INDUSTRIAL UNIVERSITY OF HO CHI MINH CITY
FACULTY OF CHEMICAL ENGINEERING



PROGRAMME SPECIFICATION

MASTER PROGRAMME IN CHEMICAL ENGINEERING

Short Version for Candidates

Ho Chi Minh City, July 2022



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ABBREVIATION

ABET	Accreditation Board for Engineering and Technology
AUN-QA	ASEAN University Network – Quality Assurance
CDIO	Conceive-Design-Implement-Operate
CLO	Course Learning Outcomes
FCE	Faculty of Chemical Engineering
HOD	Head of Department
IUH	Industrial University of Ho Chi Minh city
MOET	Ministry of Education and Training
MOIT	Ministry of Industry and Trade
OAA	Office of Academic Affairs
OFM	Office of Facilities Management
OHRA	Office of Human Resources and Administration
PEO	Programme Education Objectives
PLOs	Programme Learning Outcomes
QA	Quality Assurance
SCSC	Student Counseling and Support Center
TOEIC	Test of English for International Communication

1. GENERAL INFORMATION OF THE PROGRAMME

1.1. Basis for programme development

The master education programme in Chemical Engineering is designed according to OBE method, meeting the regulations on education programme standards according to the following bases:

- Circular No. 17/2021/TT-BGDĐT of the Minister of Education and Training dated June 22, 2021, stipulating training program standards; formulate, appraise and promulgate training programs for higher education levels;

- Circular 02/2022/TT-BGDĐT of the Minister of Education and Training dated January 18, 2022, stipulating conditions, order and procedures for opening the training sector and suspending the operation of the training sector at university, master and doctoral levels;

- Decision No. 1982/QD-TTg of the Prime Minister dated October 18, 2016, approving the Vietnamese Qualifications Framework;

- Decision No. 1232/QD-TTg of the Prime Minister dated July 15, 2021, approving the Plan for the implementation of the Vietnamese Qualifications Framework for vocational education levels, period 2021 – 2025;

- Circular No. 23/2021/TT-BGDĐT of the Ministry of Education and Training dated June 30, 2021, promulgating the Regulation on enrollment and training for master degree;

- Decision 1048/QD-ĐHCN of the Rector of Ho Chi Minh City University of Industry HCMC dated August 17, 2021. on the promulgation of Regulations on building, reviewing and updating training programs of Ho Chi Minh City University of Industry;

- Decision No. 1470/QD-ĐHCN of the Rector of Ho Chi Minh City University of Industry dated November 10, 2021, promulgating the Regulation on enrollment and training for master degree;

- Appropriately absorb stakeholder input;

- Results of the survey on training needs of employers.

1.2. Genenal imformation of the programme

- Programme name: **Chemical Engineering**
- Programme code: **8520301**
- Type: **Master**
- Learning time: **2,0 years – 4 semesters**
- Name of the final award: **The Degree of Master Engineering in Chemical Engineering**
- Awarding institution: **Industrial University of Ho Chi Minh City**

1.3. Job opportunities

Graduates from master programme in Chemical Engineering are able to work in companies, factories and agencies such as:

- Work in manufacturing plant companies related to the field of chemicals, chemical engineering;
- Working in state agencies related to Chemical Engineering such as Department of Natural Resources and Environment, Department of Science and Technology,...
- Working in research and product development (R&D) departments of companies and corporations;
- Researcher of research centers;
- Technical consultancy for companies and corporations trading technical equipment in chemical engineering;
- Manage QA, QC departments of companies, production facilities;
- Teaching and research in Universities, Institute and Colleges.

2. THE PROGRAMME OBJECTIVES AND LEARNING OUTCOMES

The programme objectives are clearly linked to the vision, mission of the FCE and also reflect the vision, mission, objectives and slogan of IUH to provide high quality human resource and develop scientific research applications which meet the social needs

2.1. Vision – Mission – Objectives of IUH and Educational Philosophy

Industrial University of Ho Chi Minh City was formerly Go Vap Vocational School founded by Don Bosco priests on November 11, 1956 at Hanh Thong commune, Go Vap District, Gia Dinh Province. In 1968, the school was renamed as the Don Bosco Private Junior High School of Technology. Until January 31, 1970 the school was upgraded to be the Don Bosco Private Junior High School of Technology, shortly referred to as the Don Bosco High School of Engineering. After the day of peace and reunification, the Southern Liberation Army took over the school and on December 19, 1975 the School was handed over to the General Department of Metallurgy Engineering and Electronics. In 1978, the School was renamed as the School of Engineering IV belonging to The Ministry of Mechanical Engineering and Metallurgy. By 1994, the school was merged with the Chemical High School II in Bien Hoa City to become the Industrial Engineering School IV under the management of The Ministry of Industry. In March 1999, the school was upgraded to become Industrial College IV and in December 2004 the college was upgraded to become Industrial University of Ho Chi Minh City according to the Decision of 214/2004/QD - TTg by the Prime Minister. The university is currently one of the big educational and training institutions in Vietnam.

2.1.1. Vision

Nationally recognized as a leading applied university for excellence in education, research, technology transfer, innovation, and creativity.

Articulation of the Vision

- As a leading applied university, we envision ourselves being one of the top ten universities in Vietnam; the university of choice for education and applied research

and forging unity and collaboration with schools, faculty students, alumni, partners, and industry.

- As a leading applied university having a reputation for excellence in education and applied research, we develop application-oriented academic programs in response to the practical needs of society
- As a leading applied university having reputation for excellence in technology transfer, innovation, and creativity, we embrace, nurture and develop new ideas, start-ups, cooperation, industrial transformation and smartization, and the commercialization of research products.

2.1.2. Mission

IUH provides high-quality human resources who have competence, attributes, and ability to integrate globally to contribute to Vietnam's socio-economic development.

Articulation of the Mission

- High-quality human resources are those who have professional qualifications that meet practical requirements of society; ability to think creatively; entrepreneurship.
- Human resources with competence and attributes are those who possess moral values, compassion, and passion in research and learning; logical thinking, breakthrough initiatives, safety mindset, and team spirit; good attitude, working style and responsibility for work.
- Human resources with the ability to integrate globally are those who are able to adapt to regional and international working environments; have language (English) proficiency to communicate effectively in regional and international working environments and acquire new fields of knowledge; demonstrate strong IT skills to advance new knowledge and modern technology.
- High-quality human resources that can make their contribution to Vietnam's socio-economic development are those who are able to increase work productivity to meet the demands of national and international markets; enrich their intellectual and work life through their engagement in community service and contribute to the socio-economic development of the country.

2.1.3. Objectives

In order to have a state-of-the-art management system and to build an educational eco-system for training high-quality human resources contributing to society, bringing practical values as well as the effectiveness from research activities, technology transfer and international cooperation.

To be a premier application-oriented university leading in education, research and technology transfer; promote active community engagement and service; improve vibrant student life and build a state-of-the-art campus; retain and develop professional personnel; strengthen financial autonomy.

2.1.4. Educational Philosophy

IUH's educational philosophy aims to nurture its students and graduates with CARE attributes and to prepare them for life and future world of work.

It educates students and graduates in applying and advancing knowledge through hands-on experience, active and experiential learning and applied research to meet the needs of stakeholders and the society. The IUH community lives in transforming minds and enriching lives and businesses of students, graduates and stakeholders by serving the community and contributing to the betterment of the society.

