MINISTRY OF EDUCATION AND TRAINING

QUY NHON UNIVERSITY

DOCTORAL PROGRAM

Level of education:	**Doctoral**
Major::	**Theoretical and Physical Chemistry**
Code:	**9440119**
Type of education:	**Full-time**

Binh Dinh, 2023

MINISTRY OF EDUCATION AND TRAINING
QUY NHON UNIVERSITY

SOCIALIST REPUBLIC OF VIET NAM
Independence - Freedom - Happiness

DOCTORAL PROGRAM

(Issued together with Decision No. 2017/QĐ-ĐHQN dated July 31, 2023 of the Rector of Quy Nhon University)

Level of education:	Doctoral
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1. PROGRAM OBJECTIVES (POs)

1.1. General objectives

Đào tạo tiến sĩ Hóa học có kiến thức thực tế và lý thuyết tiên tiến, chuyên sâu về ngành Hóa lý thuyết và hóa lý thuộc nhóm ngành Khoa học vật chất, lĩnh vực Khoa học tự nhiên; có kỹ năng tổng hợp, phân tích thông tin, phát hiện và giải quyết vấn đề một cách sáng tạo; có kỹ năng tư duy, nghiên cứu độc lập, độc đáo, sáng tạo tri thức mới; có kỹ năng truyền bá, phổ biến tri thức, thiết lập mạng lưới hợp tác quốc gia và quốc tế trong quản lý, điều hành hoạt động chuyên môn; thể hiện năng lực sáng tạo, có khả năng tự định hướng và dẫn dắt chuyên môn, khả năng đưa ra các kết luận, khuyến cáo khoa học mang tính chuyên gia.

To train PhD graduates in Chemistry who possess advanced and in-depth theoretical knowledge and practical expertise in Theoretical Chemistry and Physical Chemistry, within the discipline of Physical Sciences and the field of Natural Sciences. Graduates are expected to develop strong skills in synthesizing and analyzing information, identifying and solving problems creatively; demonstrate independent, original, and innovative research capabilities for the creation of new knowledge; and possess the ability to disseminate and transfer knowledge, as well as to establish national and international collaborative networks in the management and implementation of professional activities. They are also expected to demonstrate creativity, the ability to self-direct and lead professional activities, and the capacity to formulate expert scientific conclusions and recommendations.

1.2. Specific objectives (POs):

– Knowledge

PO1: To provide doctoral candidates with advanced and in-depth knowledge in areas of Theoretical and Physical Chemistry, including computational chemistry, quantum chemistry, chemical thermodynamics, chemical kinetics, catalysis, electrochemistry, colloid chemistry, and polymer physical chemistry.

PO2: To update doctoral candidates with current knowledge and recent scientific achievements in Theoretical and Physical Chemistry, as well as related fields in research and practical applications.

– Skills

PO3: To develop the ability to solve complex problems and collaborate within disciplinary and interdisciplinary contexts; analytical and synthetic skills; critical thinking and evaluation skills; skills in organization, management, and team development; and expert-level decision-making skills in research and applications related to Theoretical and Physical Chemistry and associated fields.

PO4: To develop skills for generating new knowledge and technologies, and for communicating and disseminating knowledge in Theoretical and Physical Chemistry and related disciplines.

– Autonomy and Responsibility

PO5: To develop the ability for self-direction and adaptation to changing environments; the capability to guide others in performing professional tasks; and the ability to manage, evaluate, and improve working methods to enhance professional effectiveness.

PO6: To demonstrate professional ethics and academic integrity; to take responsibility toward oneself, professional teams, and the community; and to maintain professional conduct and cultural awareness.

2. EMPLOYMENT OPPORTUNITIES AND FURTHER STUDY PROSPECTS

Sau tốt nghiệp, người học có thể đảm nhận các vị trí sau: Giảng viên tại các trường đại học, cao đẳng, học viện; nghiên cứu viên tại các viện, trung tâm nghiên cứu, cơ sở sản xuất; quản lý chuyên môn tại các cơ sở giáo dục đào tạo, nghiên cứu khoa học công nghệ về Hóa học nói chung và ngành Hóa lý thuyết và hóa lý nói riêng. Ngoài ra, người học có thể thực hiện các chương trình thực tập, nghiên cứu sau tiến sĩ ở các nước tiên tiến.

