnology program would be able to work in the following position, field and organizations:

**** Job positions***

- Staffs in production and business relates to Biotechnology (Agriculture, Healthcare, environment…)
- Researchers, teachers
- Entrepreneurs (start-up).
- Others: education, sales for biotech products, equipment and supplies…

**** Field and organization***

- Agriculture - forestry - aquaculture: applying molecular marker in breeding of plant and animal, plant protection, animal husbandry, veterinary, food products preservation and processing, developing vaccines for animal and eco-friendly products;
- Healthcare: centers for analysis, testing, diagnosis, vaccines, assisted reproductive centers, hospitals;
- Education and training, research centers: universities, colleges, research institutions, hospitals;
- Business: factories, enterprises, quality control agencies, quality assurance and quality control inspection related to biotechnology.
- Working at the management agencies related to biology and biotechnology, such as the police, the military and governmental agencies.
- Entrepreneurs

3. Higher ecucation after graduation

Graduates of the Bachelor of biotechnology program would be able to pursue postgraduate degrees both nationaly and/or internationally for various majors: biotechnology, crop science, animal science, food technology, food preservation processing, environment, biomedical and pharmaceutical.

4. Prospective students and enrollment methods:

**** For Vietnamese students***

High school graduates are considered to be admiited to universities by 3 methods: (1) Direct admission; (2) Based on high school academic results; (3) Based on the results of the national high school graduation exam organized by the Ministry of Education and Training.

**** For international students:***

International students who have graduated from high school and submit academic transcripts and aspiration statement to study the International Cooperation Office (ICO).

ICO will be responsible for contacting the Faculty and Training Management Office for approval.

5. Educational philosophy and instructional strategy

**** Educational philosophy***

In the line with the Vision and Mission of VNUA and Faculty of Biotechnology, we consistently pursues the philosophy of **Constructivism**. With this philosophy, learners are considered as learner-centered, and are entitled to learn, conduct research, acquire practical experiences and practice necessary skills in the field of biotechnology and related fields for their future career.

**** Instructional strategy***

The role of lecturers is to orient students to build knowledge through lectures and meaningful learning activities. Teaching and learning strategies include:

1) Theory combined with lab practice, professional training on the farm, project learning, internship activities and scientific research.

2) Encourage self-study and teamwork

3) Participate in social activities and community service.

6. Student assessment

1. The student assessment is constructively aligned to the achievement of the expected learning outcomes.

2. Student assessment includes: entry assessment, continuous assessment (progress assessment and end-of-course assessment) and exit assessment (graduation assessment):

+ *Entry assessment:* The university uses 03 admission methods: (1) Direct admission; (2) Admission based on high school, vocational high school, college, or university academic results; (3) Admission based on the results of the national high school graduation exam organized by the Ministry of Education and Training.

+ *Continuous assessment and end-of-course assessment:* The methods for evaluating students are diverse, including : class attendance, group discussion, homework, teamwork, essays, presentations, practices, projects, mid-term exams, and final exams.

+ *Exit assessment*: Students can register for the graduation thesis as soon as the 6th semester provided that they have accumulated at least 70% of the credits of the program and an overall cumulative GPA at the time of review ≥ 2.00. Students must conduct the graduation thesis in at least 06 months

7. Grades, program duaration and graduation requirements:

The 10 point scale is then converted into a 4 point scale.

Grade conversion for courses:

No.	10-point scale	4-point scale		Pass/Fail	Classification
		Equivalents in letters	Marks		
1	8.5 - 10	A	4.0	Pass	High distinction
2	8.0 – 8.4	B^+	3.5	Pass	Distinction
3	7.0 – 7.9	B	3.0	Pass	Credit
4	6.5 – 6.9	C^+	2.5	Pass	Credit
5	5.5 – 6.4	C	2.0	Pass	Pass
6	5.0 – 5.4	D^+	1.5	Pass	Pass
7	4.0 – 4.9	D	1.0	Conditional pass	Conditional pass
8	Below 4.0	F	0	Fail	Fail

Graduation classification scale is determined by the overall cumulative GPA of the entire program as follows:

No.	GPA	Graduation classification
1	3.60 – 4.00	Excellent
2	3.20 – 3.59	Good
3	2.50 – 3.19	Fair
4	2.00 – 2.49	Average
5	< 2.00	Poor

Program duration

The program is designated for teaching in 8 semesters, 2 semesters each year. The maximum time for study is 6 years. Students are required to accumulate 131 credits of the program with 40 general knowledge credits, 8 supplementary knowledge credits, 23 foundation knowledge credits (19 compulsory credits (compulsory), 4 elective credits (elective), 50 specialized knowledge credits (50 compulsory credits, 10 elective credits), Graduation thesis 10 credits. Students must complete the certificate with 3 credits of Physical education, 9 credits military education, and 6 credits of Soft skills training courses are arranged in 8 semesters, equivalent to 4/5 years.

Graduation requirements

Students are eligible to graduate since they have accumulated 131 credits of the program; the cumulative GPA of the entire course is at least 2.00; English at least B1 level according to the Common European Framework of Reference for Languages or equivalent; having certificate of physical education and military education (grades of physical and defense education modules do not count toward the overall cumulative score); having certificate of soft skills training.

8. Structure and content of the program

Diagrams of knowledge blocks of the program

GENERAL COURSES (40 CREDITS)

POLITICAL (11 CREDITS)
1 Philosophy of Marxism – Leninism (3 credits)
2. Political economy of Marxism and Leninism (2 credits)
3. Socialism (2 credits)
4. Ho Chi Minh Ideology (2 credits)
5. Vietnamese Communist Party History (2 credits)
LAW (2 CREDITS)
Introduction to Laws (2 credits)
CHEMMISTRY (6 credits)
1. Fundamentals of Chemistry (2 credits)
2. Organic Chemistry (2 credits)
3. Analytical Chemistry (2 credits)
MATH-RELATED (3 credits)
Probability and Statistics (3 credits)
BIOLOGY (11 credits)
1. General Biology (2 credits)
2. General Microbiology (2 credits)
3. General Genetics (3 credits)
4. Molecular Biology 1 (2 credits)
5. General Biochemistry (2 credits)
ECONOMICS (5 CREDITS)
Principles of Economics (3 credits)
Agribusiness Management (2 credits)
ENVIRONMENT (2 credits)
Man and Environment (2 credits)

SUPPLEMENTARY COURSES (8 CREDITS)

FOREIGN LANGUAGES (6 CREDITS)
1. English 1 (3 credits)
2. English 2 (3 credits)

INFORMATION TECHNOLOGY (2 CREDITS)
Introdution to Informatics (2 credits)

SOFT SKILL TRAINING (-)

FOUNDATION COURSES (23 CREDITS)

1. Biology of Human and Animal (3 credits)
2. Cell Biology (2 credits)
3. Molecular Biology 1 Lab. (1 credit)
4. Evolution and Biodiversity (3 credits)
5. Fundamental Immunology (2 credits)
6. Microbial Ecology (2 credits)
7. Botany (3 credits)
8. Plant Physiology (3 credits)

ELECTIVE (choose 2 of 7 the following courses)
1. Animal Developmental Biology (2 credits)
2. Plant Developmental Biology (2 credits)
3. Introductory Animal Production (2 credits)
4. Principles of Crop production (2 credits)
5. General Entomology (2 credits)
6. Introduction to Plant Pathology (2 credits)
7. Experimental Methods (2 credits)

PRACTICAL EXPERIENCE (13 CREDITS)

Professional Internship 1 (5 credits)
Professional Internship 2 (8 credits)

SPECIALIZED COURSES (37 CREDITS)

1. English for Biotechnology (2 credits)
2. Molecular Biology 2 (2 credits)
3. Applied Bioinformatics (3 credits)
4. Animal Cell Technology (3 credits)
5. Animal Cell Technology Lab (1 credit)
6. Genetic engineering - principles and applications (3 credits)
7. Genetic engineering lab (1 credit)
8. Protein-enzyme technology (3 credits)
9. Protein – Enzyme technology Lab (1 credit)
10. Microbial Biotechnology (3 credits)
11. Microbial Biotechnology lab (1 credit)
12. Plant cell and tissue culture technology (3 credits)
13. Plant cell and tissue culture techniques lab (1 credit)

ELECTIVE (10/29 CREDITS)
Students choose 10 credits according to the following orientations:
Plant Biotechnology
1. Biotechnology in plant breeding (2 credits)
2. Biotechnology in plant breeding lab (1 credit)
3. Hi-tech in Agriculture (2 credits)
4. Natural compounds (2 credits)
5. Principles and methods of Plant breeding (2 credits)
Animal Biotechnology
1. Stem Cell Technology (2 credits)
2. Biotechnology in Animal Breeding (2 credits)
3. Molecular Diagnostics and Gene Therapy (2 credits)
Microbial Biotechnology
1. Environmental Biotechnology (2 credits)
2. Virology (2 credits)
3. Biotechnology of Edible and Medicinal Mushrooms (2 credits)
Others:
1. Biosafety (2 credits)
2. Nanobiotechnology Principles and applications (2 credits)
3. Current topics in Biotechnology (2 credits)
4. Intellectual Property in Biotechnology (2 credits)
5. Seminar (1 credit)

BIOTECHNOLOGY PROGRAM

(131 CREDITS)

GRADUATION THESIS (10 CREDITS

Graduation thesis (10 credits)

CONDITIONAL COURSES

1. Physical education
2. Military education

Note: *Before taking course of English 1, students are required to take an entrance exam to assess their English proficiency. If they do not meet the requirements, they are required to retake two English courses including Supplementary English at semester 1 and English 0 at semester 2 and earned credits do not count toward the program's credits.*

Program structure

No.	Code	Course	English name	Credits	Theory	Practice	Prerequisite course	Compulsory	Elective
BLOCK OF GENERAL KNOWLEDGE				**40**	**36.5**	**2.5**		**40**	**0**
1.	ML01020	Triết học Mác – Lênin	Marxism - Leninism Philosophy	3	3.0	0.0		x	
2.	ML01021	Kinh tế chính trị Mác – Lênin	Marxism – Leninism Political Economy	2	2.0	0.0		x	
3.	ML01022	Chủ nghĩa xã hội khoa học	Scientific Socialism	2	2.0	0.0		x	
4.	ML01005	Tư tưởng HCM	Ho Chi Minh Ideology	2	2.0	0.0		x	
5.	ML01023	Lịch sử Đảng Cộng sản Việt Nam	Vietnamese Communist Party History	2	2.0	0.0		x	
6.	ML01009	Pháp luật đại cương	Introduction to Laws	2	2.0	0.0		x	
7.	MT01001	Hóa học đại cương	Fundamentals of Chemistry	2	1.5	0.5		x	
8.	MT01002	Hóa hữu cơ	Organic Chemistry	2	1.5	0.5		x	
9.	MT01004	Hóa phân tích	Analytical Chemistry	2	1.5	0.5		x	
10.	TH01007	Toán xác suất thống kê	Probability and Statistics	3	3.0	0.0		x	
11.	SH01001	Sinh học đại cương	General Biology	2	1.5	0.5		x	
12.	SH01002	Vi sinh vật đại cương	General Microbiology	2	1.5	0.5		x	
13.	SH01004	Di truyền học đại cương	General Genetics	3	3.0	0.0		x	
14.	SH01005	Sinh học phân tử 1	Molecular Biology 1	2	2.0	0.0		x	
15.	CP02005	Hóa sinh đại cương	General Biochemistry	2	1.5	0.5		x	
16.	KT02003	Nguyên lý kinh tế	Principles of Economics	3	3.0	0.0		x	
17.	KQ03111	Quản trị kinh	Agribusiness	2	2.0	0.0		x	

No.	Code	Course	English name	Credits	Theory	Practice	Prerequisite course	Compulsory	Elective
		doanh nông nghiệp	Management						
18.	MT02038	Môi trường và con người	Man and Environment	2	2.0	0.0		x	
BLOCK OF SUPPLEMENTARY KNOWLEDGE				**8**	**7.5**	**0.5**		**8**	**0**
19.	SN01032	Tiếng Anh 1	English 1	3	3.0	0.0	English 0	x	
20.	SN01033	Tiếng Anh 2	English 2	3	3.0	0.0	English 1	x	
21.	TH01009	Tin học đại cương	Introduction to Informatics	2	1.5	0.5		x	
BLOCK OF FOUDATION KNOWLEDGE				**23**	**19**	**4**		**19**	**4/10**
22.	SH02002	Sinh học người và động vật	Biology of Human and Animal	3	3.0	0.0		x	
23.	SH02003	Sinh học tế bào	Cell Biology	2	2.0	0.0		x	
24.	SH02006	Thực hành SHPT 1	Molecular Biology 1 Lab.	1	0.0	1.0		x	
25.	SH02009	Tiến hóa và đa dạng sinh học	Evolution and biodiversity	3	3.0	0.0		x	
26.	SH02011	Miễn dịch học cơ sở	Fundamental immunology	2	2.0	0.0	General Microbiology	x	
27.	SH02008	Sinh thái VSV	Microbial ecology	2	2.0	0.0		x	
28.	NH02001	Thực vật học	Botany	3	2.0	1.0		x	
29.	NH02003	Sinh lý thực vật	Plant Physiology	3	2.0	1.0		x	
30.	SH03064	Sinh học phát triển động vật	Animal Developmental Biology	2	2.0	0.0			x
31.	SH03065	Sinh học phát triển thực vật	Plant Developmental Biology	2	2.0	0.0			x
32.	NH02005	Phương pháp thí nghiệm	Experimental Methods	2	1.5	0.5	Probability and Statistics		x
33.	RQ02001	Nguyên lý trồng trọt	Principle of Crop Production	2	1.5	0.5			x

No.	Code	Course	English name	Credits	Theory	Practice	Prerequisite course	Compulsory	Elective
34.	NH02038	Bệnh cây đại cương	Introduction to Plant Pathology	2	1.5	0.5			x
35.	NH02037	Côn trùng đại cương	General Entomology	2	1.5	0.5			x
36.	CN01007	Nhập môn chăn nuôi	Introductory Animal Production	2	2	0			x
BLOCK OF SPECIALIZED KNOWLEDGE				**50**	**31**	**19**		**40**	**10/33.**
37.	SH03001	Tiếng anh chuyên ngành CNSH	English for Biotechnology	2	2.0	0.0	English 1	x	
38.	SH03004	Sinh học phân tử 2	Molecular Biology 2	2	2.0	0.0	Molecular Biology 1	x	
39.	SH03005	Tin sinh học ứng dụng	Applied Bioinformatics	3	2.0	1.0	Introdution to Informatics	x	
40.	SH03006	Công nghệ tế bào động vật	Animal Cell Technology	3	3.0	0.0	General Biology	x	
41.	SH02062	Thực hành công nghệ tế bào động vật	Animal Cell Technology Lab	1	0.0	1.0		x	
42.	SH03008	Kỹ thuật di truyền, Nguyên lý và ứng dụng	Genetic engineering - principles and applications	3	3.0	0.0	Molecular Biology 1	x	
43.	SH03009	Thực hành kỹ thuật di truyền	Genetic engineering lab	1	0.0	1.0		x	
44.	SH03010	Công nghệ protein-enzym	Protein-enzyme technology	3	3.0	0.0	Genetic engineering - principles and applications	x	
45.	SH03011	Thực hành công nghệ protein-enzym	Protein – Enzyme technology Lab	1	0.0	1.0		x	
46.	SH03012	Công nghệ vi sinh	Microbial Biotechnology	3	3.0	0.0	Microbial Biology	x	