Articulation of Educational Philosophy

- CARE attributes – To nurture students and graduates as compassionate leaders, avid lifelong learners, rational thinkers, and enterprising innovators.
- Applying and advancing knowledge – curricula are designed to assure their relevancy and currency considering industrial development and trends and stakeholders' needs using outcome-based education to meet national, regional and international quality assurance standards.
- Preparing for life and future of work – immerse students and graduates in the real-life environment and world of work through internships, projects, applied research, experiments, active learning, and community service. Equipping students and graduates with lifelong skills such as critical thinking, creativity, innovation, communication and management skills, compassion and entrepreneurship mindsets.
- Transforming minds, enriching lives and business - through community services, and contributing to businesses and the economy through applied research and technology transfer for a sustainable economy and higher standard of living.

2.2. Vision – Mission of FCE

2.2.1. Vision

Being at the forefront of education, applied research and innovation in the field of Chemical Engineering in Vietnam.

2.2.2. Mission

To offer high quality programs in chemical engineering with high professional qualifications and skills in order to carry out operational requirements, management of production processes, research and technology transfer.

2.3. The programme objectives

The objectives of the MCE Programme are after graduation and working from 3 to 5 years, the graduated students are able to:

PEO1. Synthesiz`es in-depth knowledge and appropriate scientific research methods to independently research and develop scientific perspectives and treatises in the field of Chemical Engineering;

PEO2. Analyze, synthesize and evaluate data and information to solve problems, and perform work in research, teaching, consulting and policy making positions;

PEO3. Preform working independently, creatively, critically, and solve problems; generate new scientific ideas, discoveries and experiments; self-orientate and guide others through professional activities; and continue to participate in the doctoral programme.

2.4. Programme Learning Outcomes

The graduates from this programme are able to demonstrate the following measurable outcomes.

Table 1. Alignment of PLOs, Bloom's level and domain

PLOs		Domain	Bloom's level
PLO1	**Summarize** advanced knowledge and research methods to discuss, communicate and conduct research;	Cognitive	Create (6/6)
PLO2	**Evaluate** research data to solve problems and generate innovative solutions in the field of Chemical Engineering;	Cognitive	Evaluate (5/6)
PLO3	**Develop** manufacturing process for particular product and results of experimental research appropriate to Chemical Engineering discipline;	Cognitive	Evaluate (5/6)
PLO4	**Criticize** specialized issues for scientific ideas, innovation and entrepreneurship;	Psychomotor	Adaptation (5/6)
PLO5	**Display** ethics, lifelong learning and social responsibility in professional activities./.	Affective	Characterization (5/5)

The PLOs are reviewed, evaluated, and ensured in accordance with the programme learning objectives (PEOs)

Table 2. Mapping of PEOs and PLOs

	PEO1	PEO2	PEO3
PLO1	E		
PLO2		E	R
PLO3	R	E	R
PLO4	E	R	E
PLO5			E
Note: I – introduced; R – reinforced; E – emphasize			

Table 3. The mapping the PLOs and the learning outcomes of Vietnamese Qualifications Framework

PLOs	The learning outcomes of Vietnamese Qualifications Framework level 7											
	KT1	KT2	KT3	KN1	KN2	KN3	KN4	KN5	TCTN1	TCTN2	TCTN3	TCTN4
PLO1	x	x	x									
PLO2				x					x		x	
PLO3						x	x				x	
PLO4					x			x	x			
PLO5							x			x		x
	Note: KT - Knowledge, KN – Skills, TCTN – Self-control and responsibility											

Note:

KT1. In-deapth, advanced and practical specialized knowledge, mastering basic principles and theories in the field of research in the specialty of training;

KT2. Relevant milti-disciplinary knowledge;

KT3. General knowledge of administration and management.

KN1. Skills in analyzing, synthesizing, evaluating data and information to come up with solutions to solve problems scientifically;

KN2. Skills in imparting knowledge based on research, discussing professional and scientific issues with peers and with others;

KN3. Skills in organizing, administering and managing professional activities;

KN4. Skills in research, development and creative use of technologies in the academic and professional fields;

KN5. Have foreign language proficiency equivalent to level 4/6 of the Vietnamese Foreign Language Proficiency Framework;

TCTN1. Research and take important initiatives;

TCTN2. Adapt, self-direct, and guide others;

TCTN3. Make expert conclusions in the field of expertise;

TCTN4. Manage, evaluate and improve professional activities.

3. ADMISSION INFORMATION, TRAINING PROCESS AND GRADUATION CONDITION

3.1. Admission information

Based on the regulations of the Ministry of Education and Training, notifications and guidelines of IUH (https://ipe.iuh.edu.vn/)

3.1.1. Admission conditions

- Qualifications: candidates meet one of the following two conditions:
  - a) Having graduated from a university in the correct major, a major suitable to the major or major registered for the examination.
  - b) Having graduated from a university in a discipline close to the major or major, registering for the master's degree training exam and having studied additional knowledge as prescribed.
- Health requirements: Be healthy enough to study.

3.1.2. Candidates' foreign language proficiency requirements

Candidates are considered exempt from the foreign language test if they have one of the following diplomas or certificates:

a) Having university, master or doctoral diplomas trained full-time abroad and having their diplomas recognized by competent agencies according to current regulations (the language used in training is English).

b) Having a university diploma of advanced programs under the scheme of the Ministry of Education and Training on training advanced programs at a number of Vietnamese universities or a high-quality engineer degree (PFIEV) recognized by the Commission for Engineering Degrees (CTI, France) with foreign partners jointly granting degrees.

c) Having a university diploma in English language.

d) Having a foreign language proficiency certificate of at least level 3/6 or higher according to the 6-level foreign language proficiency framework for Vietnam or equivalent within 2 years from the date of issuance of the certificate to the date of registration for the exam, issued by an institution permitted or recognized by the Ministry of Education and Training.

Candidates who do not have foreign language diplomas or certificates as prescribed above must register for the foreign language test in the entrance exam.

3.2. Education process

- Education period: 2 years.
- Education forms: formal.
- The training regulations used are the master's training regulations issued together with Decision No. 1019/QD-DHCN dated August 19, 2015 of the Principal of Ho Chi Minh City University of Industry to facilitate conditions for students to actively and proactively adapt to the education process to achieve the best results in learning and training.
- The Curriculum is built based on the plan to update Curriculum No. 24/KH-DHCN dated May 14, 2021 of the Principal of Ho Chi Minh City University of Industry and Circular No. 17/2021/TT-BGDDT Regulations on training program standards; Develop, evaluate and promulgate education programmes for all levels of higher education.

- Training regulations are built on the basis of Circular No. 23/2021/TT-BGDDT dated August 30, 2021 on promulgating regulations on admission and training for master's degrees.
- The education program is designed to consist of 4 semesters corresponding to 2 years of study, including 60 credits.
- Each school year is divided into 2 main semesters of about 16 weeks of study, 2 weeks of exams, 1 week of reserve and an extra semester of about 8 weeks.
- Registration for the courses to be studied for each semester must ensure the prerequisites, pre- and post-course conditions of each course and the learning sequence of each specific programme.