After graduation, graduates may take up positions such as lecturers at universities, colleges, and academies; researchers at research institutes, research centers, and industrial or production facilities; and professional managers at educational institutions and scientific and technological organizations in the field of Chemistry in general and in Theoretical and Physical Chemistry in particular. In addition, graduates may pursue postdoctoral research and fellowship programs in advanced countries.

3. LEARNING OUTCOMES (PLOs)

3.1. Knowledge

PLO1: Analyze and evaluate advanced and specialized knowledge in a scientific area within Theoretical and Physical Chemistry, such as computational chemistry, quantum chemistry, chemical thermodynamics, chemical kinetics, catalysis, electrochemistry, colloid chemistry, and polymer physical chemistry.

PLO2: Apply core and fundamental knowledge of Theoretical and Physical Chemistry and related disciplines to address research problems and practical applications; apply relevant interdisciplinary knowledge to the field of Theoretical and Physical Chemistry.

PLO3: Generate new knowledge and develop new technologies in Theoretical and Physical Chemistry and related fields.

PLO4: Apply knowledge of research group management and research organization in scientific activities.

3.2. Skills

PLO5: Apply and analyze scientific theories, methods, and tools used in research and development in Theoretical and Physical Chemistry and related fields.

PLO6: Demonstrate creativity in enriching and advancing professional knowledge in Theoretical and Physical Chemistry.

PLO7: Analyze scientific problems and propose creative and original approaches for research and applications in Theoretical and Physical Chemistry and related areas.

PLO8: Organize, manage, and lead professional activities in research and development; communicate, discuss, analyze, critically evaluate, and disseminate research results in Theoretical and Physical Chemistry and related fields.

3.3. Autonomy and Responsibility

PLO9: Demonstrate a strong passion for research and the creation of new knowledge.

PLO10: Show creativity and the ability to adapt to changing environments, as well as the capacity for self-direction and leadership in research and development.

PLO11: Demonstrate research management capabilities and the ability to make timely and well-reasoned expert decisions in research activities within Theoretical and Physical Chemistry.

PLO12: Uphold professional ethics and academic integrity; demonstrate responsibility toward oneself, research teams, and the community; and maintain professional conduct and cultural awareness.

4. ADMISSION REQUIREMENTS

- Applicants must hold a Master's degree or have completed a specialized training program at Level 7 in a relevant field, or possess an excellent Bachelor's degree (or an equivalent or higher qualification) in a relevant discipline, and demonstrate research capability and experience.

- Applicants must have foreign language proficiency at Level 4 of the Vietnamese 6-Level Foreign Language Proficiency Framework (or an equivalent or higher level).

Applicants holding a Master's degree or an excellent Bachelor's degree in a relevant field:

Doctoral Program	**Relevant Master's or Excellent Bachelor's Degree**	**Bridging Credits Required**
Theoretical and Physical Chemistry	Master's degree: - Theoretical and Physical Chemistry - Inorganic Chemistry - Organic Chemistry - Analytical Chemistry - Chemistry	0
	Bachelor's degree (Excellent): - Chemistry - Chemistry Education	30

Applicants holding a Master's degree or an excellent Bachelor's degree in a related field (bridging courses required):

Doctoral Program	**Related Degree Requiring Bridging Courses**	**Required Bridging Credits**	**Notes**
Theoretical and Physical Chemistry	Master's degree: - Theory and Methods of Teaching Chemistry - Pharmaceutical Chemistry - Fields within the Physical Sciences group (Code: 84401xx)	3	

	- Fields within Chemical Engineering, Materials, Metallurgy and Environmental Engineering (Code: 85203xx)		
	Bachelor's degree (Excellent): - Chemical Engineering Technology - Chemical Engineering - Pharmaceutical Chemistry	33	
	Other related fields in Natural Sciences, Life Sciences, Environmental Sciences, Engineering and Technology, Manufacturing and Processing	Determined by the training institution during the admission review for each specific case	

5. ADMISSION CANDIDATES

In accordance with the current regulations on doctoral admission and training issued by the Ministry of Education and Training of Vietnam and Quy Nhon University.

