MINISTRY OF AGRICULTURE
AND RURAL DEVELOPMENT
VIETNAM NATIONAL UNIVERSITY OF AGRICULTURE

SOCIALIST REPUBLIC OF VIETNAM
Independence - Freedom - Happiness

BACHELOR OF SCIENCE IN BIOTECHNOLOGY

COURSE SPECIFICATION

SH03060: MOLECULAR DIAGNOSTICS AND GENE THERAPY

I. Information about the course

- Course code: SH03060
- Semester: 06
- Number of credits: 2 (2; 0; 6)
- Credit hours for learning activities
  + Theoretical lessons in the class: 45 periods
- Self-studying: 90 periods (according to individual plans, and based on the lecturer's instructions)
- Units in charge:
  - Department: Animal Biotechnology
  - Faculty: Biotechnology
- The course belongs to the following knowledge group:

General knowledge □		Foundation knowledge □		Specialized knowledge ☒	
Compulsory □	Elective □	Compulsory □	Elective □	Compulsory □	Elective ☒

- Prerequisite course: Human and Animal Biology (SH02002)
- Language used for teaching: Vietnamese

II. Course objectives and course expected learning outcome

*** The objectives of the course:**

The course aims to provide students with the following knowledge:

+ Scientific basis, development and new achievements in the field of molecular diagnostics and gene therapy, including:

- ✓ 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.

The course aims to provide students with the following skills:

+ Apply creative critical thinking in collecting, analyzing, evaluating, selecting and synthesizing specialized documents.

+ Working and reporting project.

The course helps students develop the following qualities:

+ Active and creative; eager to learn; conscious accumulation of knowledge and lifelong self-learning.

*** The Expected Learning Outcomes for the *Bachelor of Biotechnology* program**

Expected learning outcomes (ELOs) of the Bachelor of Science in Biotechnology program Upon graduation, graduates 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**
Professional 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**
Professional 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, 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**

**** Course expected learning outcomes (CELOs):***
The course contributes to the expected learning outcomes of the program at the following levels:
I - Introduction); P -Practice; R - Reinforce; M –Master

Course code	Course name	Contribution level towards the expected learning outcomes of the program							
SH03060	Molecular diagnostics and gene therapy	ELO1	ELO2	ELO3	ELO4	ELO5	ELO6	ELO7	ELO8
				R			R		
		ELO9	ELO10	ELO11	ELO12	ELO13	ELO14	ELO15	
			R					R	

Code	Course expected learning outcomes Upon completion of this course, students are able to:	ELOs of the program
Knowledge		
CELO1	**Evaluate** the quality of biotech products according to biosafety, environmental protection, legal and ethical standards. **Analyze** the following issues: - 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.	**ELO3**
Skills		
CELO2	**Apply** critical and creative thinking to effectively solve research, technology transfer and production problems in the biotechnology industry.	**ELO6**
CELO3	**Apply** methods and skills to collect, analyze and process information in scientific research and investigate problems of professional practice.	**ELO10**
Attitude		
CELO4	**Make** a habit of updating knowledge and experience to improve your professional level.	**ELO15**

III. Summary of course content

SH03060. Molecular diagnostics and gene therapy: 2 credits (2–0–6).

Chapter 1: Some basic concepts in diagnosis;
Chapter 2: Some diagnostic techniques;
Chapter 3: Application of diagnostic techniques;
Chapter 4: Some basic concepts in gene therapy;
Chapter 5: Gene therapy;
Chapter 6: Existence of gene therapy in cells and target gene groups.

IV. Teaching and learning methods

1. Teaching methods

- ✓ Lecturing method
- ✓ Teaching with videos
- ✓ Online-Teaching MSTeams-Vnua

2. Learning methods

- ✓ Listen to lectures in class
- ✓ Online learning (E-learning) MSTeams-Vnua

V. Requirements for students

- Attend class (classroom class or online class-MSTeams-Vnua): Students must attend the class fully according to the regulations of the University, participate in expressing opinions, discussing and developing articles.
- Preparing for the lecture: Students attending this module are required to read the lecture and reference materials before learning related content.
- 15-minute exercises and tests (if any): Students must complete the exercises and tests in 15 minutes.
- Essays (if any): Students must fully prepare essays, participate in discussions and pass tests.
- Must take the midterm exam, the final exam and must pass the requirements.
- For online learning: students need to install learning software and fulfill the teacher's requirements for online learning.