3.3. Graduation Conditions

a) Students will be recognized as graduating from graduate school and awarded a master's degree if they meet the following conditions:

- Complete the industry/specialized education programme as prescribed.
- Not prosecuted for criminal liability.

b) Graduation ranking for students is done based on the cumulative average score of the major/major (DTBTLN) according to the following evaluation scale:

- Excellent classification: Average score from 9.00 - 10.00.
- Excellent rating: Average score from 8.00 - 8.99.
- Good rating: Average score from 7.00 - 7.99.
- Good average rating: Average score from 6.00 - 6.99.
- Average ranking: Average score from 5.50 - 5.99.
- Cumulative industry average score is the average calculated by coefficient (number of course credits) of all satisfactory final course scores (≥5.50) in the industry/major education programme relate to. The cumulative industry average score is calculated on a 10-point scale and rounded to 2 decimal places.

c) Students with a cumulative industry average score of 9 - 10 points will only be ranked "Excellent" if they do not fall into one of the following cases:

- Have a training period that exceeds the official education period (two years).
- Have the number of retake credits exceeding 10% of the total credits of the education programme.

3.4. Assessment method

According to the credit system training regulations of the Ministry of Education and Training and the Master training regulations of Ho Chi Minh City University of Industry..

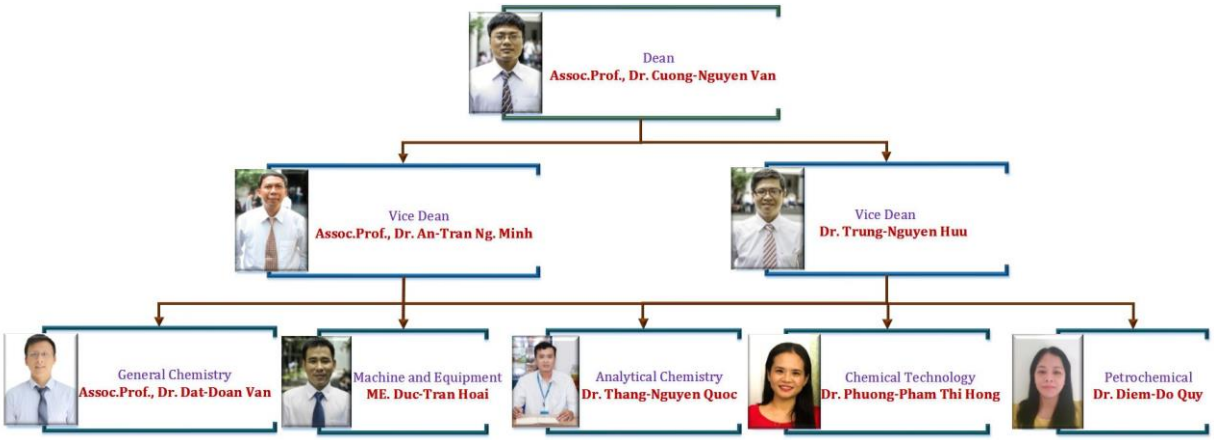
4. ACADEMIC STAFF AND INFRASTRUCTURE

FCE consists of five departments: Department of General Chemistry, Department of Machine and Equipment, Department of Analytical Chemistry, Department of Petrochemical Technology and Department of Chemical Technology and Materials. There are 60 qualified

teaching staffs including 2 associate professors, 20 Ph. Ds holders (ratio 40%), and 44 masters (58%) [Table 4].

Table 4. Academic staff of FCE in year 2021

Level	Male	Female	Sum
Associate Professors	2	0	2
Doctor	12	10	22
Masters	26	18	44
Sum	41	29	60



In FCE, there are 30 laboratories in F Building for teaching and doing research of lecturers and students. The list of laboratories is presented in Table 5. The laboratories and equipment are assigned to each department. There are two staffs who are in charge of chemical, tool, material management and other issues related to the operation of laboratories. Every year, FCE laboratories serve about 2,000 students and lecturers in which a class size of is not more than 25 students in a laboratory.

Table 5. List of laboratories in FCE

Laboratories	General	Specialized	Project	Advanced analysis
Department of Chemical Technology and Materials	2	2		
Department of Petrochemical Technology	1	2	1	
Department of General Chemistry	5	2	1	
Department of Analytical Chemistry	2	2	2	1
Department of Machine and Equipment	1	4		
Management of the Faculty				4

Laboratories, especially specialized laboratories, are equipped with advanced equipment and model-based system for higher training human resource in chemical engineering. The laboratory equipment are listed such as GC-MS, GC-FID, HPLC, IR, UV-Vis,

nitrogen analyzer, compressive strength tester, ASTM based petrochemical products specifications analyzers, pulp systems, extraction systems, distillation systems, etc. In the period of 2006-2009, FCE benefited from the ADB-AFD project with 3.5 Million EUR for high technology equipment for teaching of chemical engineering programme. Additionally, the numerous equipment for teaching practical courses were the research outputs from our lecturers and students.

5. TEACHING LEARNING STRATEGIES

FCE employs the outcomes based approach for teaching and learning at undergraduate level. Based on the expected learning outcomes of the programme (PLOs), the expected learning outcomes for each course (CLOs) are designed, which in turn become the core for the construction and development of teaching plans, syllabi, teaching and learning methods and assessment tools. After the completion of the courses, the CLOs for each course will be evaluated. Subsequently, the program evaluation will be conducted to improve the PLOs - Diagram [*Figure 1*]

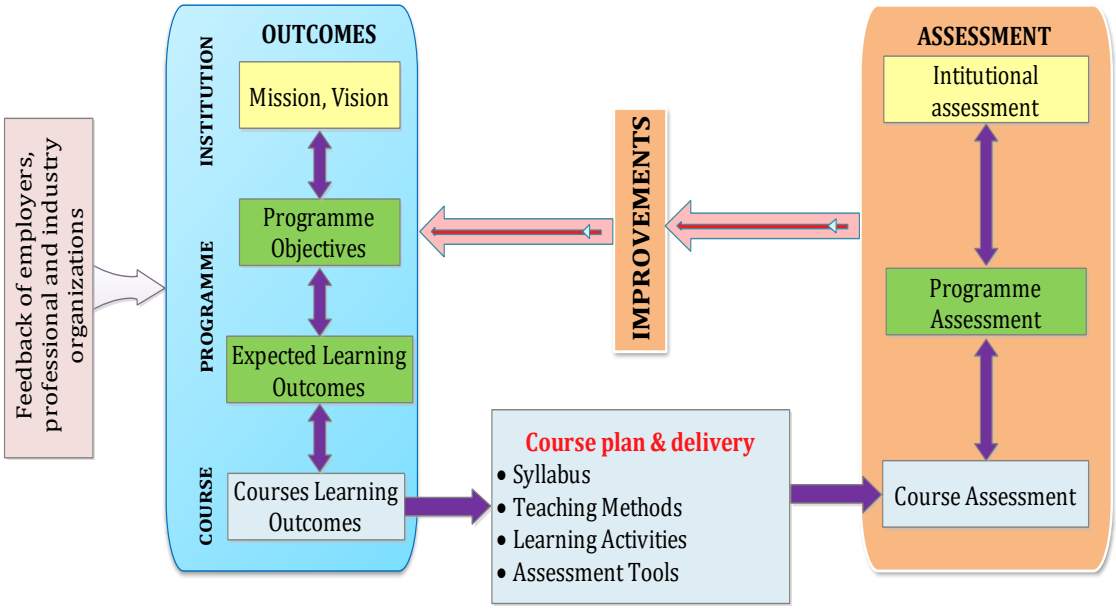


Figure 1. Outcomes-based education framework

List of teaching strategy and teaching methods are used in programme as Table 6.