6. PROGRAM DURATION AND TOTAL CREDITS

6.1. Program Duration: From **03 years (36 months)** to **04 years (48 months)**.

6.2. Total Credits:

- **Category 1:** Doctoral candidates holding a Master's degree in a relevant field**.**
- **Category 2:** Doctoral candidates holding a Master's degree in a related field**.**
- **Category 3:** Doctoral candidates holding an excellent Bachelor's degree in a relevant field**.**
- **Category 4:** Doctoral candidates holding an excellent Bachelor's degree in a related field**.**

Program Structure	**Number of credits**	**Category**			
		1	**2**	**3**	**4**
I. Bridging Courses		**0**	**3**	**30**	**33**
Theoretical Foundations of Chemistry	3				3
Advanced Theoretical and Physical Chemistry	3		3		
Advanced Inorganic Chemistry	3			3	3
Advanced Organic Chemistry	3			3	3
Data Processing and Experimental	3			3	3

Design					
Research Methodology in the Discipline	3			3	3
Advanced Computational Chemistry	3			3	3
Multiscale Simulation in Chemistry	3			3	3
Spectroscopic Methods in Chemistry	3			3	3
Advanced Thermodynamics	3			3	3
Advanced Chemical Kinetics	3			3	3
Advanced Electrochemistry	3			3	3
II. Doctoral-level Courses (Compulsory and Elective)		**15**	**15**	**15**	**15**
II.1 Compulsory Courses		***6***	***6***	***6***	***6***
Advanced Electronic Structure Theory	3	3	3	3	3
Selected Topics in Physical Chemistry	3	3	3	3	3
II.2 Elective Courses		***9***	***9***	***9***	***9***
Advanced Group Theory and Applications in Chemistry	3	3	3	3	3
Simulation and Calculation of Weak Interactions in Chemistry	3	3	3	3	3
Materials Modeling and Simulation	3	3	3	3	3
Advanced Materials for Energy Conversion and Storage	3	3	3	3	3
Advanced Materials for Environmental and Biomedical Applications	3	3	3	3	3
Synthesis and Characterization of Advanced Materials	3	3	3	3	3
III. Scientific Research and Doctoral Dissertation		**75**	**75**	**75**	**75**
III.1 Scientific Research		***15***	***15***	***25***	***15***
Seminar at the Department					
Participation in national and international scientific conferences					
Scientific publications					
Other activities related to scientific research					
III.2 Doctoral Dissertation		***60***	***60***	***60***	***60***
Total		**90**	**93**	**120**	**123**

7. TRAINING METHOD, GRADUATION REQUIREMENTS

7.1. Training Method

The training program is implemented under the credit-based system and complies with the current regulations and policies issued by the Ministry of Education and Training of Vietnam and Quy Nhon University.

7.2. Recognition of Qualification and Award of the Doctoral Degree

Doctoral candidates shall be considered for recognition of qualification and the award of the Doctoral degree when they satisfy the following requirements:

a) The candidate's doctoral dissertation has been approved by the University-level Doctoral Dissertation Evaluation Council;

b) The candidate has submitted to the University (both printed and electronic versions) the finalized dissertation bearing the candidate's signature, the supervisor's confirmation, and the certification of the Chair of the Dissertation Evaluation Council after all required revisions and amendments (if any) have been completed;

c) The candidate has submitted to the National Library of Vietnam (both printed and electronic versions) the dissertation abstract and the final complete dissertation, bearing the candidate's signature, the supervisor's signature, and the confirmation of the University.

8. ASSESSMENT

8.1. Grading Scale

A 10-point grading scale is used for all forms of assessment.

8.2. Format of Assessment, Evaluation Criteria, and Weighting

These are implemented in accordance with the current regulations on doctoral admission and training issued by the Ministry of Education and Training of Vietnam and Quy Nhon University. Specific criteria are described in detail in the syllabus of each course.

8.3. Assessment Methods

Assessment methods are implemented in accordance with the current regulations on doctoral admission and training issued by the Ministry of Education and Training of Vietnam and Quy Nhon University. Specific criteria are detailed in the syllabus of each course.