VI. Scoring and assessment

1. Scale: 10

2. The average score of the course is score of each rubric multiplying with the corresponding weight of each rubric

- ✓ Rubric 1 - Attendance: 10%
- ✓ Table 1 - Mid-term exam score: 30%
- ✓ Table 2 - Final exam score: 60%

3. Assessment methods

The criteria, rubrics, and assessment methods	**CELOs to be assessed**	**Percentage (%)**	**Time / Studying week**
Progress assessment		**40**	
Attendance (Rubric 1)	K1, K2, K3, K4	10	Week 1 to week 13
Mid-term exams (Table 1)	K1	30	Week 7 or week 8
End-of-course assessment		**60**	
Final exam (Table 2)	K1	60	At least 2 weeks after the end of the course

Rubic 1: Attendance class

Criteria	**Percentage**	**Excellent** 8.5 - 10 points (A)	**Good** 6.5 - 8.4 points (C+, B, B+)	**Average** 4.0 – 6.4 points (D, D+, C)	**Poor** 0 – 3.9 points (F)
Participation time	50%	Participation ≥ 19 periods **(4.5 -5.0đ)**	Participation 14-18 periods **(3.5 - 4.0đ)**	Participation 9-13 periods **(2.0 - 3.0đ)**	Participation <9 periods **(0 - 1.5đ)**
Participation attitude	50%	Actively participate **(4.5 - 5.0đ)**	Not really actively participate **(3.5 - 4.0đ)**	Occasionally participate **(2.0 - 3.0đ)**	Rarelly participate **(0- 1.5đ)**

Table 1: Criteria and contents for assessment of mid-term exams (Maximum score of 10/10)

CELOs that are assessed through the exam	**Exam content**	**Performance indicator** (Students are required to perform and be evaluated based on these indicators)

K1 Apply basic knowledge to analyze problems in the field of molecular diagnostics and gene therapy	Chapter 1: Some basic concepts in diagnosis; Chapter 2: Some diagnostic techniques; Chapter 3: Application of diagnostic techniques;	Indicator 1: Present and analyze the basic concepts in diagnosis Indicator 2: Present and analyze the diagnostic techniques Indicator 3: Present and analyze the application of diagnostic techniques

The form of essay or multiple-choice exam, thematic; online or at the exam room according to the University's regulations.

Table 2: Criteria and contents for assessment of final exams (Maximum score of 10/10)

CELOs that are assessed through the exam	**Exam content**	**Performance indicator** (Students are required to perform and be evaluated based on these indicators)
K1 Apply basic knowledge to analyze problems in the field of molecular diagnostics and gene therapy	Chapter 1: Some basic concepts in diagnosis; Chapter 2: Some diagnostic techniques; Chapter 3: Application of diagnostic techniques; Chapter 4: Some basic concepts in gene therapy; Chapter 5: Gene therapy; Chapter 6: Existence of gene therapy in cells and target gene groups.	Indicator 1: Present and analyze the basic concepts in diagnosis Indicator 2: Present and analyze the diagnostic techniques Indicator 3: Present and analyze the application of diagnostic techniques Indicator 4: Present and analyze the basic concepts in gene therapy Indicator 5: Present and analyze the gene therapy Indicator 6: Present and analyze the existence of gene therapy in cells and target gene groups

The form of essay or multiple-choice exam, thematic; online or at the exam room according to the University's regulations.

4. Requirements of the course

- ✓ Late submission: Late submission of assignments, discussions, and essays will result in a 50% deduction of marks.
- ✓ Taking exams: Failure to participate in any test will result in a score of 0 for that test.
- ✓ Ethical requirements: According to the requirements of the Vietnam National University of Agriculture.