No.	Code	Course	English name	Credits	Theory	Practice	Prerequisite course	Compulsory	Elective
47.	SH03013	Thực hành công nghệ vi sinh	Microbial Biotechnology Lab	1	0.0	1.0		x	
48.	SH03014	Công nghệ nuôi cấy mô và TB thực vật	Plant cell and tissue culture technology	3	3.0	0.0	General Biology	x	
49.	SH03015	Thực hành CN nuôi cấy mô và tế bào thực vật	Plant cell and tissue culture technology lab	1	0.0	1.0		x	
50.	SH04001	Thực tập nghề nghiệp 1	Professional Internship 1	5	0.0	5.0	General Genetics General Microbiology Botany	x	
51.	SH04002	Thực tập nghề nghiệp 2	Professional Internship 2	8	0.0	8.0	Professional Internship 1	x	
52.	SH03050	Công nghệ tế bào gốc	Stem Cell Technology	2	2.0	0.0	Biology of Human and Animal		x
53.	SH03051	CNSH trong chọn tạo giống cây trồng	Biotechnology in plant breeding	2	2.0	0.0	Genetic engineering - principles and applications		x
54.	SH03068	Thực hành CNSH trong chọn tạo giống cây trồng	Biotechnology in plant breeding lab	1	0.0	1.0			x
55.	SH03052	CNSH trong chọn tạo giống động vật	Biotechnology in animal breeding	2	2.0	0.0	General Genetics		x
56.	SH03053	Công nghệ sinh học môi trường	Environmental biotechnology	2	2.0	0.0	Man and Environment		x
57.	SH03054	An toàn sinh học	Biosafety	2	2.0	0.0	Introduction to Laws		x
58.	SH03055	Công nghệ sinh học nấm ăn và nấm dược liệu	Biotechnology of edible and medicinal mushrooms	2	1.5	0.5	General Microbiology		x
59.	SH03056	Seminar	Seminar	1	1.0	0.0			x

No.	Code	Course	English name	Credits	Theory	Practice	Prerequisite course	Compulsory	Elective
60.	SH03057	Chuyên đề trong CNSH	Current topics in biotechnology	2	2.0	0.0			x
61.	SH03058	Nông nghiệp công nghệ cao	Hi-tech in Agriculture	2	2.0	0.0			x
62.	SH03059	Công nghệ sinh học Nano Nguyên lý và Ứng dụng	Nanobiotechnology Principles and applications	2	2.0	0.0	Cell Biology		x
63.	SH03060	Chẩn đoán phân tử và liệu pháp gen	Molecular Diagnostics and Gene Therapy	2	2.0	0.0	Molecular Biology 1		x
64.	SH03061	Virus học	Virology	2	1.5	0.5	General Microbiology		x
65.	SH03062	Sở hữu trí tuệ trong CNSH	Intellectual Property in Biotechnology	2	2.0	0.0	Introduction to Laws		x
66.	SH03063	Hợp chất thứ cấp thiên nhiên	Natural compounds	2	2.0	0.0	Introduction to Biochemistry		x
67.	NH03046	Nguyên lý và phương pháp chọn tạo giống cây trồng	Principles and methods of Plant breeding	2	1.5	0.5			x
68.	**SH04999**	**Khóa luận tốt nghiệp**	**Graduation thesis**	**10**	**0**	**10**	**Professional Internship 2**	**x**	

**** Soft-skills training courses***

Course group	Code	Course title	Credit	Compulsory /Elective
Soft-skills training courses	KN01001	Communication skills	2	Elective
	KN01002	Leadership skill	2	Elective
	KN01003	Self management skills	2	Elective
	KN01004	Job search skills	2	Elective
	KN01005	Teamwork skills	2	Elective
	KN01006	Intergrated skills	2	Elective

**** Physical education and Military education courses***

Course group	Code	Course title	Credit	Compulsory /Elective
GDTC	GT01016	General physical education	1	Compulsory
GDTC	GT01017	Athletics	1	Elective
GDTC	GT01018	Aerobic gymnastics	1	Elective
GDTC	GT01019	Football	1	Elective
GDTC	GT01020	Volleyball	1	Elective
GDTC	GT01021	Basketball	1	Elective
GDTC	GT01022	Badminton	1	Elective
GDTC	GT01023	Chess	1	Elective
GDTC	GT01014	Dancesport	1	Elective
GDTC	GT01015	Swimming	1	Elective
GDQP	QS01011	Vietnamese Communist Party's guidelines of natinal defence and security	3	Compulsory
GDQP	QS01012	National defense and security works	2	Compulsory
GDQP	QS01013	General military	2	Compulsory
GDQP	QS01014	Infantry combat technique and tactics	2	Compulsory
Total			**19**	

9. Sample learning roadmap *(intentative)*

No.	Year	Semester	Course title	Code	Credits	Theory	Lab/practice	Prerequisite	Prerequisite code	Compulsory /Elective	Min no. of credits
1.	1	1	Fundamentals of Chemistry	MT01001	2	1.5	0.5			Compulsory	0
2.	1	1	Probability and Statistics	TH01007	3	3.0	0.0			Compulsory	
3.	1	1	Philosophy of Marxism and Leninism	ML01020	2	2.0	0.0			Compulsory	
4.	1	1	Supplementary english	SN00010	1	1.0	0.0			Compulsory	
5.	1	1	General Biology	SH01001	2	1.5	0.5			Compulsory	
6.	1	1	Introduction to informatics	TH01009	2	1.5	0.5			Compulsory	
7.	1	1	General genetics	SH01004	3	3.0	0.0			Compulsory	
8.	1	1	General Biochemistry	CP02005	2	2.0	0.0			Compulsory	
9.	1	1	General physical education	GT01016	1	0.0	1.0			Compulsory	
10.	1	1	Vietnamese Communist Party's guidelines of national defence and security	QS01011	2	2.0	0.0			Compulsory	
11.	1	2	English 0	SN00011	2	2.0	0.0	Supplementary english	SN00010	Compulsory	0
12.	1	2	Organic Chemistry	MT01002	2	1.5	0.5			Compulsory	
13.	1	2	Cell Biology	SH02003	2	2.0	0.0			Compulsory	
14.	1	2	Introduction to laws	ML01009	2	2.0	0.0			Compulsory	
15.	1	2	General Microbiology	SH01002	2	1.5	0.5			Compulsory	
16.	1	2	Political economy of Marxism and Leninism	ML01021	2	2.0	0.0			Compulsory	
17.	1	2	Molecular Biology 1	SH02005	2	2.0	0.0			Compulsory	
18.	1	2	Molecular biology 1 lab	SH02006	1	0.0	1.0			Compulsory	
19.	1	2	Botany	NH02001	3	2.0	1.0			Compulsory	
20.	1	2	Soft skills courses	KN01001-6	6	0.0	6.0			Compulsory	

No.	Year	Semester	Course title	Code	Credits	Theory	Lab/practice	Prerequisite	Prerequisite code	Compulsory /Elective	Min no. of credits
21.	1	2	Physical education 2 (choose 1 in 9 courses GT01017-GT01023)	GT01017-23	1	0.0	1.0			Compulsory	
22.	1	2	National defense and security work	QS01012	2	2.0	0.0			Compulsory	
23.	2	3	English 1	SN01032	3	3.0	0.0	English 0	SN00011	Compulsory	0
24.	2	3	Microbial ecology	SH02008	2	2.0	0.0			Compulsory	
25.	2	3	Biology of Human and Animal	SH02002	3	3.0	0.0			Compulsory	
26.	2	3	Analytical Chemistry	TM01004	2	1.5	0.5			Compulsory	
27.	2	3	Socialism	ML01022	2	2.0	0.0			Compulsory	
28.	2	3	Plant Physiology	NH02003	3	2.0	1.0			Compulsory	
29.	2	3	Man and Environment	MT02038	2	2.0	0.0			Compulsory	
30.	2	3	General military, tactics, techniques of pistol shooting and grenade usage	QS01003	6	1.5	4.5			Compulsory	
31.	2	4	English 2	SN01033	3	3.0	0.0	English 1	SN01032	Compulsory	0
32.	2	4	Molecular biology 2	SH03004	2	2.0	0.0	Molecular Biology 1	SH01005	Compulsory	
33.	2	4	Ho Chi Minh Ideology	ML01005	3	3.0	0.0			Compulsory	
34.	2	4	Evolution and biodiversity	SH02009	3	3.0	0.0			Compulsory	
35.	2	4	English for Biotechnology	SH03001	2	2.0	0.0	English 1	SN01032	Compulsory	
36.	2	4	Fundamental Immunology	SH02011	2	2.0	0.0	General Microbiology	SH01002	Compulsory	
37.	2	4	Principles of Economics	KT02003	3	3.0	0.0			Compulsory	

No.	Year	Semester	Course title	Code	Credits	Theory	Lab/practice	Prerequisite	Prerequisite code	Compulsory /Elective	Min no. of credits
38.	2	4	Infantry combat technique and tactics	QS01014	1	1.0	0.0			Compulsory	
39.	3	5	Vietnamese Communist Party History	ML01023	2	2.0	0.0			Compulsory	
40.	3	5	Genetic engineering - principles and applications	SH03008	3	3.0	0.0	Molecular Biology 1	SH02005	Compulsory	4
41.	3	5	Genetic engineering lab	SH03009	1	0.0	1.0			Compulsory	
42.	3	5	Microbial Biotechnology	SH03012	3	3.0	0.0	Microbial ecology	SH02008	Compulsory	
43.	3	5	Microbial biotechnology lab	SH03013	1	0.0	1.0			Compulsory	
44.	3	5	Agribusiness Management	KQ03111	2	2.0	0.0			Compulsory	
45.	3	5	Professional Internship 1	SH04001	5	0.0	5.0	General Genetics General Microbiology Botany	SH02004 SH01002 NH02001	Compulsory	
46.	3	5	Experimental Methods	NH02005	2	1.5	0.5	Probability and Statistics	TH01007	Elective	
47.	3	5	General Entomology	NH02037	2	2.0	0.0			Elective	
48.	3	5	Introduction to Plant Pathology	NH02038	2	2.0	0.0			Elective	
49.	3	5	Principles of crop production	RQ02001	2	1.5	0.5			Elective	
50.	3	5	Introductory Animal Production	CN01007	2	1.5	0.5			Elective	
51.	3	5	Animal Developmental Biology	SH03064	2	2.0	0.0			Elective	
52.	3	5	Plant developmental biology	SH03065	2	2.0	0.0			Elective	
53.	3	6	Professional Internship 2	SH04002	8	0.0	8.0	Professional Internship 1	SH04001	Compulsory	0

No.	Year	Semester	Course title	Code	Credits	Theory	Lab/practice	Prerequisite	Prerequisite code	Compulsory /Elective	Min no. of credits
54.	3	6	Protein-enzyme technology	SH03010	3	3.0	0.0	Molecular Biology 2	SH03004	Compulsory	
55.	3	6	Protein-enzyme technology Lab	SH03011	1	0.0	1.0			Compulsory	
56.	3	6	Plant cell and tissue culture technology	SH03014	3	3.0	0.0	General Biology	SH01001	Compulsory	
57.	3	6	Plant cell and tissue culture techniques lab	SH03015	1	0.0	1.0			Compulsory	
58.	3	6	Biotechnology in plant breeding	SH03051	2	2.0	0.0	Genetic engineering - principles and applications	SH03008	Elective	
59.	3	6	Biotechnology in plant breeding lab	SH03068	1	0.0	1.0			Elective	
60.	3	6	Virology	SH03061	2	1.5	0.5	General Microbiology	SH01002	Elective	
61.	3	6	Principles and methods of Plant breeding	NH03046	2	1.5	0.5			Elective	
62.	3	6	Molecular Diagnostics and Gene Therapy	SH03060	2	2.0	0.0	Molecular Biology 1	SH02005	Elective	
63.	4	7,8	Applied Bioinformatics	SH03005	3	2.0	1.0	Introduction to Informatics	TH01009	Compulsory	10
64.	4	7,8	Animal Cell Technology	SH03006	3	3.0	0.0	Biology of Human and Animal	SH02002	Compulsory	
65.	4	7,8	Animal Cell Technology Lab	SH02062	1	0.0	1.0			Compulsory	
66.	4	7,8	Current topics in biotechnology	SH03057	2	2.0	0.0			Elective	
67.	4	7,8	Seminar	SH03056	1	1.0	0.0			Elective	
68.	4	7,8	Biosafety	SH03054	2	2.0	0.0	Introduction to Laws	ML01009	Elective	

No.	Year	Semester	Course title	Code	Credits	Theory	Lab/practice	Prerequisite	Prerequisite code	Compulsory /Elective	Min no. of credits
69.	4	7,8	Stem Cell Technology	SH03050	2	2.0	0.0	Biology of Human and Animal	SH02002	Elective	
70.	4	7,8	Biotechnology in animal breeding	SH03052	2	2.0	0.0	General Genetics	SH02004	Elective	
71.	4	7,8	Biotechnology of edible and medicinal mushrooms	SH03055	2	1.5	0.5	General Microbiology	SH01002	Elective	
72.	4	7,8	Environmental biotechnology	SH03053	2	2.0	0.0	Man and Environment	MT02038	Elective	
73.	4	7,8	Hi-tech in Agriculture	SH03058	2	2.0	0.0			Elective	
74.	4	7,8	Nanobiotechnology - Principles and applications	SH03059	2	2.0	0.0	Cell Biology	SH02003	Elective	
75.	4	7,8	Intellectual Property in Biotechnology	SH03062	2	2.0	0.0	Introduction to laws	ML01009	Elective	
76.	4	7,8	Natural compounds	SH03063	2	2.0	0.0	General Biochemistry	CP02005	Elective	
77.	4	7,8	Graduation thesis	SH04999	10	0.0	10.0	Professional Internship 2	SH04002	Compulsory	

10. Brief outline of all courses in the program

I. GENERAL COURSES

1. Philosophy of Marxism - Leninism **Credits: 3**

- *Credits: 3 (3/0/9)*

- *Prerequisite: None*

- *Course description*: The course is consist of the following content: Chapter 1: Outline of Philosophy and Marxism - Leninism philosophical school; Chapter 2: Dialectical Materialism; Chapter 3: Historical Materialism.

2. Political economy of Marxism and Leninism **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: None*

- *Course description:* The course is consist of six chapters introducing the following content: Objective, research methodology, and function of Marxism – Leninism Political Economy; Commodity, market, and roles of economic agents; Surplus value; Competition and monopoly; Socialist-oriented market economy and relations of economic interest in Vietnam; Industrialization, modernization and international economic integration of Vietnam.

3. Vietnamese Communist Party History **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: None*

- *Course description:* The course is consist of chapters: Objects, functions, tasks, content and methods of studying and studying History of the Communist Party of Vietnam, The Communist Party of Vietnam was born and led the struggle for power (1930-1945), The Party led the two resistance wars to complete the national liberation and reunification of the country (1945-1975); The Party led the country in the transition to socialism and carried out the renovation work (1975-2018). Conclusion on the great victories of the Vietnamese revolution and great lessons on the leadership of the Party.

4. Socialism **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: None*

- *Course description:* The course is consisted of the following content: Introduction to Scientific Socialism; Historical mission theory of the proletariat; Socialism and Socialist Transition; Socialist Democracy and Socialist State; Structure of Social classes and League of social classes in the socialist transition; Issues of ethnicity and Religion in socialist transition; Issues of Family in socialist transition.

5. Ho Chi Minh Ideology **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: None*

- *Course description:* The course presents Ho Chi Minh's thoughts on the path of national liberation and building new societies.