9. PROGRAM FRAMEWORK

No.	Course code		Course name	Year	Workload				Prerequisite course code	Managing Faculty	Applicable Category
	Text	Figure			Total	Theory	Practise	Tests			
I. Học phần bổ sung kiến thức					**0**						**Candidate 1**
					3						**Candidate 2**
					30						**Candidate 3**
					33						**Candidate 4**
1	TSHL	01	Theoretical Foundations of Chemistry	1	3	1.5	0.5	1.0		KHTN	4

No.	Course code		Course name	Year	Workload				Prerequisite course code	Managing Faculty	Applicable Category
	Text	Figure			Total	Theory	Practise	Tests			
2	TSHL	02	Advanced Theoretical and Physical Chemistry	1	3	1.5	0.5	1.0		KHTN	2
3	TSHL	03	Advanced Inorganic Chemistry	1	3	1.5	0.5	1.0		KHTN	3, 4
4	TSHL	04	Advanced Organic Chemistry	1	3	1.5	0.5	1.0		KHTN	3, 4
5	TSHL	05	Data Processing and Experimental Design	1	3	1.5	0.5	1.0		KHTN	3, 4
6	TSHL	06	Research Methodology in Chemistry	1	3	1.5		1.5		KHTN	3, 4
7	TSHL	07	Advanced Computational Chemistry	1	3	1.5	0.5	1.0		KHTN	3, 4
8	TSHL	08	Multiscale Simulation in Chemistry	1	3	1.5	0.5	1.0		KHTN	3, 4
9	TSHL	09	Spectroscopic Methods in Chemistry	1	3	1.5	1.5			KHTN	3, 4
10	TSHL	10	Advanced Thermodynamics	1	3	1.5	0.5	1.0		KHTN	3, 4
11	TSHL	11	Advanced Chemical Kinetics	1	3	1.5	0.5	1.0		KHTN	3, 4
12	TSHL	12	Advanced Electrochemistry	1	3	1.5	0.5	1.0		KHTN	3, 4
II. Doctoral-level Courses					**15**						**1, 2, 3, 4**
II.1. Compulsory Courses					**6**						**1, 2, 3, 4**
13	TSHL	13	Lý thuyết cấu trúc electron nâng cao	1 2	3	1.5	0.5	1.0		KHTN	1, 2 3, 4
14	TSHL	14	Một số vấn đề chọn lọc Hóa lý	1 2	3	1.5	0.5	1.0		KHTN	1, 2 3, 4
II. 2. Elective Courses (Select 3/6 courses)					**9**						**1, 2, 3, 4**
15	TSHL	15	Advanced Group Theory and Applications in Chemistry	1 2	3	1.5	0.5	1.0		KHTN	1, 2 3, 4
16	TSHL	16	Simulation and Calculation of Weak Interactions in Chemistry	1 2	3	1.5	0.5	1.0		KHTN	1, 2 3, 4
17	TSHL	17	Materials Modeling and Simulation	1 2	3	1.5	0.5	1.0		KHTN	1, 2 3, 4
18	TSHL	18	Advanced Materials for Energy Conversion and Storage	1 2	3	1.5		1.5		KHTN	1, 2 3, 4
19	TSHL	19	Advanced Materials for Environmental and Biomedical Applications	1 2	3	1.5		1.5		KHTN	1, 2 3, 4
20	TSHL	20	Synthesis and Characterization of Advanced Materials	1 2	3	1.5	0.5	1.0		KHTN	1, 2 3, 4
III. Scientific Research and Doctoral Dissertation					75						**1, 2, 3, 4**

No.	Course code		Course name	Year	Workload				Prequisite course code	Managing Faculty	Applicable Category
	Text	Figure			Total	Theory	Practise	Tests			
21	TSHL	21	Scientific Research	1-3	15					KHTN	1, 2
				2-4							3, 4
22	TSHL	22	Doctoral Dissertation	1-3	60					KHTN	1, 2
				2-4							3, 4
Total					**90**						**Category 1**
					93						**Category 2**
					120						**Category 3**
					123						**Category 4**

Mapping of courses and program learning outcomes:

No.	Course	PLO											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Theoretical Foundations of Chemistry	x	x			x				x	x		
2	Advanced Theoretical and Physical Chemistry	x	x			x	x		x	x	x		
3	Advanced Inorganic Chemistry		x				x		x	x	x		
4	Advanced Organic Chemistry		x				x		x	x	x		
5	Data Processing and Experimental Design		x		x			x	x			x	x
6	Research Methodology in Chemistry				x			x	x			x	x
7	Applied Computational Chemistry	x	x			x	x			x	x		
8	Multiscale Simulation in Chemistry		x	x			x	x			x	x	
9	Spectroscopic Methods in Chemistry		x		x			x	x			x	x
10	Advanced Thermodynamics	x	x			x			x			x	x
11	Advanced Chemical Kinetics	x	x			x			x			x	x
12	Advanced Electrochemistry	x	x			x			x			x	x
13	Advanced Electronic Structure Theory	x	x			x			x	x	x		
14	Selected Topics in Physical Chemistry	x	x			x			x			x	x
15	Advanced Group Theory and Applications in Chemistry	x	x				x	x			x	x	
16	Simulation and Calculation of Weak Interactions in Chemistry		x	x			x	x			x	x	
17	Materials Modeling and Simulation		x	x			x	x			x	x	
18	Advanced Materials for Energy		x	x			x	x			x		x

	Conversion and Storage												
19	Advanced Materials for Environmental and Biomedical Applications		x	x			x	x			x		x
20	Synthesis and Characterization of Advanced Materials		x	x			x	x			x		x
21	Scientific Research	x	x	x	x	x	x	x	x	x	x	x	x
22	Doctoral Dissertation	x	x	x	x	x	x	x	x	x	x	x	x

10. TRAINING PLAN

No.	Course code	Course name	Number of credits	Plan*(year)*				Suggested Lecturers	Managing Faculty	Appicable category
				1	2	3	4			
I. I. Bridging Courses										**2, 3, 4**
1	TSHL01	Theoretical Foundations of Chemistry	3	3				Dr. Trương Thị Cẩm Mai PGS.TS. Nguyễn Phi Hùng	KHTN	4
2	TSHL02	Advanced Theoretical and Physical Chemistry	3	3				Assoc.Prof. Dr.. Nguyễn Tiến Trung Assoc.Prof. Dr. Nguyễn Phi Hùng		2
3	TSHL03	Advanced Inorganic Chemistry	3	3				Assoc.Prof. Dr. Nguyễn Văn Kim TS. Trương Thị Cẩm Mai	KHTN	3, 4
4	TSHL04	Advanced Organic Chemistry	3	3				Assoc.Prof. Dr. Nguyễn Thị Việt Nga Dr. Diệp Thị Lan Phương	KHTN	3, 4
5	TSHL05	Data Processing and Experimental Design	3	3				Dr. Nguyễn Lê Tuấn Assoc.Prof. Dr. Cao Văn Hoàng	KHTN	3, 4
6	TSHL06	Research Methodology in Chemistry	3	3				Prof. Dr. Võ Viễn Assoc.Prof. Dr. Nguyễn Tiến Trung	KHTN	3, 4
7	TSHL07	Applied Computational Chemistry	3	3				Assoc.Prof. Dr. Nguyễn Tiến Trung Assoc.Prof. Dr. Vũ Thị Ngân	KHTN	3, 4
8	TSHL08	Multiscale Simulation in Chemistry	3	3				Assoc.Prof. Dr. Nguyễn Tiến Trung Assoc.Prof. Dr. Vũ Thị Ngân		3, 4