VII. Textbook / reference materials

**** Textbook /Lectures:***

1. Vo Thi Thuong Lan (2017) Textbook of Cellular and Applied Molecular Biology. Vietnam Education Publishing House.

2. Vo Van Toan, Le Thi Phuong (2013). Textbook of human and animal anatomy and physiology. Vietnam Education Publishing House.

* ***Reference materials:***

1. Nguyen Van Hanh, Vi Dai Lam, Nguyen Huu Duc, Do Trung Kien, Nguyen Viet Linh (2015). Studying the effects of DMSO in the differentiation of hepatocytes from umbilical cord stem cells. Journal of Biotechnology 37(1se): 190-195.
2. Bui Ha My, Nguyen Thi Huong, Nguyen Huu Duc, Tran Thi Thuy Ha (2018). Study of genetic diversity of the spotted pompano (Hemibagrus guttatus Lacepede, 1803) using microsatellite markers. Journal of Biotechnology, 16(1): 59-65.
3. Vu Thi Trang, Le Thi Quynh Chi, Chu Chi Thiet, Nguyen Huu Duc, Tran Thi Thuy Ha (2018). Genetic relationship of asiatic hard clam populations collected in northern coastal provinces in Vietnam based on mtDNA sequence analysis. Journal of Aquaculture & Marine Biology, 7 (1): 55-59.

**** Online references:***

Molecular Diagnostics : Promises and Possibilities
https://www.researchgate.net/publication/229088969_Molecular_Diagnostics_Promises_and_Possibilities

VIII. Teaching plan

Week	Content	CELOs
	Chapter 1: Some basic concepts in diagnosis	K1, K2, K3, K4
	A/ Main content in class: (03 periods) Theoretical content: 1.1. Diagnose 1.2. Screening 1.3. Sensitivity, specificity 1.4. Basic issues in diagnosis 1.4.1. Pattern recognition 1.4.2. Probabilistic reasoning 1.4.3. Opinion about the cause	
	B/ Contents to be self-study at home: (12 periods) Read the syllabus, lectures and find out information related to the content of the chapter.	
	Chapter 2: Some diagnostic techniques	K1, K2, K3, K4
	A/ Summary of the main content in class: (10 periods) Theoretical content: 2.1. Culture specimen 2.2. Cytology technics 2.2.1. In vitro staining 2.2.2. In vivo staining 2.3. Immunological methods 2.3.1. Western blot 2.3.2. Immunohistochemistry 2.3.3. Radioimmunoassay (RIA) 2.3.4. Agglutination Test 2.3.5. ELISA (Enzyme-Linked Immunosorbent Assay) 2.4. FISH (Fluoescent In Situ Hybridization) method 2.4.1. Types of probes mẫu 2.4.2. Two cell types using FISH 2.5. Method FLOW CYTOMETRY 2.5.1. Concept	

Week	Content	CELOs
	2.5.2. Working Principle 2.5.3. Analyze the results 2.6. Nucleic acid amplification method 2.6.1. Sample preparation 2.6.2. Amplify target, probe and signal 2.6.3. Identify and analyze qualitative and quantitative 2.6.4. Nucleic Acid Sequencing 2.6.5. Using chips in analysis	
	B/ The contents to be self-study at home: (30 periods) Read the syllabus, lectures and find out information related to the content of the chapter.	
	Chapter 3: Application of diagnostic techniques	K1, K2, K3, K4
	A/ Summary of the main content in class: (07 periods) Theoretical content: 3.1. Diagnosis of infectious diseases 3.1.1. Observation 3.1.2. Culture and identification 3.1.3. The body's response 3.1.4. Immune method 3.1.5. Methods of using nucleic acids 3.2. Diagnosis of cancer 3.2.1. Screening and early detection 3.2.2. Conventional diagnosis 3.2.3. Molecular diagnostics 3.3. Diagnosis of genetic diseases 3.3.1. Pre-implantation diagnosis 3.3.2. Prenatal diagnosis	
	B/ Contents to be self-study at home: (21 periods) Read the syllabus, lectures and find out information related to the content of the chapter.	
	Chapter 4: Some basic concepts in gene therapy	K1, K2, K3, K4
	A/ Summary of the main content in class: (03 periods) Theoretical content: 4.1. Introduction 4.2. Target cells 4.2.1. Somatic cells 4.2.2. Sexual cells	
	B/ Contents to be self-study at home: (09 periods) 4.5. Read the syllabus, lectures and find out information related to the content of the chapter.	
	Chapter 5: Gene therapy	K1, K2, K3, K4
	A/ Summary of the main content in class: (04 periods) Theoretical content: 5.1. History of gene therapy research 5.2. Gene therapy strategy 5.2.1. In vivo therapy 5.2.2. ex vivo therapy 5.3. Viral vectors for gene therapy pháp	