6. Introduction to laws **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: None*

- *Course description:* Basic knowledge about the Government and Laws; Basic knowledge about the Government and the Law system of the Socialist Republic of Vietnam; Basic contents of Civil Law and Criminal Law; Basic contents of Economic Law, Labor Law, Marriage and Family Law; Basic contents of the Administrative Law and the law on anti-corruption.

7. Fundamentals of Chemistry **Credits: 2**

- *Credits: 2 (1.5/0.5/6)*

- *Prerequisite: None*

- *Course description:* The course consists of 7 theoretical chapters with the following contents: Basic concepts and rules, structures of matter, thermodynamics, reaction rate and chemical equilibrium, solution, electrochemistry, colloid and 3 lab sessions.

8. Organic Chemistry **Credits: 2**

- *Credits: 2 (1.5/0.5/6)*

- *Prerequisite: None*

- *Course description:* Basic theory of organic chemistry: Isomers and interactions between atoms, groups of atoms in molecules of organic compounds. Structure and basic properties of important organic functional groups. The main mechanism of organic reactions. Structure and properties of some natural organic groups: glucids, lipids, amino acids, proteins, alkaloids, terpenoids, etc…. and 3 lab sessions.

9. Analytical Chemistry **Credits: 2**

- *Credits: 2 (1.5/0.5/6)*

- *Prerequisite: None*

- *Course description:* The concept and role of analytical chemistry; classifications of analytic methods; basic concepts in analytical chemistry. Basic principles, influencing factors, the

methods of result calculation in the participate's mass analysis. Principles, basic concepts, requirements of titration, classification of titration methods, preparation standard solutions, building of a calibration curve, indicator selection, calculation of the results in precipitation analysis method.

10. Probability and Statistics **Credits: 3**

- *Credits: 3 (3/0/9)*

- *Prerequisite: None*

- *Course description:* The course consists of 6 chapters with the following contents: Descriptive statistics; Probability; Random variables; Estimating parameters; Testing statistical hypotheses; Correlation and regression.

11. General Biology **Credits: 2**

- *Credits: 2 (1.5/0.5/6)*

- *Prerequisite: None*

- *Course description:* The course consists of the following theory chapters: An overview of the organism's organization; The energy processes and metabolism of cells; The cell division and reproduction in organisms; The induction and adaptability of organisms; The biological evolution. Practice lessons: Microscope - how to use and observe cells; Observing the plasmolysis and the de- plasmolysis of the cell; Observing the phases of mitosis and mitosis of cells.

12. General Microbiology **Credits: 2**

- *Credits: 2 (1.5/0.5/6)*

- *Prerequisite: None*

- *Course description:* The course consists of the following chapters: General knowledge of microbiology; Viruses; Bacteria; Eukaryotes; Nutrition and Microbial Growth.

13. General genetics **Credits: 3**

- *Credits: 3 (3/0/9)*

- *Prerequisite: None*
- *Course description:* This course consists of the following chapters: Genetics – the heart of biology; Mendelian Genetics; The interaction of genes with each other and with the environment; Chromosomal Genetics and Gene Linking; Molecular basis of heredity; Gene, chromosomal, genomic variation, and error correction; Microbial Genetics; Quantitative inheritance, hybrid dominance, and cytoplasmic inheritance; Genetics of Individual Development and Evolution; Applied Genetics; Human genetics and biomedical applications.

14. Molecular Biology 1 **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: None*

- *Course description:* The course consists of the seven chapters: History of molecular biology; Macromolecules: Nucleic acid and Protein; Structure of gene and genome; DNA replication; DNA mutation and repair; Gene transcription in eukaryote; Genetic code and translation.

15. General Biochemistry **Credits: 2**

- *Credits: 2 (1.5/0.5/6)*

- *Prerequisite: None*

- *Course description:* The theoretical section consists of 7 chapters with the following contents: Structure, properties and functions of amino acid molecules, proteins, enzymes, vitamins, nucleic acids, carbohydrates, lipids in cells; metabolism and energy metabolism in cells: carbohydrate, lipid, amino acid and protein metabolism.

The practical section consists of 3 chapters with the following contents: qualitative reactions to determine the presence of amino acids, proteins, vitamins, reducing sugars; methods of identifying the amount proteins, reducing sugars, total sugars, vitamin C, organic acids in agricultural products and foods.

16. Principles of Economics **Credits: 3**

- *Credits: 3 (3/0/9)*

- *Prerequisite: None*

- *Course description:* Introduction of the basic principles of Microeconomics, Applying microeconomics to agricultural market analysis, Macroeconomics, Applying macroeconomics to policy analysis. The course consists of 3 parts, (A) General issues of economics, (B) Fundamental principles of microeconomics, (C) Fundamental principles of macroeconomics.

17. Agribusiness Management **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: None*

- *Course description:* The course consists of 5 chapters with the following contents: General issues of agribusiness management; Types of agricultural business; Financial statements of the agribusiness; Marketing activities of the agribusiness; and Agribusiness resources.

18. Man and Environment **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: None*

- *Course description:* The course contents include: (1) Introduction to environmental science; (2) Basic principles of ecology and environmental science; (3) Demography and population growth; (4) The needs and activities that meet the needs of people; (5) Natural resources; (6) Environmental pollution and sustainable development issues.

II. SUPPLEMENTARY COURSES

1. Supplementary English Credits: 1

- *Credits: 1 (1/0/3)*

- *Prerequisite: None*

- *Course description:* An introductory course on the Basic English Program for students of Vietnam National University of Agriculture, introduce the structure and format of the English proficiency test according to the European reference framework. The course's exercises consist of 2 parts: Section A - Grammar and Reading (Grammar and Reading); Section B - Listening (Listening comprehension); each section contains a number of questions in different types that may appear in the English proficiency test according to the European reference framework.

2. English 0 Credits: 2

- *Credits: 2 (2/0/6)*

- *Prerequisite: Supplementary English*

- *Course description:* The content of the course includes practicing sessions for skills of Listening - Speaking - Reading – Writing and introducing vocabulary and grammar associated with the lesson topics: familiarizing and introducing yourself, telling about daily tasks, shopping, talking about family. Students use the vocabularies and the grammars of the present simple, "there is/are" and the possessive adjectives/possessive pronouns to practice communicating sentences, listening and understanding simple conversations and write short paragraphs in situations that are relevant to the lesson's topic.

3. English 1 Credits: 3

- *Credits: 3 (3/0/9)*

- *Prerequisite: English 0*

- *Course description:* This course consists of 5 units at pre-intermediate level about the five topics including It's a great job (Unit 1), Great vacations (Unit 2), Cities around the world (Unit 3), Wildlife (Unit 4), All about sports (Unit 5). In each unit, English grammar, vocabulary, and skills are provided and practiced by students through different parts: Start, Listening, Vocabulary, Grammar, Reading, Song/Culture, Pronunciation, Conversation Takeaway, Writing Takeaway, Test Takeaway.

4. English 2 **Credits: 3**

- *Credits: 3 (3/0/9)*

- *Prerequisite: English 1*

- *Course description:* This course consists of 5 units at pre-intermediate level about the five topics including Good luck, bad luck (Unit 1), My favorite things (Unit 2), Memorable experiences (Unit 3), I love chocolate (Unit 4), How can we help? (Unit 5). In each unit, English grammar, vocabulary, and skills are provided and practiced by students through different parts: Start, Listening, Vocabulary, Grammar, Reading, Song/Culture, Pronunciation, Conversation Takeaway, Writing Takeaway and Test Takeaway.

5. Introduction to informatics **Credits: 2**

- *Credits: 2 (1.5/0.5/6)*

- *Prerequisite: None*

- *Course description:* General introduction to informatics; Computer architecture; Computer software and operating system; Computer network and Internet; Social issues of information technology; MS Word and MS PowerPoint; MS Excel.

6. Soft skills courses

1. Communication Skills **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Course description:* Presentation skills; Effective listening and feedback skills; Negotiation skills.

2. Leadership Skills **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Course description:* Overview of leadership skills; Motivational skills; Organizational and planning skills; Communication and negotiation skills; Decision-making skills. Provide basic knowledge of leadership, decision-making, and how to handle leadership issues.

3. Self Management Skills **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Course description:* Self-discovery skills; Emotional control skills; Goal identifying skills; Effective time management skills.

4. Job Search Skills **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Course description:* Skills for finding job opportunities; Skills for preparing job applications; Job interview skills; Negotiation skills on compensation policies; Global integration and self-development in the work environment.

5. Teamwork Skills **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Course description:* The concepts of teams and teamwork; Teamwork skills; Managing and operating the group.

6. Intergrated Skills **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Course description:* Skills to explore world cultures; Communication, behavioural and working skills in an international environment; Independent working skills in an international environment; International cooperation and networking skills; Problem-solving skills in an international environment.

III. FOUNDATION COURSES

1. Biology of Human and Animal **Credits: 3**

- *Credits: 3 (3/0/9)*

- *Prerequisite: None*

- *Course description:* This course includes the following chapters: Cell; Blood; Circulatory; Respiratory; Physiology of digestion; Metabolism of matter and energy; Physiological of excretion; Endocrine; Genital physiology and reproduction; Physiology of muscles and nerves; Neurophysiology; High-level neural activity.

2. Cell Biology **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: None*

- *Course description:* The course consists of the following chapters: An overview of the cells; Cell-membrane systems; Transport of substances across the cell membrane; Cytoskeleton system and cellular dynamics; Cell cycle and the control of cell cycle.

3. Molecular biology 1 lab **Credits: 1**

- *Credits: 1 (0/1/3)*

- *Prerequisite: None*

- *Course description:* This course includes the following topics: Assemble a model of the spatial structure of the DNA molecule; Extract DNA and visually observe the precipitated DNA molecule from the sample selected by the group of students; Determine the absorption spectrum and the maximum absorption wavelength of the DNA and protein solutions at the wavelength of 220-320 nm, using a spectrometer to build a standard curve and measure the concentration of DNA in the solution; Work on a group project.

4. Evolution and biodiversity **Credits: 3**

- *Credits: 3 (3/0/9)*

- *Prerequisite: None*

- *Course description:* The course consists of the following chapters: Darwin's theory of evolution; Evolution and the evidence; Population - the basic evolutionary unit; Natural selection and organism adaptation; Species and the mechanism of species formation; Evolution of Chromosomes and Genomes; he generation of the individual and the generation of the species; Origin of life; The Origin of Mankind; Types of Biodiversity; Impacts on biodiversity; Biodiversity in Vietnam; Conservation of genetic resources.

5. Fundamental Immunology **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: General Microbiology*

- *Course description:* The course consists of the following chapters: Research history and classification of immunity; Structure and function of components involved in the immune system; Antigen; Antibody; Complement system; Cytokines.

6. Microbial ecology **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: None*

- *Course description:* The course consists of the following chapters: Overview of microbial diversity and ecology; The natural habitats of microorganisms; Microbial interactions; Plant-microbe interactions; Animal-microbe interactions; Information exchange in microorganisms in the process of life; The role of microorganisms in natural biogeochemical processes; Research methods in microbial ecology.

7. Botany **Credits: 3**

- *Credits: 3 (2/1/9)*

- *Prerequisite: None*

- *Course description:* Plant tissue; The nutritional organs of angiosperms; Reproduction in angiosperms; Classification methods, taxon and names of plants; General classification of plants; Magnoliopsida class; Monocotyledon class.

8. Plant physiology **Credits: 3**

- *Credits: 3 (2/1/9)*

- *Prerequisite: None*

- *Course description:* Plant physiology course studies physiological activities in plants such as Cell physiology; Water exchange; Mineral nutrition; Photosynthesis; Respiratory; The process of transporting and distributing metabolic products. The results of these physiological activities lead to plant growth, development and productivity; In order to survive and develop, plants possess different reactions to adapt with unfavorable environmental conditions. Based on such knowledge, people adjust the growth and development of plants in the ways that can bring benefits to them.

9. Animal Developmental Biology **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: None*

- *Course description:* Development; Reproductive forms of organisms; The development of lower organisms; Gametogenesis; Fertilization; Early embryonic development; Postembryonic development; Individual development in multicellular animals.

10. Plant developmental biology **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: None*

- *Course description:* Overview of Plant Developmental Biology; Cell lineages and positional information; Embryogenesis; Seedling development; Shoot development; Leaf development ; Transition to flowering and Flower development; Development of floral reproductive organs and gametophytes; Pollination and apomixes; Seed and fruit development; Root development; Vascular development.

11. Introductory Animal Production **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: None*

- *Course description:* The course includes 9 theoretical chapters about the importance, the economic and social significance of livestock; Basic principles in animal science (genetics, breeding, reproduction and nutrition); Basic concepts of animal behavior, animal welfare and animal health; Basic contents in livestock production (pigs, poultry, cattle).

12. Principles of crop production **Credits: 2**

- *Credits: 2 (1.5/0.5/6)*

- *Prerequisite: None*

- *Course description:* The purpose of crop production; Basics of agricultural crops; The role of soil, climate in crop production; Principles of production of several major crops; Differences in techniques of production of crops.

13. General Entomology **Credits: 2**

- *Credits: 2 (1.5/0.5/6)*

- *Prerequisite: None*

- *Course description:* Introduction; Insect morphology; Insect biology; Insect ecology; Insect classification; Principles and methods of pest control.

14. Introduction to Plant Pathology **Credits: 2**

- *Credits: 2 (1.5/0.5/6)*

- *Prerequisite: None*

- *Course description:* The basic concepts of plant pathogens; Transformation of plant pathogens; Plant pathogen groups; Plant pathogens; Diagnosis of plant pathogens and methods of control; Fungi and plant deseases by fungi; Bacteria and plant deseases by bacteria; Viruses and plant deseases by viruses; Nematodes and plant deseases by nematodes.

15. Experimental Methods **Credits: 2**

- *Credits: 2 (1.5/0.5/6)*

- *Prerequisite: Probability and Statistics*

- *Course description:* General introduction to scientific research; Experimental design; Conducting experiments in the field; Summarization of observed data; Estimation; Testing statistical hypotheses; Methods of arranging experimental formulas and analyzing results; Regression correlation analysis; Summarization of experiments.

IV. SPECIALIZED COURSES

1. English for Biotechnology **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: None*

- *Course description:* Introduction to Biotechnology; Cell biology; Ecology; Biomolecules; Genetics; Genetic Engineering; Bioinformatics; Plant tissue culture; Taxonomy; Mushroom Biotechnology

2. Molecular biology 2 **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: Molecular Biology 1*
- *Course description:* This course consists of 5 chapters including: Genomes and gene activity; Mechanisms of gene expression regulation in prokaryotes; Complexity in the regulation of gene expression in eukaryotic cell; Targeted transport and proteolysis; Epigenetics and regulation of gene activity.

3. Applied Bioinformatics **Credits: 3**

- *Credits: 3 (2/1/9)*

- *Prerequisite: Introdution to Informatics*
- *Course description:* This course consists of 9 chapters including Introduction to Bioinformatics; Biological foundations of Bioinformatics; Searching and managing research papers; Biological Database; Sequencing and registering the sequence in the gene bank; Genome browser; Become familiar with biological database analysis tools; Exploiting and analyzing biological data; Introduction to some biological data analysis software.

4. Animal Cell Technology **Credits: 3**

- *Credits: 3 (3/0/9)*

- *Prerequisite: Biology of Human and Animal*

- *Course description:* Scientific background and some typical achievements of animal cell technology; Organization of animal biotechnology laboratories; Animal cell culture techniques; Animal cell culture techniques on 3-dimensional substrates and other culture systems; Related techniques in animal cell culture; Applications of animal cell technology; Project.