No.	Course code	Course name	Number of credits	Plan *(year)*				Suggested Lecturers	Managing Faculty	Appicable category
				1	2	3	4			
9	TSHL09	Spectroscopic Methods in Chemistry	3	3				Dr. Nguyễn Lê Tuấn Dr. Lê Cảnh Định		3, 4
10	TSHL10	Advanced Thermodynamics	3	3				Assoc.Prof. Dr. Nguyễn Phi Hùng Assoc.Prof. Dr. Nguyễn Thị Vương Hoàn		3, 4
11	TSHL11	Advanced Chemical Kinetics	3	3				Prof. Dr. Võ Viễn Assoc.Prof. Dr. Nguyễn Phi Hùng		3, 4
12	TSHL12	Advanced Electrochemistry	3	3				Assoc.Prof. Dr. Huỳnh Thị Miền Trung Prof. Dr. Võ Viễn		3, 4
II. Doctoral-Level Courses			**15**							**1, 2, 3, 4**
II.1. Compulsory Courses			**6**							**1, 2, 3, 4**
13	TSHL13	Advanced Electronic Structure Theory	3	3				Assoc.Prof. Dr. Vũ Thị Ngân Assoc.Prof. Dr. Nguyễn Tiến Trung	KHTN	1, 2
					3					3, 4
14	TSHL14	Selected Topics in Physical Chemistry	3	3				Prof. Dr. Võ Viễn Assoc.Prof. Dr. Nguyễn Phi Hùng	KHTN	1, 2
					3					3, 4
II.2. Elective Courses (Select 3/6 courses)			**9**							**1, 2, 3, 4**
15	TSHL15	Advanced Group Theory and Applications in Chemistry	3	3				Assoc.Prof. Dr. Vũ Thị Ngân Dr. Nguyễn Văn Thắng	KHTN	1, 2
					3					3, 4
16	TSHL16	Simulation and Calculation of Weak Interactions in Chemistry	3	3				Assoc.Prof. Dr. Nguyễn Tiến Trung Assoc.Prof. Dr. Vũ Thị Ngân	KHTN	1, 2
					3					3, 4
17	TSHL17	Materials Modeling and Simulation	3	3				Assoc.Prof. Dr. Nguyễn Tiến Trung Assoc.Prof. Dr. Vũ Thị Ngân	KHTN	1, 2
					3					3, 4
18	TSHL18	Materials for Energy Conversion and Storage	3	3				Prof. Dr. Võ Viễn Assoc.Prof. Dr. Huỳnh Thị Miền Trung	KHTN	1, 2
				3	3					3, 4

No.	Course code	Course name	Number of credits	Plan*(year)*				Suggested Lecturers	Managing Faculty	Appicable category
				1	2	3	4			
		Applications								
19	TSHL19	Materials for Environmental and Biomedical Applications	3	3				Assoc.Prof. Dr. Nguyễn Thị Vương Hoàn, Assoc.Prof. Dr. Nguyễn Thị Diệu Cầm	KHTN	1, 2
					3					3, 4
20	TSHL20	Synthesis and Characterization of Advanced Materials	3	3				Dr. Trần Thị Thu Phương Dr. Nguyễn Văn Thắng	KHTN	1, 2
					3					3, 4
III. Scientific Research and Doctoral Dissertation										**1, 2, 3, 4**
21	TSHL21	Scientific Research	15					Faculty members of the Faculty of Natural Sciences		1, 2, 3, 4
22	TSHL22	Doctoral Dissertation	60					Faculty members of the Faculty of Natural Sciences		1, 2, 3, 4
Total			**90**							**1**
			93							**2**
			120							**3**
			123							**4**

Notes:
- Scientific Research and Doctoral Dissertation activities are conducted from Year 1 for candidates in Categories 1 and 2, and from Year 2 for candidates in Categories 3 and 4.
- The minimum number of credits per academic year is 30 credits.

11. GUIDELINES FOR PROGRAM IMPLEMENTATION

This training program has been implemented since the 2023 admission cycle.

- The training process is developed based on the designed curriculum, training objectives, target learners, human resource requirements, and specific requirements for doctoral education. For elective courses, depending on practical conditions, development trends, and societal needs, the managing faculty will advise doctoral candidates in selecting appropriate courses.
- The Dean of the managing faculty is responsible for organizing and guiding the principles for developing detailed course syllabi to ensure that the objectives, contents, and requirements are fully met, while also satisfying the needs of learners and society.

- The training program is periodically reviewed and updated in accordance with current regulations to ensure alignment with the development of Theoretical and Physical Chemistry and to meet the demands of socio-economic development.

12. SYLLABI OF COURSES

See Appendix.

Binh Dinh, July 31, 2023

RECTOR

Assoc.Prof. Dr. Do Ngoc My