Week	Content	CELOs
	5.3.1. Vectors of a viral nature 5.3.2. Retroviral vector (Rv) 5.3.3. Adenovirus Vector (Ad) 5.3.4. Virus vector system combined with Adeno 5.3.5. Other viral vectors 5.4. Non-viral vectors used in gene therapy 5.4.1. DNA and RNA amplified in bacteria and eukaryotic cells 5.4.2. Oligonucleotides 5.4.3. Ribozyme 5.4.4. Triplex DNA 5.4.5. SmaRT	
	B/ Contents to be self-study at home: (12 periods) Read the syllabus, lectures and find out information related to the content of the chapter.	
	Chapter 6: Existence of gene therapy in cells and target gene groups	K1, K2, K3, K4
	A/ Summary of the main content in class: (03 periods) Theoretical content: 6.1. The existence of therapeutic genes in cells 6.2. Target Gene 6.3. Application 6.3.1. Treatment of genetic diseases 6.3.2. Treatment of cancer 6.3.3. Treatment of infectious diseases, acquired diseases 6.3.4. Gene therapy applied in transplantation 6.3.5. Gene therapy and "designing people"	
	B/ Contents to be self-study at home: (09 periods) Read the syllabus, lectures and find out information related to the content of the chapter.	

IX. Lecturer requirements for the course:

- Classrooms: required to have enough tables, chairs, boards, chalk, light, ventilation, and hygiene.
- Teaching facilities: projectors, speakers, internet, E-learning.
- E-learning: online teaching software (MSTeams), computers, server systems and infrastructure connecting to the Internet with bandwidth to meet user requirements, without network congestion or overload. Online classrooms are full of light, soundproof, well-ventilated, tidy, neat and clean.

X. Revisions (The course specification is revised annually according to the regulations of the University)

- 1st revision: 7/2018
- 2nd revision: 7/2019
- 3rd revision: 7/2020

Hanoi, July 29th, 2020

HEAD OF DEPARTMENT	**LECTURER**
(Name and signature)	*(Name and signature)*
Nguyen Huu Duc	**Nguyen Huu Duc**
DEAN	**ON BEHALF OF THE PRESIDENT**
(Name and signature)	**VICE PRESIDENT**

APPENDIX
INFORMATION ABOUT LECTURERS WHO ARE TEACHING THE COURSE

Lecturer in charge of the course

1. Full name: Nguyen Huu Duc	Title / Degree: PhD.
Workplace address: Trau Quy, Gia Lam, Hanoi	Phone no.: 0399606099
Email: nhduc@vnua.edu.vn	Website: http://www.vnua.edu.vn/khoa/cnsh/index.php/vi/
Students can contact the lecturers teaching the course through the following ways: 1. Phone calls; 2. Writing emails to the lecturers; 3. Arrange a meeting with the lecturer; 4. Meet and discuss with the instructor during office hours as provide by the instructor.	

Supporting lecturer

2. Full name: Tran Thi Binh Nguyen	Title / Degree: PhD.
Workplace address: Trau Quy, Gia Lam, Hanoi	Phone no.: 0944661010
Email: ttbnguyen@vnua.edu.vn	Website: http://www.vnua.edu.vn/khoa/cnsh/index.php/vi/
Students can contact the lecturers teaching the course through the following ways: 1. Phone calls; 2. Writing emails to the lecturers; 3. Arrange a meeting with the lecturer; 4. Meet and discuss with the instructor during office hours as provide by the instructor.	