5. Animal Cell Technology Lab **Credits: 1**

- *Credits: 1 (0/1/3)*

- *Prerequisite: None*

- *Course description:* The course consists of the following chapters: Basic techniques in dispensing and preservation some kind of medium and how to use some major equipment in biotech laboratory animals; Collecting, operation and classification egg of higher animals; Multiplication culture in vitro and cryopreservation of animal cells; Evaluation some indicators of animal sperm.

6. Genetic engineering - principles and applications **Credits: 3**

- *Credits: 3 (3/0/9)*

- *Prerequisite: Molecular Biology 1*

- *Course description:* General concept and history of genetic engineering; Model organisms; Nucleic acid isolation; Gel electrophoresis; PCR technique; Cloning techniques; DNA sequencing techniques; Molecular hybridization techniques; Molecular marker techniques; RNAi technology and application; Oriented mutation techniques; Applications of genetic engineering.

7. Genetic engineering lab **Credits: 1**

- *Credits: 1 (0/1/3)*

- *Prerequisite: None*

- *Course description:* Project proposal presentation and defenses; DNA extraction from animals, plants, microorganisms (depend on the project); Implementation of PCR-based molecular markers (RAPD, ISSR, SSR, depend on the project); DNA gel electrophoresis technique; Learning NTSYS2.1 software; Generating binary matrix; Analyzing genetic diversity between examined samples; Project profiling, final reports, and final presentation (summaries of important project documents, such as the project plan, the lab notebook (including raw and processed data).

8. Protein-enzyme technology **Credits: 3**

- *Credits: 3 (3/0/9)*

- *Prerequisite: Molecular Biology 2*

- *Course description:* This course consists of the following content: Classification, structure and functions of proteins; Enzyme clasification and enzyme kinetics; Protein/enzyme extraction techniques; Quanlitative and quantitative methods and protein-eznyme separation; Recombinant protein technology; Principles and processes of protein-enzyme modification; Production and applications of protein-enzyme.

9. Protein – Enzyme technology Lab **Credits: 1**

- *Credits: 1 (0/1/3)*

- *Prerequisite: None*

- *Course description:* This course consists of the following content: Determination of enzyme activity; Determination of amylase activity from different sources; Determination of protease activity from different sources; Protein quantification (Lowry, Biuret and Bradford methods); Denaturing Protein Electrophoresis; Paper chromotography.

Credits: 3

10. Microbial Biotechnology

- *Credits: 3 (3/0/9)*

- *Prerequisite: Microbial Biology*
- *Course description:* The course consists of the following chapters: Microbial biotechnology: objectives, methods, and applications of microbial biotechnology; Biomass Decomposition by microorganisms; Fermentation technology; Rhizobacteria; Microbial fertilizers and microbial products for plant protection; Biofilms; Biological treatment of wastewater and soil contaminated; Prebiotics and probiotics.

11. Microbial biotechnology lab **Credits: 1**

- *Credits: 1 (0/1/3)*

- *Prerequisite: None*
- *Course description:* This course covers the following content: Isolation of microorganisms strains for specific purposes (strains that can produce extracellular enzymes such as amylase, cellulose, phospholytic phosphate solubility); Methods of preparing microbial culture medium; Methods of preserving microbial strains; Characteristics of microorganisms involved in yogurt fermentation, rice wine fermentation, factors that affect yogurt and rice wine fermentation process; Perform group discussion on topics given by the lecturer or contents related to the lesson proposed by the student.

12. Plant cell and tissue culture technology **Credits: 3**

- *Credits: 3 (3/0/9)*

- *Prerequisite: General Biology*

- *Course description:* General concept and history; Principles of plant tissue culture technology; Tissue culture medium and conditions; Techniques and applications of plant tissue culture; Discussions about the application of tissue technology and plant cells in plant breeding.

13. Plant cell and tissue culture techniques lab **Credits: 1**

- *Credits: 1 (0/1/3)*

- *Prerequisite: None*

- *Course description:* Techniques for preparing culture media; Sterilizing the media and explants; Transferring and acclimatization of *in vitro* plants to natural conditions; production of virus-free

plants by meristem culture technique; culture of anthers to produce haploid plants; Embryo culture technique.

14. Nanobiotechnology - Principles and applications **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: Cell Biology*

- *Course description:* An overview of nano biotechnology; Fabrication of nanomaterials; Application of nano biotechnology in cultivation; Application of nanotechnology in livestock and aquaculture; Application of nano-biotechnology in Medicine-Pharmacy research.

15. Intellectual Property in Biotechnology **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: Introduction to Laws*
- *Course description:* General of intellectual property; Copyrights and industrial property rights; Intellectual property rights for Agriculture; Intellectual property rights related to agricultural biotechnology; Exploitation database of IP in research

16. Biosafety **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: Introduction to Laws*

- *Course description:* General of biosafety; Laboratory Biosafety; Biosafety of genetically modified organisms; Risk assessment and management principles and procedures; International conventions, treaties and agreements on Biosafety; Bioethics: Ethical and social issues arising from biotechnology innovation and commercialization.

17. Hi-tech in Agriculture **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: None*

- *Course description:* Consists of 5 theoretical chapters and 1 field trip chapter, including: General of High-tech in Agriculture; Farming system in greenhouse; Landless planting technology; Some economic aspects of commercial production; Models of management, operation and development of high-tech agriculture in Vietnam and others countries; Practical model of high tech agriculture.

18. Stem Cell Technology **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: Biology of Human and Animal*

- *Course description:* Introduction of Stem Cells; Embryonic Stem Cells; Adult Stem Cells; Stem Cell Therapy; Stem Cell Preservation.

19. Biotechnology in animal breeding **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: General Genetics*

- *Course description:* Introduction; Concepts and principles of animal breeding; Traditional technology in animal breeding; Genetic engineering applied to animal breeding; Genetically modified animals.

20. Molecular Diagnostics and Gene Therapy **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: Molecular Biology I*

- *Course description:* Some basic concepts in diagnosis; Some diagnostic techniques; Application of diagnostic techniques; Some basic concepts in gene therapy; Gene therapy; Existence of gene therapy in cells and target gene groups.

21. Seminar **Credits: 1**

- *Credits: 1 (1/0/3)*

- *Prerequisite: None*

- *Course description:* The course consists of the following chapters: Choose topics, collect and review references; Analysis and selection of presentation methods; Build content presentations; Presentation and seminar organization.

22. Biotechnology in plant breeding **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: Genetic engineering - principles and applications*
- *Course description:* This course consists of 10 chapters including: Concepts of plant varieties and genetic resources; Basic methods in plant breeding; Development and production of plant varieties; The birth of biotechnology in plant breeding; Tissue, cell and plant varieties culture; DNA markers in plant breeding; RFLP-based PCR method; Application of DNA molecular markers in plant breeding to select some traits; Transgenic technology into plants; Protein, enzyme polymorphism and applications in plant breeding.

23. Biotechnology in plant breeding lab **Credits: 1**

- *Credits: 1 (0/1/3)*

- *Prerequisite: None*

- *Course description:* This course consists of the following topics: Applying the DNA markers for analyzing the F1 hybrid, applying the DNA markers for selecting the plants carrying the target gene(s) and artificial infection method and re-evaluate the resistance to bacteria causing the blight disease on rice.

24. Environmental biotechnology **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: Man and Environment*

- *Course description:* The course consists of the following chapters: Environmental biotechnology: scope and some applications; Contaminated soil and biological measures in the remediation of contaminated soil; Wastewater and scientific basis in wastewater treatment; Waste water treatment by biotechnological measures; Organic waste treatment technology; Phytoremediation.

25. Biotechnology of edible and medicinal mushrooms **Credits: 2**

- *Credits: 2 (1.5/0.5/6)*

- *Prerequisite: General Microbiology*

- *Course description:* The course consists of the following theory chapters: General introduction to edible and medicinal mushroom biology; Spawn production of mushroom; Cultivation technology of some edible and medicinal mushroom; Post-harvest management, preservation and processing of mushroom; Disease management in cultivation of mushroom. Practice lessions: Inoculaton oyster mushrooms spawn; Cultivation of oyster mushrooms.

26. Virology **Credits: 2**

- *Credits: 2 (1.5/0.5/6)*

- *Prerequisite: General Microbiology*
- *Course description:* This course consists of following theory chapters: Nature, classification and nomenclature of viruses; Morphology and virus structure; Regeneration and translation strategy of virus; Diversity and evolution of virus; Introduction of virus caused disease on plants; Introduction of virus caused disease on animals; Phages and applications in Biotechnology. Practice lessions: Plant virus diagnosis by ELISA; Viral infection of virus by TXCH and agroinoculation; Investigation and evaluation of plant virus disease.

27. Natural compounds **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: Introduction to Biochemistry*
- *Course description:* This course consists of five chapters: An overview of natural secondary compounds; Classification of natural secondary compounds and biosynthetic pathways; Extraction methods and identification of groups of natural secondary compounds; Biological activities and applications of natural secondary compounds; Application of biotechnology in conservation, extraction, development and application of secondary compounds.

28. Current topics in biotechnology **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: None*

- *Course description:* New achievements and new techniques in plant biotechnology; New achievements and techniques in animal biotechnology; New achievements and techniques in microbial biotechnology; New achievements and techniques in food biotechnology; New achievements and techniques in nanobiotechnology.

29. Principles and methods of plant breeding **Credits: 2**

- *Credits: 2 (1.5/0.5/6)*

- *Prerequisite: None*

- *Course description:* Introduction; Plant genetic resources; Reproduction in plants, application in plant breeding; Applied statistical biology in plant breeding selection; Methods of creating genetic variations in plant varieties selection; Selection of varieties in asexual reproduction plants; Selection of self-pollinating varieties; Method of selecting cross-pollinate varieties; Selection of a hybrid heterosis; Evaluate and disseminate varieties.

30. Professional Internship 1 **Credits: 5**

- *Credits: 5 (0/5/15)*

- *Prerequisite: General Genetics, General Microbiology, Botany*
- *Course description:* The course includes the following content: Develop an internship plan; Visiting workplaces (the internship enterprises); Learn about the workplaces: organizational structure, scale and field of operation, facilities for production and business, current status of production and management of and businesses in the field of biotechnology; Learn about the technical procedures applied in production; Participate directly in general and professional work (***basic techniques*** in biological, cell technology, plant physiology, microbiology, molecular biology, etc.) at the internship enterprises; Summarize and process data, write reports and present the results at the final reporting sessions (seminar); Students can choose a business operating in the following fields: Plant biotechnology, Animal biotechnology and Microbiological technology.

31. Professional Internship 2 **Credits: 8**

- *Credits: 8 (0/8/24)*

- *Prerequisite: Professional Internship 1*
- *Course description:* The course includes the following content: Develop an internship plan; Learn about the practising workplace: organizational structure, scale and field of operation, facilities for production and business, current status of production and management of and businesses in the field of biotechnology; Learn about the technical procedures applied in production; Participate directly in general and professional work (***basic*** and ***relatively complicated techniques*** in biological, cell technology, plant physiology, microbiology, molecular biology, etc.) at the internship enterprise; Summarize and process data, write, ***analyse*** reports and present the results at the final reporting sessions (seminar); Students can choose a business operating in the following fields: Plant biotechnology, Animal biotechnology and Microbiological technology.

32. Graduation thesis **Credits: 10**

- *Credits: 10 (0/10/30)*

- *Prerequisite: Professional Internship 2*
- *Course description:* In the course, students will be guided by 1 to 2 supervisors in applying the knowledge, experience and scientific research methods learned from the program on conducting a scientific as well as applied research project in the field of agricultural biotechnology. Finally, students are instructed in writting thesis and defending the thesis in front of the professor's committee.

V. CONDITIONAL COURSES

5.1. Physical education courses

1. General physical education **Credits: 1**

- *Credits: 1 (1/0/3)*

- *Course description:* A brief history of sports and the Olympics. Theory and methods of physical education. Measures to prevent and treat injuries during training and competitions. Training plan for physical exercises and sports. Medical examination and self-examination. General physical development, endurance development.

2. Dancesport **Credits: 1**

- *Credits: 1 (0/1/3)*

- *Course description:* A brief history of the birth and development of dancesport. Characteristics and effects of dancesport training. Dancesport rules. Basic techniques: terminology, rumba and chachacha dances. Methods for organizing training sessions and registering for competitions. General physical and professional development.

3. Swimming **Credits: 1**

- *Credits: 1 (0/1/3)*

- *Course description:* A brief history of the birth and development of swimming. Features and effects of swimming training. Swimming rules. The basic techniques: body posture, movement techniques - legs - breathing ... Methods for organizing training sessions and registering for competitions. General physical and professional development.

4. Athletics **Credits: 1**

- *Credits: 1 (0/1/3)*

- *Course description:* A brief history of the birth and development of athletics. Features and effects of athletics training, athletics rules. The basic techniques: how to close the pedal, start, run after starting, run between and to the finish (100 meters), running, stomping, and landing (long distance jump). Methods for organizing training sessions and registering for competitions. General physical and professional development.

5. Aerobic Gymnastics **Credits: 1**

- *Credits: 1 (0/1/3)*

- *Course description:* Development history of aerobics, the importance, concept, characteristics and meanings of aerobic exercises; Team roster; 7 basic steps of aerobic exercises; aerobic exercises; strength and motor coordination development.

6. Football **Credits: 1**

- *Credits: 1 (0/1/3)*

- *Course description:* A brief history of the birth and development of soccer. Characteristics and effects of soccer. Soccer rules. Basic techniques: kicking - receiving the ball with the sole of the foot, kicking the ball with the instep in the foot. Methods for organizing training sessions and registering for competitions. General physical and professional develop.

7. Volleyball **Credits: 1**

- *Credits: 1 (0/1/3)*

- *Course description:* A brief history of the birth and development of volleyball. Characteristics and effects of volleyball training. Volleyball rules. The basic techniques: Preparing posture, move, pass high-handed, low-handed, high-handed (male), low-handed (female), hit the ball, block the ball. Methods for organizing training sessions and registering for competitions. General physical and professional development.

8. Basketball **Credits: 1**

- *Credits: 1 (0/1/3)*

- *Course description:* A brief history of the birth and development of basketball. Characteristics and effects of basketball practice. Basketball rules. The basic techniques: moving, dribbling, passing - catching, throwing a basketball on one hand high. Methods of organizing training and competition. General physical and professional development.

9. Badminton **Credits: 1**

- *Credits: 1 (0/1/3)*

- *Course description:* A brief history of the birth and development of badminton. Characteristics and effects of badminton training. Badminton rules. Basic techniques: movement, serve, low right hand shot, left, high right hand left, high deep play, smashing. Methods for organizing training sessions and registering for competitions. General physical and professional development.

10. Chess **Credits: 1**

- *Credits: 1 (1/0/3)*

- *Course description:* A brief history of the birth and development of chess. Characteristics and effects of chess training. The rules of chess. Basic principles of playing chess in each stage of the game. Methods for organizing training sessions and registering for competitions.

5.2. National defense education courses

1. Vietnamese Communist Party's guidelines of national defence and security **Credits: 3**

- *Credits: 3 (3/0/9)*

- *Course description:* Study the basic views of the Party on the guidelines of National Defense and Security including: basic issues of Marxist-Leninist doctrine, Ho Chi Minh ideology about war, army, and national security and defense; The Party's viewpoint on developing national defenses and people's security; People's war for national defense; Building the people's armed forces; Combining socio-economic development while strengthening national defense and security; Knowledge of Vietnamese military arts over different periods.