Table 6. Teaching strategies and methods

Teaching strategies	Description	Teaching methods
Direct instruction	Most theoretical subjects are taught by lecture, quiz, inquiry guided learning, assignments and student self-study through exercises, group discussion and seminars.	• Explicit Teaching • Lecture • Didactic Questions • Demonstrations • Drill & Practice

Indirect instruction	For some courses, lecturers do not actively giving the lessons but only assist the teaching process. Several subjects in the FCE program are chosen to conduct in a problem-based learning or project-based learning approach. For those, the learner is given the best possible environment in terms of funding and other resources for the learning process including business internship, study tour, course plan and graduation thesis.	• Inquiry • Problem Solving • Case Studies • Concept Formulation
Experiential learning	Several subjects of the FCE curriculum are designed based the experiential learning approach, such as fundamental science, discipline fundamental subjects, and specialized subjects. Students take part in practical classes/experiments, business internships, professional development, design blueprints and graduation theses.	• Simulations • Focused Imaging • Role Play • Models • Games • Field Trip • Experiment
Interactive teaching	This teaching strategy is employed in most of the courses in the curriculum. Students do group exercises, group presentations, group experiments, business internships, field trips and graduation theses.	• Debates • Discussions • Problem Solving • Brainstorming • Peer Learning • Reflection
Individual learning	This teaching approach is manifested in experimental work and design in the graduation thesis, thesis presentation, design projects, homework assignments, report writing, individual experiments and self-learning	• Work Assignment • Research Projects • Computer-Aided Instruction • Reflection

These CLOs-based learning methods and CLOs are consistent with the PLOS of the Chemical Engineering Undergraduate Programme, based on the characteristics and expectations of chemistry students. IUH's policy is to provide the best possible financial resources, qualified lecturers/instructors with pedagogical skills, research capabilities, and enthusiasm for teaching, the FCE's infrastructure has frequently improved, equipment is updated by each school year to meet the current and future learning needs, the development of soft skills for students is also paid attention. A variety of assessment methods ensuring the interactivity and time allocation are oulined in the IUH study and assessment plans.

6. ASSESSMENT METHODS

6.1. Process assessment

Assessment methods are carried out based on the CLOs which ultimately reflect the achievement of the PLOs. The assessment must ensure the validity, reliability and fairness. Student assessments include entrance examinations, mid-term and final examinations. The employed assessment methods comprise of multiple choice, short tests, assignments, practical examinations, enterprise internships, laboratory measurement tests, presentation, case

studies, research projects (PBL), poster presentations, paper writing for publication. Course evaluation is carried out based on the rubrics set out for each course. The rubric types include checklists, analytic rubrics, and holistic rubrics. Grading, feedback from students and lecturers are received and processed according to the IUH's procedure [*Figure 2*].

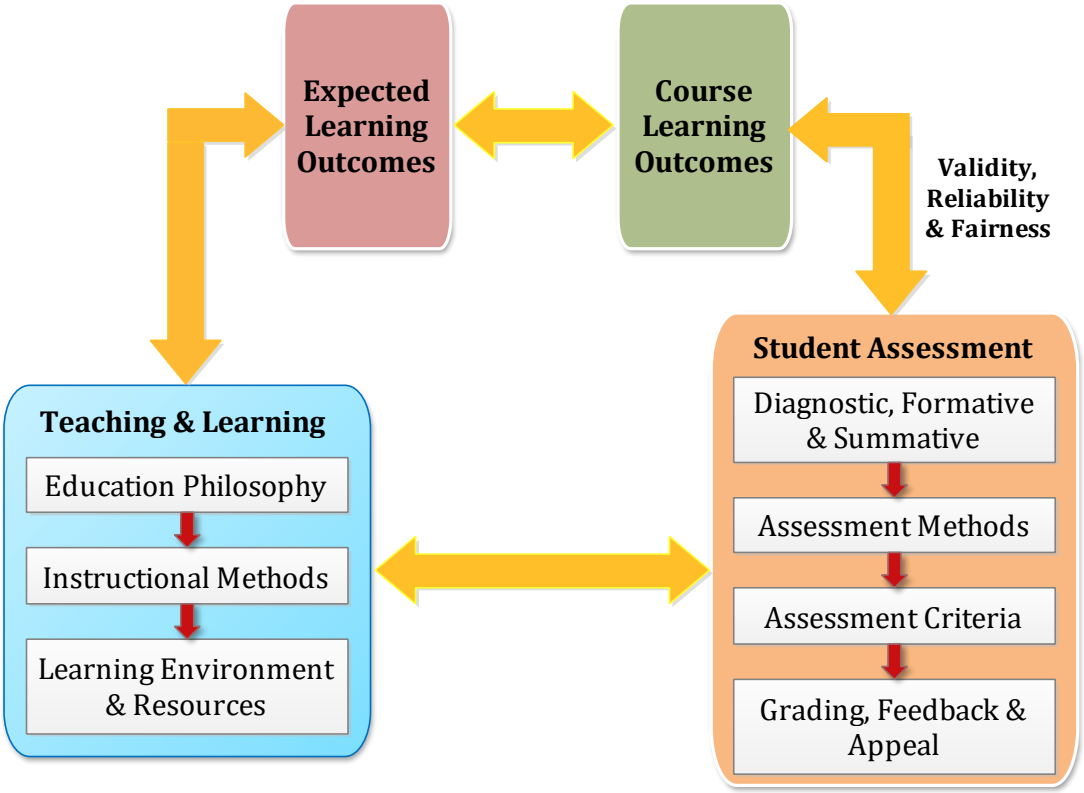


Figure 2. Process teaching - learning and student assessment

6.2. Some rubrics in programme

6.2.1. Poster assessment rubric

CLOs	Contents	Unsatisfactory	Evarage	Good	Excellent	Score limit
1	Introduction	+ The student does not explain why the thesis title was done.	+ The student try to explain why the thesis title was done, but do not understand the problem.	+ The student does not explain why the thesis title was done.	+ Student does not explain very well the context in which thesis title was done, and how important it is.	20
1-7	Contents	+ The contents appear to be incomplete, unsuccessful in addressing the stated purpose.	+ The contents contain major errors + The conclusion are some doubts	+ The contents contain some minors in experiment or designs that are weak main conclusions	+ The contents are not error, beautiful layout, harmony parts.	30

CLOs	Contents	Unsatisfactory	Evarage	Good	Excellent	Score limit
6-7	Layouts	+ The results are no argument or uncertainty and graphics and style are poor.	+ Many shortcomings, more than one goal, method, results and conclusion are unclear.	+ The objectives, methods, results and conclusions are presents clear, but only at the level of exploration. + Some minor aspects of poor presentation need to be re-arranged	+ The objectives, methods, results and conclusions are clearly presented. + Beautiful, clear, coherent and attractive of graphs, drawings and graphics.	30
	Answers questions (Maximum 2 questions)	+ The student does not solve the questions.	+ The student tries to answer the questions, but he/she doesn't understand the problems.	+ Students can answer questions related to the problems and the reviewer understands the problems.	+ Student listens carefully and answers questions easily, accurately.	20