2. National defense and security works **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Course description:* Main contents include: Prevention of "peaceful evolution" strategy, overthrowing strategies of the forces that are hostile to the Vietnamese revolution; Developing the militia and self-defense forces, the reserve force to mobilize and mobilize the defense industry; Building and protecting territorial sovereignty and national borders; A number of ethnic and religious issues, and the struggle against the enemy taking advantage on

the issue of ethnicity and religion against the Vietnamese revolution; Basic issues on national security protection to maintain social order and safety; Fight against crime and social evils; Encourage a movement of the entire people to protect the national security; Non-traditional security issues, and the fight against non-traditional security threats in Vietnam.

3. General military **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: None*

- *Course description:* Equip students with necessary military skills such as: Shooting technique; Introduction to a number of infantry weapons; Use of military maps; Preventing the enemy from attacking with high-tech weapons; military triathlon; infantry platoon attack formation; infantry platoon defending formation; Platoon team; Practicing with some types of Vietnamese grenades.

4. Infantry combat technique and tactics **Credits: 2**

- *Credits: 2 (2/0/6)*

- *Prerequisite: None*

- *Course description:* Equip students with necessary military skills such as: knowledge of AK submachine gun shooting; structure and usage of common grenades; individual responsible to perform guard duty; practice skills of AK submachine gun shooting; Offensive and defensive battle tactics of individual.

Hanoi, July 30th 2020

DEAN OF FACULTY

(Name and signature)

APPROVAL OF THE UNIVERSITY

(Name and signature)

APPENDIX 1. FACILITIES

Table 1. Classrooms, lecture halls, teaching facilities of VNUA

No.	Name	Quantity	Area (m2)
1	Laboratories	48	1,908
2	Practice rooms	160	11,888
3	Training factories	02	943,78
4	Multifunctional gymnasium	02	5,248
5	Halls	03	1,041
6	Classrooms	124	26,137
7	Multimedia classrooms	04	440
8	Libraries	01	3,795.7
9	English learning lab	4	300
10	Informatic rooms	16	1,200
11	Other functional rooms	66	3,269

Table 2. Laboratories, facilities and equipment for research and practice of the Facultyof Biotechnology

No.	Facility	Area (m^2)	List of main equipment to support rseearch and practice		
			Equipments	**Quantity**	**Support courses**
1	Plant Biotechnology Key Lab	50	Autoclave Hirayama 110L Heating magnetic stirrer IKHAG Gel Imaging System Vertical Laminar Flow Cabinet SH Faster Rotary feeder Horizontal gel electrophoresis systems (small) Horizontal gel electrophoresis systems (large) Large horizontal electrophoresis set Oven Incubator Water bath Cell electrofusion machine Centrifuge Hettich Flow cytometry Ice makers Asceptic cabinet Autoclaves Technical scales PCR machine (Small) Voltex machine Cold centrifuge Magnetic stirrer Culture rack equiped ligh system Nanodrop (mearsure DNA concentration) Realtime PCR	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 8 1 1	1. Genetic engineering - principles and applications 2. Genetic engineering lab 3. Plant cell and tissue culture technology 4. Plant cell and tissue culture techiques lab 5. Biosafety 6. Plant Developmental Biology 7. Hi-tech in Agriculture 8. Intellectual Property in Biotechnology
2	Plant Cell Biotechnology Key Lab	50	Standard experiment table Light-controlled culture rack system	7 6	

No.	Facility	Area (m^2)	List of main equipment to support rseearch and practice		
			Equipments	**Quantity**	**Support courses**
			Clean bench	2	
			Distilled water machine	1	
			RO water purifier	1	1. Genetic engineering - principles and applications
			ELISA washer	1	
			Multi-indicator analyzer	1	2. Genetic engineering lab
			Microscope	1	3. Plant cell and tissue culture technology
			Agarose gel electrophoresis systems	1	
			Sterile filtration system	1	4. Plant cell and tissue culture techiques lab
			Air conditioner	1	
			Heating magnetic stirrer	2	5. Biosafety
			Protoplast electrofusion machine	1	6. Plant Developmental Biology
			Refrigerator (4^oC)	1	7. Hi-tech in Agricultur
			ELISA reader	1	8. Intellectual Property in Biotechnology
			Centrifuge	1	
			Votex machine	1	
			Phase-contrast microscope	1	
			Deep freezer	1	
			PCR machine	1	
			Shaker	2	
			Cabinet AGHB	1	
			Fume hood cabimet	1	
			Laminar Flow Cabinet (for Plant tissue culture)	1	
			Water bath	1	
			Polyacrylamide electrophoresis system	1	
			Double distilled water machine	1	
			Test tube rack (inox)	100	
			Cell counting booth	1	
			Dehumidifier	5	

No.	Facility	Area (m^2)	List of main equipment to support rseearch and practice		
			Equipments	**Quantity**	**Support courses**
			Incubator Blinder Gel Imaging System Pipets Computer CMS Power cut-off devices Single-side laminar flow cabinet High wattage air conditioners Cell culture system Leaf area meter Photosynthesis system Magnifier Laminar flow cabinet Autoclave Analytical balance pH meter Asceptic cabinet equipped with gas system Ion meter	1 1 1 2 10 4 1 1 1 1 1 3 1 1 1 2 1	
3	Multi-Genome Livestock Germplasm Key Lab	50	Vertical electrophoresis systems (small) Asceptic cabinet Phase-contrast microscope CO2 & O2 controlled incubator Gradient PCR machine Horizontal electrophoresis systems (large) Gel scanner Warm incubator Incubator (egg cells) Autoclaves SpermaCue Photometer	2 1 1 1 1 1 1 1 1 1 1	1. Biology of Human and Animal 2. Animal Developmental Biology 3. Molecular Diagnostics and Gene Therapy 4. Animal Cell Technology 5. Animal Cell Technology Lab 6. Seminar 7. Stem Cell Technology 8. Biotechnology in animal breeding

No.	Facility	Area (m^2)	List of main equipment to support rseearch and practice		
			Equipments	**Quantity**	**Support courses**
			Tilt shaker	1	
			Uv Sterilizer Cabinet	1	
			Anti-vibration table	1	
			Cold large volume centrifuge	1	
			Refrigerator - 10^oC	1	
			Distilled water machine	1	
			Deionizer water machine	1	
4	Crop Science Intensive Lab (JICA-SATREPS)	100m^2	PCR machine	2	
			Autoclaves	1	
			Ice maker	1	
			Oven	1	
			Centrifuge 1 (Desktop type)	1	
			Centrifuge 1 (Desktop type)	1	1. General Genetics
			Centrifuge 3 (Disc Type)	1	2. Molecular Biology 1
			PH meter	2	3. Molecular Biology 1 lab
			Analytical balance	1	4. Molecular Biology 2
			Technical balance	1	5. Evolution and biodiversity
			Portable UV light	1	6. Biotechnology in plant breeding
			Magnetic stirrer	1	
			Pipette holder	1	7. Biotechnology in plant breeding lab
			Heating magnetic stirrer	2	
			Small centrifuge	2	8. Applied bioinformatics
			Shaker (Votex Machine)	1	9. Natural compounds
			Shaker	1	
			12-sided pipette (0.5 - 10µl)	4	
			12-sided pipette (5 - 50µl)	2	
			12-sided pipette (40 - 200µl)	1	
			Single-channel electronic pipettes (5 - 100µl)	1	

No.	Facility	Area (m^2)	List of main equipment to support rseearch and practice		
			Equipments	**Quantity**	**Support courses**
			Single-channel electronic pipette (50 - 1000µl)	1	
			Electronic 8-pipette (0.2 - 10µl)	2	
			12-sided electronic pipette (5 - 100µl)	1	
			Single-channel pipette 0.2-2 µl	10	
			2-20 µl single-channel pipette	2	
			10-100 µl single-channel pipettes	4	
			20-200 µl single-channel pipette	4	
			Single channel pipette 100-1000 µl	1	
			Single-channel pipettes 1000-5000 µl	2	
			Pipette holder	2	
			Measuring pipette	1	
			Real-Time PCR system	1	
			Plant growth chamber	2	
			Microwave	4	
			Horizontal gel electrophoresis system	8	
			1mm comb for 52 samples	64	
			1000VC electrophoresis power supply unit	4	
			Gel Imaging System equipped with printer	1	
			Water distiller	1	
			Granule miller	1	
			Freeze dryer	1	
			Oil for vacuum pump	1	
			Vacuum dehumidifier Acrylic	2	
			Optical microscope	1	
			Freezer	2	
			Fridge	2	
			Deep freezer	1	
			Laboratory table	4	

No.	Facility	Area (m^2)	List of main equipment to support rseearch and practice		
			Equipments	**Quantity**	**Support courses**
			Chair Aseptic cabinets Chemical cabinets DNA genetic analysis system with accessories and chemicals Glass and plastic kits DNA extraction system with chemicals Voltage regulator for water purifier UPS for PCR Vacuum bag sealer 10 liter liquid nitrogen tank	20 1 4 1 1 1 1 1 1 1 1	
5	Molecular Biology Intensive Lab (JICA Project)	50	Gel Imaging System Centrifuge Kubota 1920 Sanyo cooler Votex machine Kenis Bock thermastat IWAKI Electrophoresis power supply ATTA 8450 PCR machine HP Cycle Heating magnetic stirrer Iuchi Cold incubator EYALLA Slide washer Balance Prisica 6200 D Stereo stereoscope Olypus Thermostatic water bath ASONE PS2020 power transformer Water bath Iuchi CB30 Rotary machine EYELA	1 1 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1	1. General Genetics 2. Molecular Biology 1 3. Molecular Biology 1 lab 4. Molecular Biology 2 5. Evolution and biodiversity 6. Biotechnology in plant breeding 7. Biotechnology in plant breeding lab 8. Applied bioinformatics 9. Natural compounds

No.	Facility	Area (m^2)	List of main equipment to support rseearch and practice		
			Equipments	**Quantity**	**Support courses**
			Low temperature tank EYALLA	1	
			Thermostatic water bath IuchiEDV45	2	
			Thermal bath Iuchi EDV45	1	
			Cooler National	1	
			Dehumidifying dry cabinet	1	
			Ice maker Hoshizaki	1	
			Rice husk peeling machine SATAKE	1	
			ST Tomy CL301 cabinet	2	
			Distilled water machine EYELA SA2100E	1	
			Air conditioner National	1	
			Mini rice milling machine KECT	4	
			Electric generator Honda	1	
			BioRad electrophoresis power supply unit	1	
			Water bath IKEDARIKA	1	
			Incubator EYELA	1	
			Oven Iuchi	1	
			Growth chamber EYELA	1	
			Votex machine (Germany)	1	
			DNA blotting system	1	
			Temperature controlled cabinet, as EYELA	1	
			Incubator SANYO	1	
			Spectrometers	1	
			Incubator IB450M	1	
			Drying oven FO - 450M	1	
			Incubator IM400 RGH	1	
			Cold centrifuge Kubota	1	
			Microscope KRUSS	1	
			Autoclave SANYO	1	

No.	Facility	Area (m^2)	List of main equipment to support rseearch and practice		
			Equipments	**Quantity**	**Support courses**
6.	Microbial Biotechnology Lab	200	Vortex machine Handheld pH meter Desktop pH meter Double distilled water machine Water deionizer Hitachi PVC Laminar flow cabinet Vertical Laminar Flow Cabinet SH Faster Liquid chromatographic system AKTA COD Aqualytic meter BOD Aqualytic meter 5 liter-bioreator Sartorius Incubator Memmert Bio-Rad PCR machine 2-way electrophoresis SDS PAGE Scie-Plas Protein electrophoresis system Scie-Plas Ultrasonic Cell Disruptors Small horizontal electrophoresis set Magnetic stirrer Laboratory microbiological shaker Small centrifuge 2-eye optical microscope Incubator Technical balance Analytical balance Voltex machine UV-VIS UVD 3200 Spectrophotometer Magnetic stirrer TM500S	1 4 4 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1	1. General Microbiology 2. Microbial ecology 3. Fundamental immunology 4. Microbial Biotechnology 5. Microbial Biotechnology lab 6. Virology 7. Protein-enzyme technology 8. Protein-enzyme technology lab 9. Biotechnology of edible and medicinal mushrooms 10. Environmental biotechnology

No.	Facility	Area (m^2)	List of main equipment to support rseearch and practice		
			Equipments	**Quantity**	**Support courses**
7	Plant Biotechnology Lab	150	Light adjusted cultures rack Real time PCR machine Rotary feeder Single-channel pipette set Cold large volume centrifuge Vertical gel electrophoresis system Vertical gel electrophoresis power supply unit Growth chamber Temperature controlled shakers Ice maker Deep frezeer EVERMed Minispin Cooler Sanyo Hybrid molecular systems Biomora Gene gun Biorad Nanodrop (measure DNA concentration) Inverted microscope Block thermostat IWAKI Thermal block Biomtre Incubator Iuchi Vacuum drying oven Slide washer Hotpuck bottle washer machine Dehumidifying dry cabinet Fume hood cabinet Rice husk peeling machine SATAKE Rice milling machine KECT Medium automatic pump	8 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 2 1 2 1 1 1 3 1 1 4 1	1. Genetic engineering - principles and applications 2. Genetic engineering lab 3. Plant cell and tissue culture technology 4. Plant cell and tissue culture techniques lab 5. Biosafety 6. Plant Developmental Biology 7. Hi-tech in Agriculture 8. Intellectual Property in Biotechnology

No.	Facility	Area (m^2)	List of main equipment to support rseearch and practice		
			Equipments	**Quantity**	**Support courses**
			DNA blotting system	1	
8	Molecular Biology Lab	150	Analytical balance Technical balance Horizontal electrophoresis chamber (small) Vertical electrophoresis chamber (small) Electrophoresis power supply unit Regular PCR machine Gel scanner Small PCR machine Adjustable Pipette (10,100,1000 micro liters) Small UV-VIS spectrophotometer UV spectrophotometer WeaPro HP weather station PrimoStar optical microscope PCR 8800 thermal cycler UV-Vis Spectrophotometer (2 beam)	1 1 3 2 5 1 2 1 2 1 1 1 2 1 1	1. General Genetics 2. Molecular Biology 1 3. Molecular Biology I lab 4. Molecular Biology 2 5. Evolution and biodiversity 6. Biotechnology in plant breeding 7. Biotechnology in plant breeding lab 8. Applied bioinformatics 9. Natural compounds
9	Animal Cell Technology Lab	100	Suction device system Egg cells holding device system 8-tube centrifuge Autoclaves Cold centrifuge Tilt shaker Uv Sterilizer Cabinet Inverted microscope equipped micromanipulator Warm laying table Anti-vibration table Hoffman fluorescent light system	1 1 1 1 3 2 1 1 1 1 1	1. Biology of Human and Animal 2. Animal Developmental Biology 3. Molecular Diagnostics and Gene Therapy 4. Animal Cell Technology 5. Animal Cell Technology Lab 6. Seminar 7. Stem Cell Technology 8. Biotechnology in animal

No.	Facility	Area (m^2)	List of main equipment to support rseearch and practice		
			Equipments	**Quantity**	**Support courses**
			Cell manipulators system Nikon microscope equipped micromanipulator Neubauer counting booth Stereo stereoscope Distilled water machine Needle traction machine Needle cutting machine Mini pump Portable warm chamber Biological microscope	1 1 1 2 1 1 1 1 2 2	breeding
10	Plant cell technology	200	Cold centrifuge MIKRO 200R Heating magnetic stirrer EM 180 Water bath WEB 4 Panasonic projector Optical microscope Zeiiss Incubator NB201 Autoclave SA252F Desktop computer Biological safety cabinet level 2 Puricube Microscope cabinet	1 1 1 1 20 1 1 1 1 1	1. General Biology 2. Cell Biology 3. Hi-tech in Agriculture 4. Nanobiotechnology Principles and applications
11	Institute of Research and Development of Edible and Medical Mushroom.	4,500	Optical microscope PrimoStar Stereo microscope Stemi305lab Incubators IN30 Oven WGL-125B Autoclave 2 liter - Bioreator 5 liter - Bioreactor	3 1 1 1 1 6 6	Biotechnology of edible and medicinal mushrooms

No.	Facility	Area (m^2)	List of main equipment to support rseearch and practice		
			Equipments	**Quantity**	**Support courses**
			Silicon wires Cool house (40m3) Aeration pumps Aseptic cabinet l,4m Regular shaker 24-holder HY-6 Sample shaker KS 260 basic	100 1 4 1 1 1	
12	Institute of Research and Development of Microalgae biotechnology and Cosmeceuticals	3,000	Optical microscope PrimoStar Thermal PCR cycler 8800 UV-Vis Spectrophotometer (2 beams) Glasshouse system ($m^{2)}$	2 1 1 1500	Lab practice
13	Center for Conservation and Developments of Crop Genetic Resource	26,200	Microscope Rice milling machine Mini KECT Temperature controlled cabinet, as EYELA Rice husk peeling machine SATAKE Cooler Sanyo Cooler National Dehumidifying dry cabinets Granule milling machine Plant growth chamber Oven Leaf area meter Photosynthesis Measurement system	1 1 1 1 1 1 1 1 1 1 1 1	Lab practice

APPENDIX 2. BOOKS, TEXTBOOKS, LECTURES

No.	Courses	Textbooks/lectures	Authors	Publishers	Publishing year
1.	Philosophy of Marxism and Leninism	Textbooks of Principles of Marxism and Leninism	Pham Van Sinh va Pham Quang Phan	National Political Publishing House of Vietnam	2016
2.	Political economy of Marxism and Leninism	Textbooks of Political economy of Marxism and Leninism	Ministry of Education and Training.	National Political Publishing House of Vietnam	2019
3.	Vietnamese Communist Party History	Draft textbook of Vietnamese Communist Party History	Ministry of Education and Training.	National Political Publishing House of Vietnam	2019
4.	Ho Chi Minh Ideology	Textbooks of Ho Chi Minh Ideology	Ministry of Education and Training.	National Political Publishing House of Vietnam	2017
5.	Socialism	Textbooks of Sociallism	Ministry of Education and Training.	National Political Publishing House of Vietnam	2019
6.	Introduction to Laws	Lecture of Introduction to Laws	Vu Van Tuan	Hanoi Agricultural University Publishing House	2015
7.	Fundamentals of Chemistry	Textbooks of Fundamentals of Chemistry	Nguyen Van Tau	Vietnam Education Publishing House	2016
8.	Organic Chemistry	Textbooks of Organic Chemistry 1, 2	Tran Quoc Son, Dang Van Lieu	Publishing House of Hanoi University of education	2017
9.	Analytical Chemistry	Lecture of Analytical Chemistry	Vu Thi Huyen	Hanoi Agricultural University Publishing House	2019
10.	Probability and Statistics	Textbooks of Probability and	Le Duc Vinh	Hanoi Agricultural	2014

No.	Courses	Textbooks/lectures	Authors	Publishers	Publishing year
		Statistics		University Publishing House	
11.	General Biology	Lecture of General Biology	Dong Huy Gioi Nguyen Thi Thuy Hanh Bui Thi Thu Huong Phi Thi Cam Mien	Agricultural Institute Public Publishing House	2020
12.	General Microbiology	Textbooks of General Microbiology	Nguyen Thi Minh	Hanoi Agricultural University Publishing House	2017
13.	General Genetics	Lecture of General Genetics	Lecturers of Department of Molecular biology and applied biotechnology	Hanoi Agricultural University Publishing House	2015
14.	Molecular Biology 1	Lecture of General Molecular Biology	Phan Huu Ton	Hanoi Agricultural University Publishing House	2020
15.	Introduction to Biochemistry	Textbooks of Introduction to Biochemistry	Ngo Xuan Manh, Lai Thi Ngoc Ha, Dang Thai Hai, Nguyen Van Kiem	Hanoi Agricultural University Publishing House	2010
16.	Principles of Economics	Lecture of of Principles of Economics	Nguyen Van Ngoc	National economics Publishing House	2011
17.	Agribusiness Management	Textbooks of Agribusiness Management and food	Tran Huu Cuong	Hanoi Agricultural University Publishing House	2013
18.	Man and Environment	Textbooks of Human rights and the Environment	Sumudu Atapattu and Andrea Schapper	Routledge	2019
19.	English 1	Speakout.	Antonia C. & JJ W	Pearson Education Limited	2016

No.	Courses	Textbooks/lectures	Authors	Publishers	Publishing year
20.	English 2	New Headway: Student's Book. Pre-intermediate	Soars, L., Soars, J., & Hancock, P.	Oxford University Press	2019
21.	Introdution to Informatics	Textbooks of Introdution to Informatics	Pham Quang Dung va dong nghiep	Hanoi Agricultural University Publishing House	2015
22.	Biology of Human and Animal	Textbooks of Physiology	Pham Thi Minh Duc	Medical Publishing House	2020
23.	Cell Biology	Lecture of Cell Biology	Bui Thi Thu Huong Dong Huy Gioi Nguyen Thi Thuy Hanh	Agricultural Institute Public Publishing House	2020
24.	Molecular Biology 1 Lab	Lecture of Molecular Biology lab	Nguyen Quoc Trung, Nguyen Duc Bach, Trinh Thi Thu Thuy, Tong Van Hai, Pham Thi Dung	Agricultural Institute Public Publishing House	2020
25.	Evolution and biodiversity	Lecture of Evolution and biodiversity	Phan Huu Ton	Hanoi Agricultural University Publishing House	2020
26.	Fundamental immunology	Textbooks of Fundamental immunology	Nguyen Xuan Canh	Agricultural Institute Public Publishing House	2020
27.	Microbial Biology	Textbooks of Microbial Biology	Allen I. Laskin and Hubert Lechevalier	Critical Reviews in Microbiology Press	2017
28.	Botany	Lecture of Plant morphology	Lecturers of Department of Botany	Agricultural Institute Public Publishing House	2020
29.	Plant Physiology	Textbook of Plant Physiology	Hoang Minh Tan, Nguyen Quang Thach,	Agricultural Institute Public	2006

No.	Courses	Textbooks/lectures	Authors	Publishers	Publishing year
			Vu Quang Sang	Publishing House	
30.	Animal Developmental Biology	Textbook of Animal Developmental Biology	Mai Van Hung	Ha noi National University of Education publishing house	2015
31.	Plant developmental biology	Lecture of Plant developmental biology	Nguyen Thi Lam Hai, Dang Thi Thanh Tam	Agricultural Institute Public Publishing House	2020
32.	Experimental Methods	Lecture of Experimental Methods	Do Thi Huong	Agricultural Institute Public Publishing House	2016
33.	Principle of Crop Production	Lecture of Principle of Crop Production	Nguyen Tat Canh, Phung Dang Chinh	Hanoi Agricultural University Publishing House	2012
34.	Introduction to Plant Pathology	Lecture of Specilized Entomology 1	Nguyen Van Dinh, Nguyen Thi Kim Oanh, Ho Thi Thu Giang, Tran dinh Chien	Hanoi Agricultural University Publishing House	2015
35.	General Entomology	Lecture of specilized entomology 1	Nguyen Van Dinh, Dang Thi Dung, Ho Thi Thu Giang, Tran Dinh Chien, Nguyen Thi Kim Oanh	Agricultural Institute Public Publishing House	2016
36.	Introductory Animal Production	Textbook Introductory Animal Production	Nguyen Xuan Trach, Nguyen Thi Tuyet Le, Cu Thi Thien Thu	Agriucltural University Press	2015
37.	English for Biotechnology	Lecture of English for Biotechnology	Le thi Lan	Science and Technology Publishing House	2016
38.	Molecular Biology 2	Textbook of Molecular Biology	Phan Huu Ton	Hanoi Agricultural	2020

No.	Courses	Textbooks/lectures	Authors	Publishers	Publishing year
				University Publishing House	
39.	Applied Bioinformatics	Lecture of Applied Bioinformatics	Nguyen Duc Bach, Trinh Thi Thu Thuy	Agricultural Institute Public Publishing House	2020
40.	Animal Cell Technology	Textbooks of Animal Reproduction Technology	Nguyen Van Thanh, Tran Tien Dung, Su Thanh Long, Nguyen Thi Mai Tho, Nguyen Cong Toan, Hoang Kim Giao	Hanoi National University Publishing House	2017
41.	Animal Cell Technology Lab	Lecture of Animal Cell Technology Lab	Nguyen Huu Duc	Hanoi National University Publishing House	2015
42.	Genetic engineering - principles and applications	Lecture of Genetic engineering - principles and applications	Dinh Truong Son	Agricultural Institute Public Publishing House	2020
43.	Genetic engineering lab	Lecture of Genetic engineering lab	Nguyen Thi Thuy Linh, Dinh Truong Son, Dang Thi Thanh Tam, Ninh Thi Thao, Nong Thi Hue	Agricultural Institute Public Publishing House	2020
44.	Protein-enzyme technology	Lecture of Protein-enzyme technology	Nguyen Xuan Canh	Agricultural Institute Public Publishing House	2018
45.	Protein-enzyme technology lab	Lecture of Protein-enzyme technology lab	Nguyen Thanh Huyen, Tran Thi Dao, Nguyen Xuan Canh	Agricultural Institute Public Publishing House	2020
46.	Microbial Biotechnology	Textbook of Microbial Biotechnology	Nguyen Van Giang Tran Thi Hong Hanh,	Agricultural Institute Public Publishing	2020

No.	Courses	Textbooks/lectures	Authors	Publishers	Publishing year
			Vu Van Hanh Nguyen Thi Xuan	House	
47.	Microbial Biotechnology lab	Lecture of Microbial Biotechnology lab	Tran Thi Hong Hanh, Nguyen Van Giang, Nguyen Thanh Huyen, Tran Thi Dao	Agricultural Institute Public Publishing House	2020
48.	Plant cell and tissue culture technology	Lecture of Plant cell and tissue culture technology	Pham Thi Thu Hang, Nguyen Thi Lam Hai, Nguyen Thanh Hai, Dinh Truong Son, Dang Thi Thanh Tam, Nong Thi Hue, Ninh Thi Thao, Nguyen Thi Thuy Linh	Agricultural Institute Public Publishing House	2020
49.	Plant cell and tissue culture technology lab	Lecture of Plant cell and tissue culture technology lab	Pham Thi Thu Hang, Nguyen Thi Lam Hai, Nguyen Thanh Hai, Dinh Truong Son, Dang Thi Thanh Tam, Nong Thi Hue, Ninh Thi Thao, Nguyen Thi Thuy Linh	Agricultural Institute Public Publishing House	2020
50.	Professional Internship 1	Guidelines on Professional Internship	Faculty of Biotechnology	Faculty of Biotechnology	2020
51.	Professional Internship 2	Guidelines on Professional Internship	Faculty of Biotechnology	Faculty of Biotechnology	2020
52.	Stem Cell Technology	Textbook of Anatomy and physiology of human and animal	Vo Van Toan, Le Thi Phuong	Vietnam Education Publishing House	2013
53.	Biotechnology in plant breeding	Textbook of Biotechnology in plant breeding	Phan Huu Ton	Hanoi Agricultural University Publishing House	2020

No.	Courses	Textbooks/lectures	Authors	Publishers	Publishing year
54.	Biotechnology in plant breeding lab	Lecture of Biotechnology in plant breeding lab	Nguyen Quoc Trung, Tong Van Hai, Pham Thi Dung, Phan Huu Ton	Hanoi Agricultural University Publishing House	2020
55.	Biotechnology in animal breeding	Textbook of Animal genetics	Nguyen Hoang Thinh, Nguyen Chi Thanh, Chu Tuan Thinh	Agricultural Institute Public Publishing House	2018
56.	Environmental biotechnology	Lecture of Environmental biotechnology	Nguyen Van Giang Nguyen Thanh Huyen	Agricultural Institute Public Publishing House	2020
57.	Biosafety	Lecture of Biosafety	Nguyen Thi Thuy Linh, Dinh Truong Son, Dang Thi Thanh Tam	Agricultural Institute Public Publishing House	2020
58.	Biotechnology of edible and medicinal mushrooms	Lecture of Biotechnology of edible and medicinal mushrooms	Nguyen Thi Bich Thuy; Ngo Xuan Nghien; Tran Dong Anh	Agricultural Institute Public Publishing House	2020
59.	Seminar	Guidelines on Seminar presentations	Nguyen Huu Duc, Tran Thi Binh Nguyen	Agricultural Institute Public Publishing House	2020
60.	Current topics in biotechnology	Journal of Biotechnology	Journal of Biotechnology	Journal of Biotechnology	2020
61.	Hi-tech in Agriculture	Lecture of Hi-tech in Agriculture	Nguyen Thanh Hai	Agricultural Institute Public Publishing House	2020
62.	Nanobiotechnology Principles and applications	Lecture of Nanobiotechnology Principles and applications	Dong Huy Gioi	Agricultural Institute Public Publishing House	2020
63.	Molecular Diagnostics and Gene Therapy	Textbook of Cellular Molecular Biology and Applications	Vo Thi Thuong Lan	Vietnam Education Publishing House	2017
64.	Virology	Principles of Virology, Volume	Jane Flint, Vincent	Washington, DC : ASM	2015

No.	Courses	Textbooks/lectures	Authors	Publishers	Publishing year
		II: Pathogenesis and control	Racaniello, Glenn Rall, Anna Marie Skalka	Press	
65.	Intellectual Property in Biotechnology	Lecture of Intellectual Property in Biotechnology	Nguyen Thanh Hai	Hanoi Agricultural University Publishing House	2015
66.	Natural compounds	Lecture of Natural compounds	Nguyen Duc Bach, Ly Thi Bich Thuy, Phan Huu Ton, Nguyen Thanh Hai	Agricultural Institute Public Publishing House	2020
67.	Principles and methods of plant breeding	Lecture of Principles and methods of plant breeding	Phan Thanh Kiem	Agricultural Publishing House	2016
68.	Graduation thesis	Guidelines on Graduation thesis	Faculty of Biotechnology	Faculty of Biotechnology	2020

APPENDIX 3. LIST OF LECTURERS OF THE PROGRAM

No	Courses	Faculties	Lecturer in charge		
			Full name	Year of birth	Highest degree
1.	Philosophy of Marxism and Leninism	Political and Social Sciences	Le Van Hung	1978	PhD
2.	Political economy of Marxism and Leninism	Political and Social Sciences	Le Thi Xuan	1981	MSc
3.	Vietnamese Communist Party History	Political and Social Sciences	Ta Quang Giang	1976	MSc
4.	Ho Chi Minh Ideology	Political and Social Sciences	Tran Le Thanh	1968	PhD
5.	Socialism	Political and Social Sciences	Tran Le Thanh	1968	PhD
6.	Introduction of Laws	Political and Social Sciences	Vu Van Tuan	1978	MSc
7.	Fundamentals of Chemistry	Natural resources and environment	Tran Thanh Hai	1971	MSc
8.	Organic Chemistry	Natural resources and environment	Nguyen Thi Hong Hanh	1982	PhD
9.	Analytical Chemistry	Natural resources and environment	Vu Thi Huyen	1981	PhD
10.	Man and Environment	Natural resources and environment	Dinh Thi Hai Van	1975	PhD
11.	Probability and Statistics	Information Technology	Nguyen Van Hanh	1983	PhD
12.	Introdution to Informatics	Information Technology	Do Thi Nham	1987	MSc
13.	Supplementary English	Education and Foreign Languages	Nguyen Thi Bich Ngoc	1965	MSc
14.	English 0	Education and Foreign Languages	Ngo Thi Thanh Tam	1966	MSc
15.	English 1	Education and Foreign Languages	Tran Thi Tuyet Mai	1986	MSc
16.	English 2	Education and Foreign Languages	Tran Thanh Phuong	1987	MSc
17.	Introduction to	Food Science and	Hoang Hai Ha	1971	PhD