6.2.2. Rubric for assessment of graduate thesis

CLOs	Achievement levels				Min. level to achieve CLO
	Weak	***Average***	***Good***	***Excellent***	
	0 – 3.9	***4.0 – 5.9***	***6.0 – 7.9***	***8.0 – 10***	
CLO1. Summarize knowledge related to research topic in the field of Chemical Engineering.	- Low quality of information, low quality of documents, unreliable sources and insufficient update level, lack of logical methodology and imbalance between sections.	- The information has low reliability, with few reliable citation sources, lack of updates within the past 5 years, and a small number of citations. - The presentation is general and does not explain why the author chose this methodology, and the overall balance of the article is lacking.	- The information has high reliability, with reliable citation sources, updates within the past 5 years, and a sufficient and relevant number of citations. However, there are still a few citations that do not meet the requirements. - The presentation of information is good, with a well-chosen methodology and balance between sections in the article.	- The information has high reliability, with reliable citation sources, updates within the past 5 years, and a sufficient and relevant number of citations. - The thesis demonstrates a balanced presentation across its sections.	Good

CLO2. Assess the experimental results of the project to giving in-depth conclusions in the field of Chemical Engineering	- The problem statement does not demonstrate its timeliness and importance. - The rationale for choosing the topic is not clear. - There is no title or clear research content/objectives.	- The urgency and relevance of the research topic in the context of the field's knowledge and interdisciplinary aspects are not evident. - The logic behind selecting the research topic is not apparent. - There is no title or clear research content/objectives.	- The urgency and timeliness of the research topic in the context of the field's knowledge and interdisciplinary aspects are not demonstrated. - The explanation for why the author chose this research topic is not provided. - There is no title or clear research content/objective.	- The urgency and timeliness of the research topic in the context of the field's knowledge and interdisciplinary aspects are demonstrated. - The explanation for why the author chose this research topic is provided. - The research content/objectives are presented clearly.	Good
CLO3. Design the experimental process of the research topic.	- Failure to select the appropriate research methodology for each research content/hypothesis. - Inadequate presentation of the required raw materials, chemicals, materials, and equipment. - Proposing an incorrect or incomplete method for evaluating the experimental results.	- Selecting the appropriate research methodology for each research content/hypothesi. - Presenting suitable raw materials, chemicals, materials, and equipment. - Proposing the correct experimental method. However, the method for evaluating the results is not fully comprehensive.	- Selecting the appropriate research methodology for each research content/hypothesi. - Presenting suitable raw materials, chemicals, materials, and equipment. - Proposing the correct experimental method. However, the method for evaluating the results is not comprehensive enough.	- Selecting the appropriate research methodology for each research content/hypothesis. Presenting suitable raw materials, chemicals, materials, and equipment. - Proposing the correct and comprehensive method for evaluating the experimental results.	Good
CLO4. Perform criticism of the research topic about achieving the research objectives, the	The experimental results are insufficient and lack supporting evidence and analysis.	- The evaluation of the experimental results is missing, only presenting the experimental data. - The analysis of the compatibility or relationship	- The evaluation of the experimental results is accurate and comprehensive. - The compatibility or relationship between the	- The evaluation of the experimental results is accurate and comprehensive. - The compatibility or relationship between the	Good

scientificity, and the novelty of the research topic..		between the experimental results is incomplete. - There is no comparison of the author's research results with those of colleagues domestically and internationally.	experimental results is clearly identified. - There is a comparison of the author's research results with those of colleagues domestically and internationally. However, there is a lack of identification of new concepts, principles, models, or research findings.	experimental results is clearly identified. - There is a comparison of the author's research results with those of colleagues domestically and internationally. - The identification of new concepts, principles, models, or research findings has been accomplished.	
CLO5. Display lifelong learning and professional ethics in doing research, writing dissertation and oral presentation .	- Very low problem-solving capability; - Failure to adhere to the planned tasks; Insufficient referencing; - Lack of diligence in conducting experiments.	- Inadequate problem-solving skills - Limited adherence to plans - Incomplete citations - Lack of diligence in completing research work	- Strong problem-solving skills - Adherence to plans at a 100% level - Honest in research and citations - Limited hands-on experimentation and unclear lifelong learning abilities	- Strong problem-solving skills - Adherence to plans at a 100% level Honest in research and citations - Enthusiastic attitude towards experimentation and strong lifelong learning abilities	Good

7. CURRICULUM DESCRIPTION

The Curriculum distributed the courses from basic knowledge to specialized knowledge to ensure updated constantly, gradually increasing and have sufficient time to accumulate knowledge. The curriculum distributed system will also let students focus more on learning and archiving specific course learning outcomes and the program's PLOs. In the fundamental knowledge and specialized knowledge, students can choose one of two specialized knowledge groups: research orientation and appication orientation, so that students can select their specialized field for future careers.

7.1. Brief

- Total credits of the training program **60 credits**

- Basic courses group **16 credits**

- Compulsive 06 credits
- Elective 10 credits

- Intermediate courses group **16 credits**

- Compulsive 6 credits
- Elective 10 credits

- Specialized courses group **28 credits**

- Compulsive: 0 credits
- Elective: 13 credits
- Graduate Practice and internship: 15 credits

- Practical credits: 17 credits, ratio 28.3%

7.2. Curriculum

No.	Courses	Credits	CLOs	Bloom's level-domain	Learning activities	Assessment methods
Semester 1		**16(15,2,32)**				
Compulsory courses		***6(6,0,12)***				
1.	Philosophy	3(3,0,6)	1	3 - Cognitive	Short answers, Case studies	Short answers, Test
			2	4 - Cognitive	Discussions, Compare and contrast	Case studies, Test
			3	3 - Cognitive	Short answers, Case studies	Short answers, Test
2.	Scientific research methodology	3(3,0,6)	1	5 - Cognitive	Discussion	Presentation
			2	5 - Cognitive	Discussion	Research proposal
			3	4 - Affective	Discussion	Research proposal
Elective courses 1		***4(4,0,8)***				
3.	Research course 1	4(4,0,8)	1	5 - Cognitive	Lectures, Case Studies, Group Discussions	Examinations, Research Papers, Class Presentations
			2	5 - Cognitive	Problem-Solving Exercises, Data Analysis Software	Quizzes, Problem Sets
			3	5 - Cognitive	Case Studies, Group Projects, Research Seminars	Group Presentations, Research Papers, Peer and Self-Assessment, Final Exam or Oral Exam
4.	Simulation in chemical engineering	2(2,0,4)	1	5 - Cognitive	Questionnaires	Provide alternative solutions
			2	5 - Cognitive	Review paper, Debates	Discussions, report
			3	5 - Cognitive	Review paper, Debates	Report
5.	Statistical methods and experiments design	2(2,0,4)	1	5 - Cognitive	Discussions, worked examples	Report
			2	5 - Cognitive	Discussions, Review paper	Report
			3	5 - Cognitive	Discussions, Review paper	Report, presentation
Elective courses 2		***6(5,2,12)***				
6.	The organometallic chemistry of the	3(3,0,6)	1	5 - Cognitive	Interactive lecture	Discussion
			2	5 - Cognitive	Problem-based learning	Research proposal