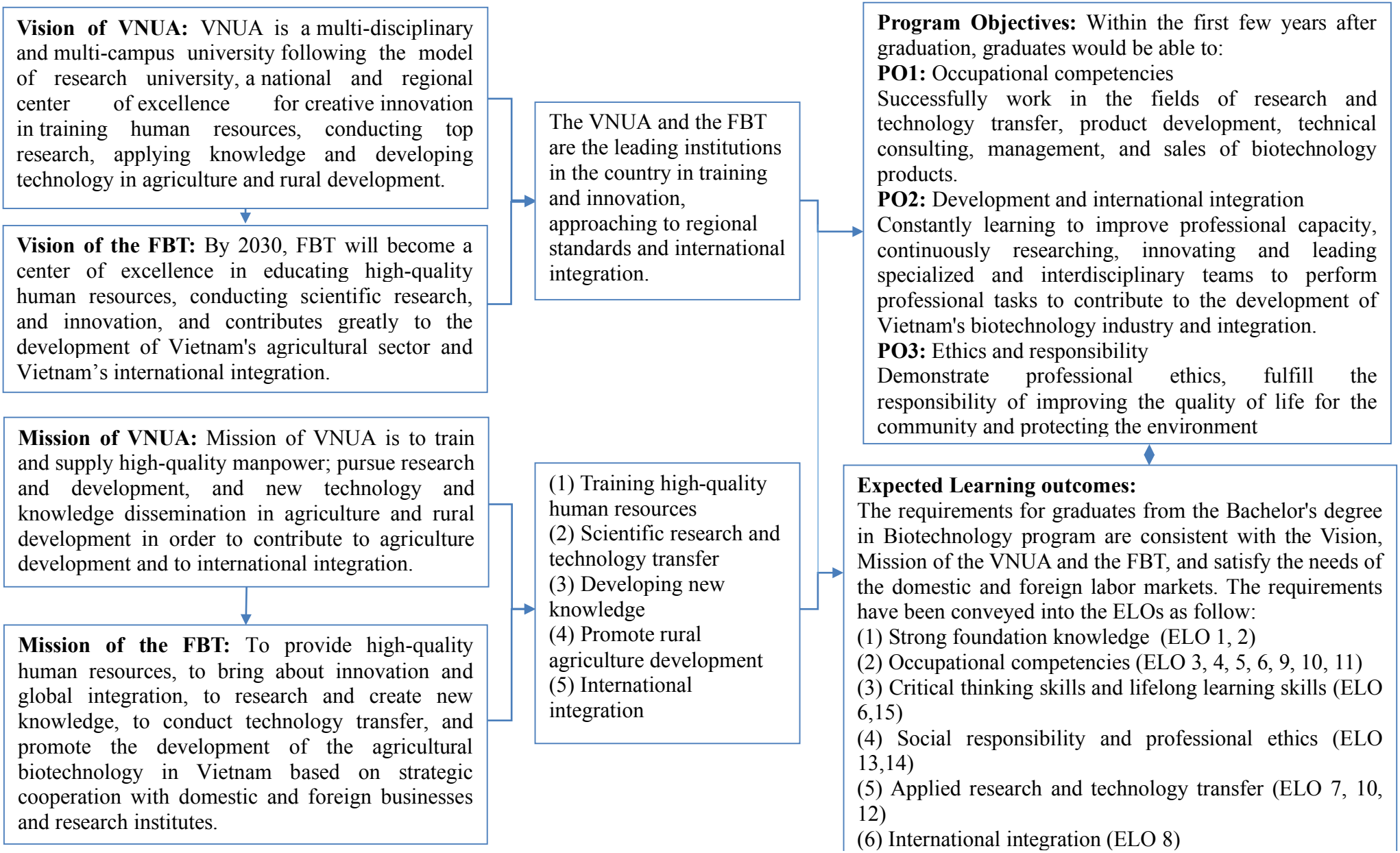
No	Courses	Faculties	Lecturer in charge		
			Full name	Year of birth	Highest degree
	Biochemistry	Technology			
18.	Principles of Economics	Economics and Rural Development	Nguyen Tat Thang	1970	PhD
19.	Agribusiness Management	Accounting and Business Management	Pham Thi Huong Diu	1978	PhD
20.	Principles and methods of Plant breeding	Agronomy	Vu Thi Thuy Hang	1980	PhD
21.	Experimental Methods	Agronomy	Do Thi Huong	1974	PhD
22.	Principle of Crop Production	Agronomy	Chu Anh Tiep	1975	PhD
23.	Introduction to Plant Pathology	Agronomy	Ha Viet Cuong	1971	Assoc. Prof. Dr.
24.	General Entomology 1	Agronomy	Nguyen Duc Tung	1979	PhD
25.	Botany	Agronomy	Nguyen Huu Cuong	1976	MSc
26.	Plant Physiology	Agronomy	Nguyen Van Phu	1962	PhD
27.	Introductory Animal Production	Animal Science	Nguyen Van Thang	1957	PhD
28.	General Biology	Biotechnology	Dong Huy Gioi	1972	PhD
29.	General Microbiology	Biotechnology	Nguyen Van Giang	1969	PhD
30.	Microbial Biology	Biotechnology	Nguyen Xuan Canh	1979	PhD
31.	Molecular Biology 1	Biotechnology	Phan Huu Ton	1955	Prof. Dr.
32.	Molecular Biology 1 lab	Biotechnology	Pham Thi Dung	1986	PhD
33.	Cell Biology	Biotechnology	Bui Thi Thu Huong	1977	PhD
34.	General Genetics	Biotechnology	Phan Huu Ton	1955	Prof. Dr.
35.	Biology of Human and Animal	Biotechnology	Tran Thi Binh Nguyen	1982	PhD

No	Courses	Faculties	Lecturer in charge		
			Full name	Year of birth	Highest degree
36.	Fundamental immunology	Biotechnology	Nguyen Xuan Canh	1979	PhD
37.	Genetic engineering - principles and applications	Biotechnology	Dinh Truong Son	1977	PhD
38.	Genetic engineering lab	Biotechnology	Dinh Truong Son	1979	PhD
39.	Molecular Biology 2	Biotechnology	Pham Thi Dung	1986	PhD
40.	Animal Cell Technology	Biotechnology	Nguyen Huu Duc	1966	PhD
41.	Animal Cell Technology Lab	Biotechnology	Tran Thi Binh Nguyen	1982	PhD
42.	Evolution and biodiversity	Biotechnology	Nguyen Duc Bach	1979	PhD
43.	Plant cell and tissue culture technology	Biotechnology	Nguyen Thi Lam Hai	1979	PhD
44.	Plant cell and tissue culture technology lab	Biotechnology	Dang Thi Thanh Tam	1985	PhD
45.	Microbial Biotechnology	Biotechnology	Nguyen Van Giang	1969	PhD
46.	Microbial Biotechnology lab	Biotechnology	Nguyen Van Giang	1969	PhD
47.	Applied Bioinformatics	Biotechnology	Nguyen Duc Bach	1979	PhD
48.	Protein-enzyme technology	Biotechnology	Nguyen Xuan Canh	1979	PhD
49.	Protein-enzyme technology lab	Biotechnology	Nguyen Xuan Canh	1979	PhD
50.	Virology	Biotechnology	Nguyen Xuan Canh	1979	PhD
51.	Animal Developmental Biology	Biotechnology	Nguyen Huu Duc	1966	PhD
52.	Plant developmental	Biotechnology	Nguyen Thi Lam Hai	1979	PhD

No	Courses	Faculties	Lecturer in charge		
			Full name	Year of birth	Highest degree
	biology				
53.	Biotechnology in plant breeding	Biotechnology	Phan Huu Ton	1955	Prof. Dr.
54.	Biotechnology in plant breeding lab	Biotechnology	Phan Huu Ton	1955	Prof. Dr.
55.	Molecular Diagnostics and Gene Therapy	Biotechnology	Nguyen Huu Duc	1966	PhD
56.	Seminar	Biotechnology	Tran Thi Binh Nguyen	1982	PhD
57.	Current topics in biotechnology	Biotechnology	Nguyen Thi Thuy Hanh	1973	PhD
58.	Biosafety	Biotechnology	Dinh Truong Son	1977	PhD
59.	Stem Cell Technology	Biotechnology	Nguyen Huu Duc	1966	PhD
60.	Biotechnology in animal breeding	Biotechnology	Nguyen Huu Duc	1966	PhD
61.	Biotechnology of edible and medicinal mushrooms	Biotechnology	Nguyen Thi Bich Thuy	1972	PhD
62.	Environmental biotechnology	Biotechnology	Nguyen Van Giang	1969	PhD
63.	Hi-tech in Agriculture	Biotechnology	Nguyen Thanh Hai	1980	Assoc. Prof. Dr.
64.	Nanobiotechnology Principles and applications	Biotechnology	Dong Huy Gioi	1972	PhD
65.	Intellectual Property in Biotechnology	Biotechnology	Nguyen Thanh Hai	1980	Assoc. Prof. Dr.
66.	Natural compounds	Biotechnology	Nguyen Duc Bach	1979	PhD
67.	English for Biotechnology	Biotechnology	Nguyen Thi Thuy Hanh	1973	PhD
68.	Professional Internship 1	Biotechnology	Nguyen Thi Thuy Hanh	1973	PhD
69.	Professional	Biotechnology	Nguyen Thi Thuy	1973	PhD

No	Courses	Faculties	Lecturer in charge		
			Full name	Year of birth	Highest degree
	Internship 2		Hanh		
70.	Graduation thesis	Biotechnology	Nguyen Thi Thuy Hanh	1973	PhD

APPENDIX 4
ALIGNMENT OF THE POS, ELOS WITH THE VISION, MISSION OF THE UNIVERSITY AND THE FACULTY OF BIOTECHNOLOGY



APPENDIX 5

BENCHMARKING WITH DOMESTIC AND INTERNATIONAL BIOTECHNOLOGY PROGRAMS

ELO groups	Expected learning outcomes (ELOs) of the Bachelor of Biotechnology program of VNUA	Bachelor of Biotechnology Ho Chi Minh City University of Agriculture and Forestry	Bachelor of Biotechnology International University, Vietnam National University-Ho Chi Minh City	Bachelor of Biotechnology Florida Gulf Coast University	Bachelor of Biotechnology Northeastern University
General Knowledge	ELO1: **Apply** knowledge of mathematics, social sciences, natural sciences, laws, and contemporary issues into the field of biotechnology.	PLO1: Possess basic knowledge of natural and social sciences, and biological processes relating to life and living environments of organisms.	a. an ability to apply knowledge of mathematics, science, and engineering. j. a knowledge of contemporary issues.	Demonstrate knowledge of biological processes from the molecular and cellular perspectives	
	ELO 2: **Analyze** the needs and requirements of stakeholders for the purposes of management, production, and sales of biotechnology products.	PLO7: Analyze trends of biotechnology development by integrating research results which have been published by national and international scientists.	c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	Engage in the scientific process to form hypotheses, synthesize scientific information, gather and analyze data, apply statistical techniques and draw conclusions	Describe and evaluate an emerging biotechnology-related problem or challenge in a wider global context using theories, tools, techniques, and methods from biology, medicine, biotechnology, healthcare, and other related fields of study.
Professional Knowledge	ELO3: **Evaluate** the quality of	PLO6: Establish precise diagnosis	b. an ability to design and conduct		Describe and evaluate an emerging

ELO groups	Expected learning outcomes (ELOs) of the Bachelor of Biotechnology program of VNUA	Bachelor of Biotechnology Ho Chi Minh City University of Agriculture and Forestry	Bachelor of Biotechnology International University, Vietnam National University-Ho Chi Minh City	Bachelor of Biotechnology Florida Gulf Coast University	Bachelor of Biotechnology Northeastern University
	biotechnology products with regard to biosafety standards, environmental protection, legal, and ethical standards.	methods and tests based on biological and genetic techniques. PLO14: Comply with professional ethical standards, and rules and regulations of national and international laws.	experiments, as well as to analyze and interpret data. f. An understanding of professional and ethical responsibility h. The broad education necessary to understand the impact of biotechnological solutions in a global, economic, environmental and societal context		biotechnology-related problem or challenge in a wider global context using theories, tools, techniques, and methods from biology, medicine, biotechnology, healthcare, and other related fields of study.
	ELO4: **Develop** ideas for biotechnology products based on personal knowledge of natural sciences, life sciences, and analysis of social needs.	PLO11: Apply basic principles of the biotechnology to develop novel and highly competitive products.	e. An ability to identify, formulate and solve problems in Biotechnology	Engage in the scientific process to form hypotheses, synthesize scientific information, gather and analyze data, apply statistical techniques and draw conclusions	Develop and justify a position on an issue pertaining to political, social, environmental, and economic challenges in biotechnology on a local, national, or global level.
	ELO5: **Design** production models for	PLO12: Establish processes for	c. an ability to design a system, component, or	Demonstrate ability to perform molecular,	Develop and justify a position on an issue

ELO groups	Expected learning outcomes (ELOs) of the Bachelor of Biotechnology program of VNUA	Bachelor of Biotechnology Ho Chi Minh City University of Agriculture and Forestry	Bachelor of Biotechnology International University, Vietnam National University-Ho Chi Minh City	Bachelor of Biotechnology Florida Gulf Coast University	Bachelor of Biotechnology Northeastern University
	biotechnology products	technological transfer of new biological products in order to serve the communities and meet social demands	process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.	cellular, and biochemical techniques used in biotechnology.	pertaining to political, social, environmental, and economic challenges in biotechnology on a local, national, or global level.
General Skills	ELO6: **Apply** critical and creative thinking skills to effectively solve issues related to research, technology transfer, and production in the field of biotechnology**.**	PLO9: Propose approaches to solve real-life problems using biological knowledge, techniques and tools.	e. An ability to identify, formulate and solve problems in Biotechnology	Approach and solve biological problems critically with scientific literacy in individual and group settings	Define, explain, and analyze vocabularies, experiments, theories, and concepts in biotechnology using current research, tools, methods, and technologies.
	ELO7: **Coordinate** with team members to achieve set goals, either as a team member or team leader.	PLO8: Establish a research team as well as conduct the proposed projects.	d. An ability to function on multi-disciplinary teams.	Approach and solve biological problems critically with scientific literacy in individual and group settings Engage in effective scientific communication as	Develop and justify a position on an issue pertaining to political, social, environmental, and economic challenges in biotechnology on a local, national, or

ELO groups	Expected learning outcomes (ELOs) of the Bachelor of Biotechnology program of VNUA	Bachelor of Biotechnology Ho Chi Minh City University of Agriculture and Forestry	Bachelor of Biotechnology International University, Vietnam National University-Ho Chi Minh City	Bachelor of Biotechnology Florida Gulf Coast University	Bachelor of Biotechnology Northeastern University
				individuals and as team members by listening, speaking, writing and presenting in oral and poster format	global level.
	ELO8: **Communicate** effectively through various channels in the diverse contexts of the workplace; satisfy English proficiency levels as required by the Ministry of Education and Training.		g. An ability to communicate effectively.	Engage in effective scientific communication as individuals and as team members by listening, speaking, writing and presenting in oral and poster format	
Professional skills	ELO9: **Utilize** information technology and equipment effectively for management, production, and sales in the field of biotechnology**.**	PLO5: Use biological instruments/ tools and computational software in research relating to biological fields.	k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	Engage in the scientific process to form hypotheses, synthesize scientific information, gather and analyze data, apply statistical techniques and draw conclusions	Integrate acquired biotechnology skills, principles, best practices, techniques, and tools into a hands-on, real-world project in a local biotech company
	ELO10: **Use** appropriate methods	PLO3: Possess knowledge of basic	b. an ability to design and conduct	Approach and solve biological problems	Prepare and present a project or paper which