	transition metals		3	5 - Affective	Problem-based learning	Criteria for project
7.	Green chemistry	3(3,0,6)	1	5 - Cognitive	Present, concept map, Review paper	Report, Presentation
			2	5 - Cognitive	Present, concept map, Review paper	Report, Presentation
			3	5 - Affective	Critical reflection, Self-report goals (personally and academically)	Report, Presentation
8.	Industrial catalysis	3(3,0,6)	1	4 - Cognitive	Interactive lecture, Discussion	Case studies
			2	5 - Cognitive	Interactive lecture, Discussion	Report, presentation
			3	5 - Cognitive	Problem-based learning	Report, presentation
9.	Advances in analytical chemistry	3(2,2,5)	1	5 - Cognitive	Debates	Discussion
			2	5 - Cognitive	Problem-based learning	Problem-solving tasks, Discussion
			3	5 - Psychomotor	Demonstrations, Discussion	Observation (checklist), Lab reports
Semester 2		**13(13,0,26)**				
Compulsory courses		***3(3,0,6)***				
10.	Chemical engineering thermodynamics	3(3,0,6)	1	5 - Cognitive	Debates, Compare and contrast	Discussion, Provide alternative solutions
			2	5 - Cognitive	Review paper, Debates	Discussions, Report
			3	5 - Cognitive	Review paper, Debates	Discussions, Report
Elective courses 1		***4(4,0,8)***				
11.	Research course 2	4(4,0,8)	1	5 – Cognitive	Review papers	Discussions
			2	5 – Cognitive	Review papers	Discussions
			3	5 – Psychomotor	Analyze and contrast (with charts, tables)	Presentation
			4	6 – Psychomotor	Analyze and contrast (with charts, tables)	Presentation
12.	Electrochemical applications in chemical engineering	3(3,0,6)	1	5 - Cognitive	Debates, Compare and contrast	Problem-solving tasks
			2	5 - Cognitive	Debates, Compare and contrast, review papers	Report and presentation
			3	5 - Cognitive	Debates, Compare and contrast, review papers	Report and presentation
13.	Applied nanomaterials	2(2,0,4)	1	5 - Cognitive	Compare and contrast	Discussion, Report
			2	5 - Cognitive	Debates, Review paper	Discussion, Report
			3	5 - Cognitive	Debates, Review paper	Discussion, Report
Elective courses 2		***6(6,0,12)***				
14.	Separation methods and applications	2(2,0,4)	1	5 - Cognitive	Research Seminars	Report, Presentation
			2	6 - Cognitive	Data analysis	Report; Presentation
			3	5 - Cognitive	Problem-based learning	Report; Presentation

15.	Renewable energy	2(2,0,4)	1	5 - Cognitive	Present, concept map, Review paper	Essay, Presentation
			2	6 - Cognitive	Present, concept map, Review paper	Essay, Presentation
			3	5 - Affective	Critical reflection, Self-report goals (personally and academically)	Essay, Presentation
16.	Seminar	2(2,0,4)	1	5 - Cognitive	Problem-based learning and discussion	Report/Presentation
			2	5 - Cognitive	Problem-based learning and discussion	Presentation
			3	5 - Affective	Discussion	Presentation
17.	Green analytical chemistry and application	2(2,0,4)	1	5 - Cognitive	Review paper	Presentation
			2	5 - Cognitive	Compare and contrast	Presentation
			3	5 - Cognitive	Compare and contrast	Report
18.	Innovation management in chemical engineering	2(2,0,4)	1	4 - Cognitive	Review paper or Compare and Contrast	Report
			2	4 - Cognitive	Review paper or Compare and Contrast	Report
			3	5 - Cognitive	Review paper or Compare and Contrast	Report
			4	5 - Cognitive	Review paper or Compare and Contrast	Report
Semester 3		**16(15,2,32)**				
Compulsory courses		***3(2,2,6)***				
19.	Structural analysis and application	3(2,2,6)	1	5 - Cognitive	Debates and Discussions	Problem-solving tasks
			2	5 - Cognitive	Debates and Discussions	Problem-solving tasks
			3	5 - Psychomotor	Collaborative Learning	Scenario-Based Assessments
Elective courses 1		***4(4,0,8)***				
20.	Research Course 3	4(4,0,8)	1	5 - Cognitive	Paper review	Report, Presentation
			2	5 - Cognitive	Paper review	Report, Presentation
			3	5 - Cognitive	Paper review	Report, Presentation
21.	Organic synthesis and medicinal chemistry	3(3,0,6)	1	6 - Cognitive	Guided reading and discussion, paper club discussions, free response questions	Research article analysis essay, research article presentation, examination
			2	5 - Cognitive	Case studies, data analysis, free response questions	Pharmacological assessment report, presentation, examination

			3	6 - Cognitive	Case-based learning, free response questions	Manufacturing process proposal, presentation, examination
Elective courses 2		***9(9,0,18)***				
22.	Chemistry of natural products	3(3,0,6)	1	5 - Cognitive	Research Seminars	Literature Review and Critique
			2	6 - Cognitive	Data analysis	Presentation
			3	5 - Affective	Ethical Case Studies and Discussions, Sustainable development plan for natural products	Presentation
23.	Drug delivery	3(3,0,6)	1	5 - Cognitive	Learning through creative projects	Written task/essay
			2	6 - Cognitive	In-Class Collaborative Problem Solving Exercise	Oral presentation- in person
			3	6 - Cognitive	Teaching through Design Problem base project	Performance and Written essay
24.	Catalysis for petroleum processing	3(3,0,6)	1	5 - Cognitive	Mind map	Discussion
			2	5 - Cognitive	Compare and contrast	Persuasive essay
			3	6 - Cognitive	Decision-making tasks	Outline alternative solutions
25.	Polymer synthesis and application	3(3,0,6)	1	6 - Cognitive	Lectures, Case Studies, Group Discussions	Examinations, Research Papers, Class Presentations
			2	5 - Cognitive	Problem-Solving Exercises, Data Analysis Software	Quizzes, Problem Sets
			3	5 - Cognitive	Case Studies, Group Projects, Research Seminars	Group Presentations, Research Papers, Peer and Self-Assessment, Final Exam or Oral Exam
26.	Advanced organic synthesis	3(3,0,6)	1	6 - Cognitive	Presentation, discussion, case study, problem solving task, group discussion	Defend
			2	6 - Cognitive	Presentation, discussion, group discussion, case studies	Defend
			3	6 - Cognitive	Problem solving task, Presentation, group discussion	Defend
27.	Advanced methods of physical analysis	3(2,2,5)	1	4 - Psychomotor	Lab experiments	Lab report
			2	5 - Cognitive	Compare and contrast (with charts, tables), journals	Report

			3	5 - Cognitive	Review scientific papers, specialized journals, and books	Report and presentation
Semester 3		**15(0,30,30)**				
Research orientation options						
28.	Master thesis	15(0,30,15)	1	6 - Cognitive	Review paper, discussion	Dissertation, presentation
			2	5 - Cognitive	Pros and cons list, Discussion	Dissertation, presentation
			3	6 - Cognitive	Compare and contrast, mind map, presentation	Dissertation, presentation
			4	5 - Psychomotor	Describe processing, Research projects	Dissertation, presentation
			5	5 - Affective	Instruct students about self-reliance and show ways they can work independently	Dissertation, presentation
Applied orientation options						
29.	Enterprise practice	6(0,12,12)	1	6 - Cognitive	Compare and contrast, pros and cons list	Reports, Presentations
			2	5 - Cognitive	Brainstorm, Pros and cons list	Reports, Presentations
			3	5 - Psychomotor	Provide alternative solutions	Reports, Presentations
			4	5 - Affective	Discussion, Problem Solving	Reports, Presentations
30.	Research project	9(0,18,18)	1	6 - Cognitive	Review paper, discussion	Dissertation, presentation, proposal
			2	5 - Cognitive	Pros and cons list, discussion	Dissertation, presentation, proposal
			3	5 - Psychomotor	Describe processing, Research projects	Dissertation, presentation, proposal
			4	5- Affective	Instruct students about self-reliance and show ways they can work independently	Dissertation, presentation, proposal

7.3. Matrix of integrated courses and expected learning outcomes

No.	Course	Code	PLO1	PLO2	PLO3	PLO4	PLO5
Semester 1		**16 credits**					
Compulsory courses		***6 credits***					
1	Philosophy	**PHI**	① ②				③
2	Scientific research methodology	**SRM**	①			②	③
Elective courses 1 *(Choose 1 or 2 of the courses)*		***4 credits***					

3	Research Course 1	**RC1**	①	② ③			
4	Simulation in chemical engineering	**SCE**	①	②	③		
5	Statistical methods and experiments design	**SED**		① ② ③			
Elective courses 2 *(Choose 2 of the courses)*		***6 credits***					
6	The organometallic chemistry of the transition metals	**OCM**	②	①			③
7	Green chemistry	**GRE**		❶	②		③
8	Industrial catalysis	**ICA**		① ②	③		
9	Advances in analytical chemistry	**AAC**	①	②		③	
Semester 2		**13 credits**					
Compulsory courses		***3 credits***					
10	Chemical engineering thermodynamics	**CET**			❷	❶ ③	
Elective courses 1 *(Choose 1 of the courses)*		***4 credits***					
11	Research course 2	**RC2**		❶ ❷	❹	❸	
12	Electrochemical applications in chemical engineering	**ELA**	❶	②		❸	
13	Applied nanomaterials	**ANM**	❶	❷ ❸			
Elective courses 2 *(Choose 1 of the courses)*		***6 credits***					
14	Separation methods and applications	**SMA**		❸	❶ ❷		
15	Renewable energy	**RNE**		❶	❷		❸
16	Seminar	**SEM**	❶			❷	❸
17	Green analytical chemistry and application	**GAC**		❷ ❸			❶
18	Innovation management in chemical engineering	**ICE**		① ②		❸ ❹	
Semester 3		**16 credits**					
Compulsory courses		***3 credits***					
19	Structural analysis and application	**SAA**	❶ ❷			❸	
Elective courses 1 *(Choose 1 of the group of courses)*		***4 credits***					
20	Research course 3	**RC3**		❶ ❷		❸	
21	Organic synthesis and medicinal chemistry	**OSM**	❶	❷	❸		
Elective courses 2 *(Choose 1 of the courses)*		***9 credits***					
22	Chemistry of natural products	**NCP**	❶	❷			❸
23	Drug Delivery	**DDC**	❶		❷ ❸		
24	Catalyst for petroleum processing	**CGP**	❶	❷	③		

25	Polymer synthesis and application	**POS**	❶	❷ ❸			
26	Advanced organic synthesis	**AOS**	❶	❷	❸		
27	Advanced methods of physical analysis	**AMP**		① ❷		❸	
Semester 4 *(Choose 1 of the group of courses)*		**15 credits**					
Research orientation options		***15 credits***					
28	Master thesis	**THE**	❶	❷	❸	❹	❺
Applied orientation options		***15 credits***					
29	Enterprise practice	**ENP**	❶		❷	❸	❹
30	Research project	**REP**	❶	❷		❸	❹
Note: Symbols: ❶❷❸❹❺_CLOs Colours: **Blue_Introduced**; **Orange_Reinforced**; **Red_Emphasize**							