ELO groups	Expected learning outcomes (ELOs) of the Bachelor of Biotechnology program of VNUA	Bachelor of Biotechnology Ho Chi Minh City University of Agriculture and Forestry	Bachelor of Biotechnology International University, Vietnam National University-Ho Chi Minh City	Bachelor of Biotechnology Florida Gulf Coast University	Bachelor of Biotechnology Northeastern University
	and skills to collect, analyze, and interpret data in scientific research, and examine practical issues at the workplace.	methods that are applied in fields of biological sciences. PLO13: Plan and conduct biological researches to the standards, which are acceptable in Vietnam.	experiments, as well as to analyze and interpret data.	critically with scientific literacy in individual and group settings Engage in the scientific process to form hypotheses, synthesize scientific information, gather and analyze data, apply statistical techniques and draw conclusions	utilizes key research, scientific literature, and/or data, communication, and experiences with local biotech companies to address an existing area of interest in biotechnology.
	ELO11: **Perform** basic and intensive technical procedures fluently in the field of biotechnology	PLO4: Apply biological techniques in research and production of biological products in meeting social demands.	k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Demonstrate ability to perform molecular, cellular, and biochemical techniques used in biotechnology.	Integrate acquired biotechnology skills, principles, best practices, techniques, and tools into a hands-on, real-world project in a local biotech company
	ELO12: **Advise** customers and partners on biotechnology products with a positive business perspective.		f. An understanding of professional and ethical responsibility g. An ability to communicate effectively.	Apply ethical practices and behavior in all aspects of biotechnological scientific endeavors.	Integrate acquired biotechnology skills, principles, best practices, techniques, and tools into a hands-on, real-world project

ELO groups	Expected learning outcomes (ELOs) of the Bachelor of Biotechnology program of VNUA	Bachelor of Biotechnology Ho Chi Minh City University of Agriculture and Forestry	Bachelor of Biotechnology International University, Vietnam National University- Ho Chi Minh City	Bachelor of Biotechnology Florida Gulf Coast University	Bachelor of Biotechnology Northeastern University
					in a local biotech company
Attitude	ELO13: **Comply** with the laws of the biotechnology industry, and conform to occupational safety principles at the workplace.	PLO14: Comply with professional ethical standards, and rules and regulations of national and international laws.	f. An understanding of professional and ethical responsibility	Apply ethical practices and behavior in all aspects of biotechnological scientific endeavors.	
	ELO14: **Maintain** professional ethics, fulfill one's duty to improve the well-being of the society and protect the environment.	PLO16: Fulfill the social responsibility, keep up to date with new development and be ready to establish work serving the community.	f. An understanding of professional and ethical responsibility. h. The broad education necessary to understand the impact of biotechnological solutions in a global, economic, environmental and societal context.	Apply ethical practices and behavior in all aspects of biotechnological scientific endeavors.	
	ELO15: **Perform the habits** of updating knowledge and experiences to improve one's professional		i. A recognition of the need for, and an ability to engage in life-long learning.		Develop and justify a position on an issue pertaining to political, social, environmental, and economic

ELO groups	Expected learning outcomes (ELOs) of the Bachelor of Biotechnology program of VNUA	Bachelor of Biotechnology Ho Chi Minh City University of Agriculture and Forestry	Bachelor of Biotechnology International University, Vietnam National University- Ho Chi Minh City	Bachelor of Biotechnology Florida Gulf Coast University	Bachelor of Biotechnology Northeastern University
	qualifications				challenges in biotechnology on a local, national, or global level.

APPENDIX 6. THE CONTRIBUTION MATRIX OF THE COURSES TO THE ELOS

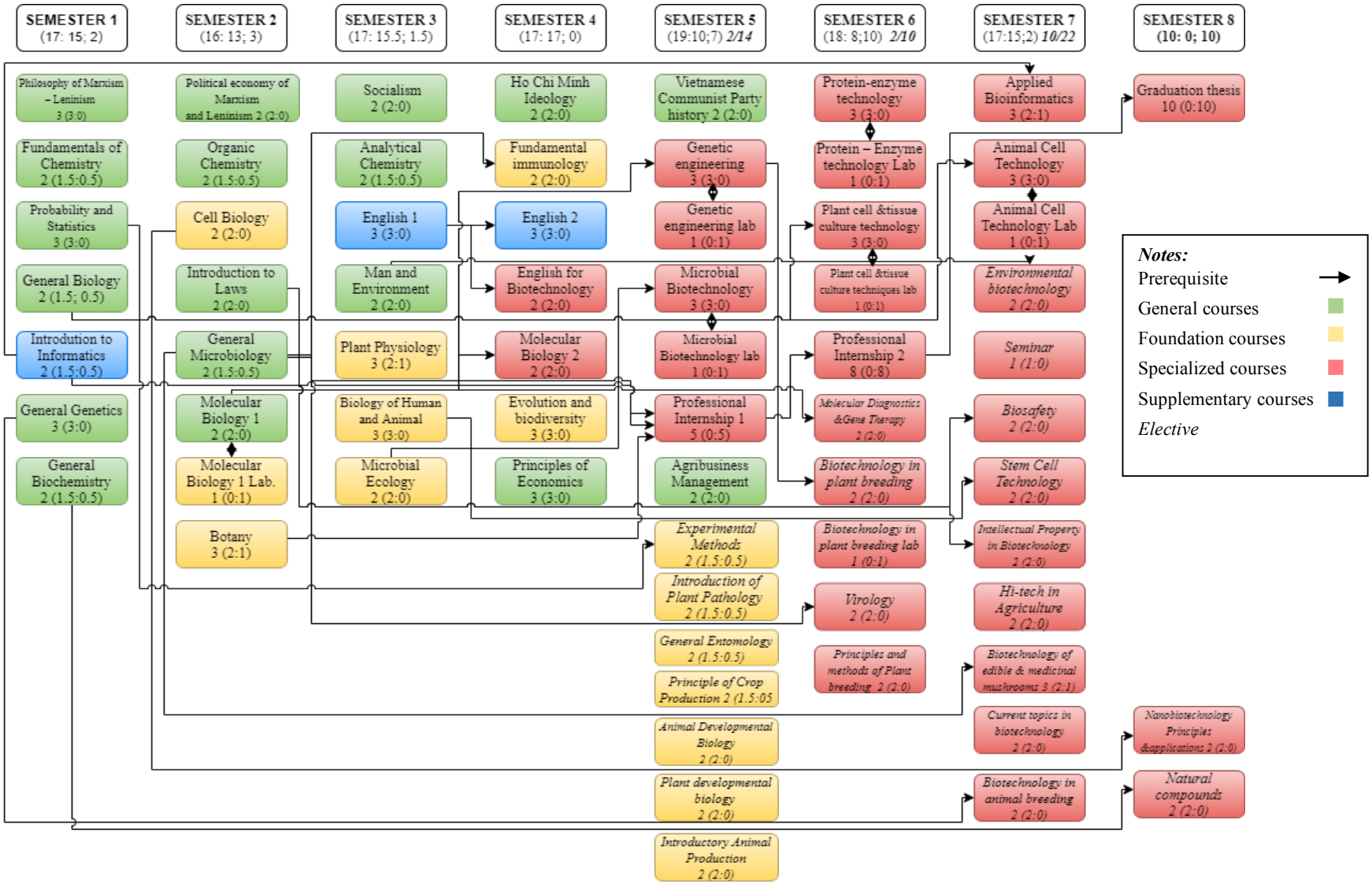
Each course is designed to assure that they make certain contributions to the ELOs of the program on 4 different levels: I (Introduce), P (Practice), R (Reinforce), M (Master).

Course name	CONTRIBUTION LEVEL TO THE ELOS														
	ELO1	ELO2	ELO3	ELO4	ELO5	ELO6	ELO7	ELO8	ELO9	ELO10	ELO11	ELO12	ELO13	ELO14	ELO15
Philosophy of Marxism – Leninism	I	I				I		I						I	
Fundamentals of Chemistry	I		I								I		I		
Probability and Statistics		I			I					I					I
General Biology	I			I			I				P		I		I
Introdution to Informatics		I			I			I	I						I
General Genetics	I			I		P	I								I
General Biochemistry	I		I								I				I
Political economy of Marxism and Leninism	P	P				P		P						P	
Organic Chemistry	P		P							I			I		
Cell Biology		I		I		P	I								I
Introduction to Laws	I	I	I					I				I	P		
General Microbiology	P		P								P				I
Molecular Biology 1		P		I			I								I
Molecular Biology 1 lab			I		P		P		I		P		P		
Botany	P						P			I			P		P
Socialism	P	P				P		P						P	
Analytical Chemistry	P						P		P	P	P				P
English 1	P							P							P
Man and Environment			P				P					I	P	P	
Plant Physiology	R				P						P				P
Biology of Human and Animal				P			P								P
Microbial Ecology			P	I		P									P
Ho Chi Minh Ideology	P	P				P		P						R	

Course name	CONTRIBUTION LEVEL TO THE ELOS														
	ELO1	ELO2	ELO3	ELO4	ELO5	ELO6	ELO7	ELO8	ELO9	ELO10	ELO11	ELO12	ELO13	ELO14	ELO15
Fundamental immunology			P		P	P									P
English 2	P							R							P
English for Biotechnology	P							R							R
Molecular Biology 2		P	P	P			P								R
Evolution and biodiversity				P			P						R	P	R
Principles of Economics	P	P										P			P
Vietnamese Communist Party History	R	R				R		R						M	
Genetic engineering - principles and applications				P		R				P					R
Genetic engineering lab			R		R		R		P		R		R		
Microbial Biotechnology				P			R			P					R
Microbial Biotechnology lab			R		R		R		P		R		R		
Professional Internship 1	R	R		R	R	R	M	R	R	P	R	R	R	R	
Agribusiness Management	R	R										P			R
Experimental Methods (Elective)			P			P				P					R
General Entomology (Elective)			P							P					R
Introduction to Plant Pathology (Elective)			P							P					R
Principle of Crop Production (Elective)			P							P					R
Introductory Animal Production (Elective)			P							P					R
Animal Developmental Biology (Elective)	R									R					R
Plant Developmental Biology (Elective)	R									R					R
Protein-enzyme technology				R		R				R			R		
Protein-enzyme technology lab			R		R				R	R	M		R		
Plant cell and tissue culture technology				R		R				R			R		
Plant cell and tissue culture techniques lab			R		R				R	R	M		R		
Professional Internship 2	R	R		R	M	M	M	M	R	R	M	R	M	R	
Molecular Diagnostics and Gene Therapy (Elective)			R			R				R					R
Biotechnology in plant breeding (Elective)		R		R		R						R			R

Course name	CONTRIBUTION LEVEL TO THE ELOS														
	ELO1	ELO2	ELO3	ELO4	ELO5	ELO6	ELO7	ELO8	ELO9	ELO10	ELO11	ELO12	ELO13	ELO14	ELO15
Biotechnology in plant breeding lab (Elective)			R		R					R			R		
Virology (Elective)				P		R									R
Principles and methods of Plant breeding (Elective)			R			R									R
Applied Bioinformatics		R			R				M	M					R
Animal cell technology				M		M				R					R
Animal cell technology lab			M						R	R	M		M		
Environmental biotechnology (Elective)			R			R								P	M
Seminar (Elective)				R		R									M
Biosafety (Elective)			M									R	R	P	M
Stem Cell Technology (Elective)		R				R				R					M
Intellectual Property in Biotechnology (Elective)		R										R	R	P	
Hi-tech in Agriculture (Elective)				R	M							R			M
Biotechnology of edible and medicinal mushrooms (Elective)					M							R		P	
Current topics in biotechnology (Elective)		R	R			R									M
Biotechnology in animal breeding (Elective)		R				R				R		R		P	M
Nanobiotechnology Principles and applications (Elective)				R		R									M
Natural compounds (Elective)			R			R									M
Graduation thesis		M	M	M	M	M		M	M	M	M	M	M	M	M

APPENDIX 7. LEARNING PATH FOR THE BIOTECHNOLOGY PROGRAM



APPENDIX 8. REVISIONS TO THE PROGRAM FOR THE PERIOD OF 2017-2021

Academic year	**Curriculum Improvement**	**Tranning time**	**Total credits**	**Improvements**	**Reasons for the changes**
2016-2017 (version 2013)	Minor revisions (at course level)	4 years (8 semesters)	120	- Updates to course content according to the VNUA's regulations and the progress of science and technology - Improvement to teaching and assessment methods based on the feedbacks from students and lecturers in each semester	- Annual updates
2017-2018	**Major revisions (at program level)**	4 years (8 semesters)	130	- Improvement of the ELOs and the program based on feedbacks of stakeholders and DACUM analysis: + Increase the number of Professional Internship credits from 03 (semester 6^{th}) to 13 (Professional Internship 1: 05 credits-semester 5^{th}, Professional Internship 2: 08 credits –semester 6^{th}) +Add Microbial Ecology course: 2 credits (Compulsory) and Biotechnology in Plant Breeding Lab course: 1 credit (Elective) +Remove some fundamental courses: Higher Mathematics, Fundamental of Psychology and Zoology +Change elective courses to compulsory courses: Agribusiness Management: 2 credits; Man and Environment: 2 credits and Principles of Economics: 3 credits	-Improving the curriculum periodically according to the quality assurance process of VNUA. -FBT analyzes the requirements of the labor market and VNUA to set out the program improvement orientation as follows: "increasing practicality, reducing academicness". This orientation is carried out by increasing the duration of professional practice at enterprises and adding closely related professional courses in order to meet the labor market's requirements, eliminating some general courses.

2018-2019	Minor revisions (at course level)	4 years (8 semesters)	130	- Updates to course content according to the VNUA's regulations and the progress of science and technology - Improvement to teaching and assessment methods based on the feedbacks from students and lecturers in each semester - Implementation of the E-learning system	- Annual updates
2019-2020	Minor revisions (at course level)	4 years (8 semesters)	131	Changed 04 courses -10 credits (Principles of Marxism-Leninism 1: 2 credits; Principles of Marxism-Leninism 2: 3 credits; Revolutionary Guideline of Vietnamese Communist Party:3 credits; Ho Chi Minh Ideology: 2 credits) into 05 courses - 11 credits (Philosophy of Marxism – Leninism: 3 credits; Political Economy of Marxism-Leninism: 2 credits; Socialism: 2 credits; Ho Chi Minh Ideology: 2 credits; Vietnamese Communist Party History: 2 credits) therefore the total credits of program are 131 - Updates to course content according to the VNUA's regulations and the progress of science and technology - Improvement to teaching and assessment methods based on the feedbacks from students and lecturers in each semester - Implementation of the MS Teams system	- The Ministry of Education and Training requires all university programs to increase political courses by 1 credit (from 10 credits to 11 credits). - Annual updates
2020-2021	Minor revisions (at course level)	4 years (8 semesters)	131	- Updates to course content according to the VNUA's regulations and the progress of science and technology - Improvement to teaching and assessment methods based on the feedbacks from students and lecturers in each semester	- Annual updates