7.4. Curriculum map

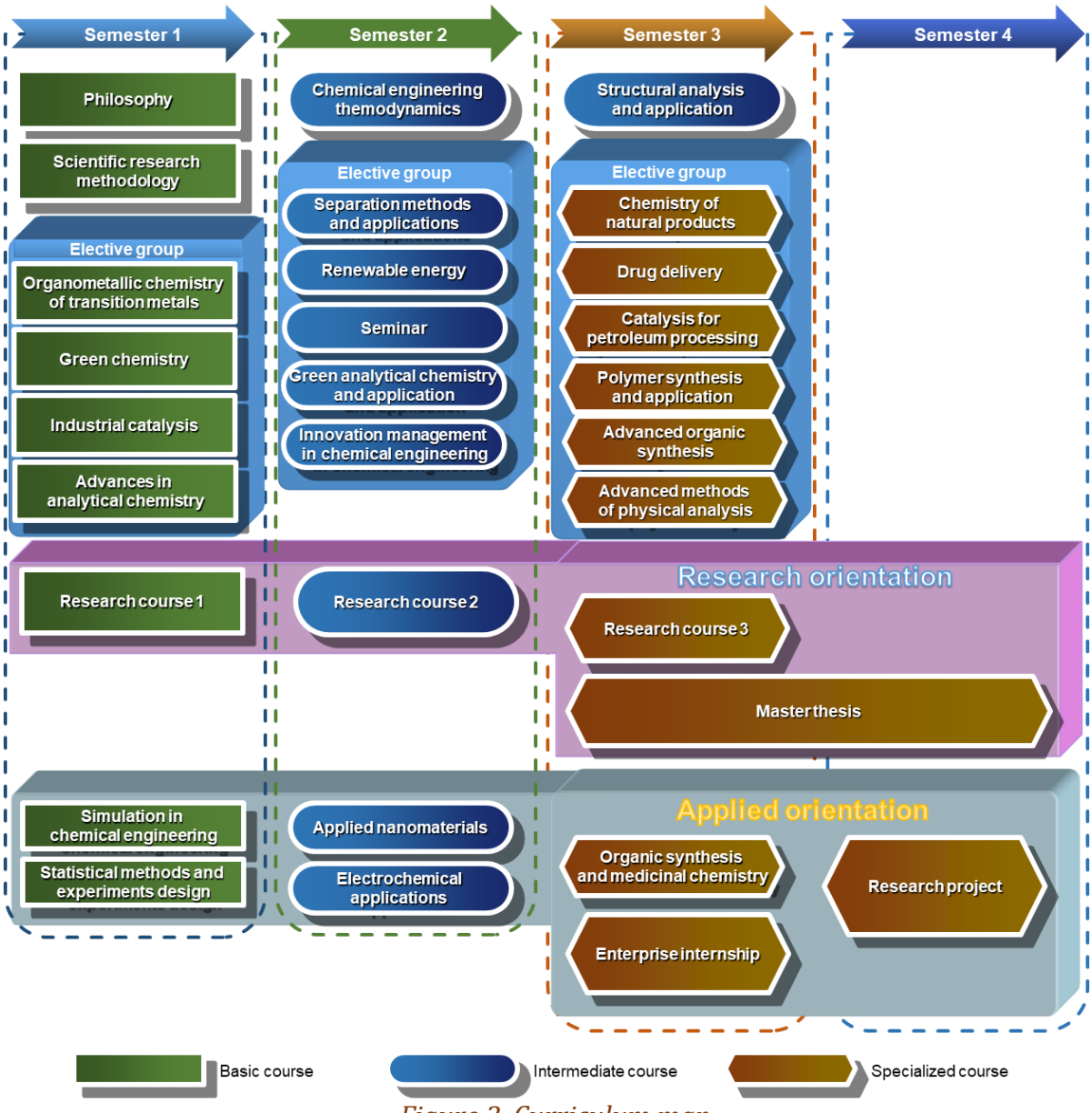


Figure 3. Curriculum map

7.5. Outline of The Courses

1. Philosophy - 3(3,0,6)

- Fostering philosophical thinking, training worldview and philosophical methodology for graduate students and doctoral students in perceiving and researching subjects in the fields of natural science and technology.

- Strengthen awareness of the philosophical theoretical basis of Vietnam's revolutionary policy, especially Vietnam's science and technology development strategy.

2. Scientific Research Methodology - 3(3,0,6)

This course aims to:

- Have basic knowledge of scientific research, research methods, and the sequential steps in the research process;

- Acquire research skills; reading, writing, and thinking skills;

- Have active learning behaviors and attitudes and research integrity awareness.

3. Simulation in chemical engineering - 2(2,0,4)

- Distinguish between the role of simulation in chemistry and chemical technology, between simulation and experiment.

- Using quantum functions to analyze simulations at the molecular level.

- Apply balance equations to simulate chemical systems.

- Simulation calculations on materials and chemical reactions based on different methods.

- Calculation simulation on chemical system based on mathematical functions.

4. Statistical Methods and Experiments Design - 2(2,0,4)

- The primary aim of this course is to provide students with the statistical methods to solve problems related to experiment data and the way to design and analyze experiments to optimize factors affecting the chemical process.

- This course also contributes to applying experiment design and analysis knowledge to conduct independent research practice, carefulness, and honesty in research and professional activities.

5. The organometallic chemistry of the transition metals - 3(3,0,6)

- Provide in-depth knowledge about the nature of metal-ligand bonding, the influence of structure on the properties of organometallic compounds, methods of synthesis, study on their structure;

- The role and position of organometallic chemistry in the environment, living organisms, and other sciences;

- Design and control characteristic reactions involving transition metals in research and manufacturing applications;

- Ability to apply knowledge of the course to conduct independent research, present carefulness and honesty in research and professional activities.

6. Green chemistry - 3(3,0,6)

Students who complete this module will:

- Identify chemical processes that impact to environment

- Recognize how chemical processes can be designed, developed and operated in a sustainable manner.

- Design and improve product synthesis processes and analysis methods towards sustainable development of green chemistry

- Consciously apply new technology and products in the direction of reducing the use of toxic substances, reducing waste generation, reducing energy and increasing the ability to recover raw materials.

7. Industrial catalysis - 3(3,0,6)

- Explain the principle of catalysis for chemical transformation processes on catalytic reactions.

- Describe, explain, and evaluate the catalytic process in chemical reaction.

- Actively self-study and practice independent research skills, have a learning attitude and creative thinking in scientific research

8. Advances in Analytical Chemistry - 3(2,2,5)

- Explain the principles of physico chemical analysis methods and apply them to determine specific analytical criteria;

- Select analitical methods and conditions to solve a specific problem;

- Evaluate experimental results from which to propose improvement;

9. Chemical Engineering Themodynamics - 3(3,0,6)

- Represent the thermodynamic properties of real substances such as elements, mixtures, and solutions.

- Apply thermodynamic laws to calculate processes: phase equilibrium, stoichiometry, phase diagram, and surface thermodynamics.

- Calculate the thermodynamic parameters for the mixture of 2 components.

10. Seminar - 2(2,0,4)

- Summarize advanced knowledge to prepare quality scientific reports on nanomaterials applied in some fields such as photocatalysis, analysis and biomedicine, medicine - pharmacy;

- Generate ideas about designing appropriate synthesis methods and nanomaterials based on knowledge of nanomaterials, new materials, and in-depth interdisciplinary knowledge;

- Criticize scientific reports in specialized fields;

- Display a positive learning and awareness attitude in discussing, contributing ideas, adjusting understanding appropriately, and drawing necessary lessons.

11. Green Analytical Chemistry and Application - 2(2,0,4)

- Compare the green analytical methods;

- Analyze /Choose the green analytical methods;

- Improve analytical methods to meet the sustainable development of green analytical chemistry.

12. Innovation Management in Chemical Engineering - 2(2,0,4)

- Apply the fundamentals of innovation management

- Analyse the process of innovation project in innovation project

- Criticise different models of innovation in practice

- Criticise an innovation project

13. Chemistry of natural products - 3(3,0,6)

- Define and classify natural products based on their chemical structure and origin;

- Explore strategies and synthetic methodologies used in the laboratory for the total synthesis of complex natural products;

- Analyze the role of natural products in industries such as pharmaceuticals, cosmetics, agriculture, and food production; Investigate challenges and opportunities in utilizing natural products for industrial purposes;

- Determine the biological activities and applicability of natural compounds, thereby propose the development of related research and technology;

- Discuss ethical considerations related to the sourcing and utilization of natural products; Emphasize the importance of sustainable practices and conservation efforts;

- Apply knowledge of natural products chemistry to solve real-world problems; Critically evaluate scientific literature and research findings in the field;

- Communicate scientific concepts, findings, and research effectively through presentations, reports, and discussions;

- Recognize the interdisciplinary nature of natural product chemistry and its relevance to chemical engineering.

14. Drug Delivery - 3(3,0,6)

- Update basic knowledge of drug delivery, in-depth knowledge of drug delivery mechanism, and common polymers in drug delivery;

- The role and position of nanotechnology in drug delivery;

- Design and control of typical reactions involving transition metals in production and research applications;

- Ability to apply knowledge from the module to conduct independent research, practice carefulness and honesty in research and professional activities.

15. Catalysis for Petroleum Processing - 3(3,0,6)

- Analyze and evaluate the characteristics, quality and development directions of catalysts used in oil and gas processing processes

- Organize and carry out the catalytic research process in laboratory conditions

- Ability to apply knowledge from the module to conduct independent research, practice carefulness and honesty in research and professional activities.

16. Polymer Synthesis and Application - 3(3,0,6)

- After finishing this course, learners are able to:

+ Summary the difference of theoretical basis of polymer synthesis including step polymerization, radical polymerization, ionic polymerization, copolymerization, and ring opening polymerization;

+ Analyze a polymer synthesis process;

+ Evaluate the basic parameters of synthetic polymer materials such as: monomer concentration, efficiency, average degree of polymerization;

+ Design a polymer synthesis strategy from some available monomers;

+ Evaluate the results from the synthesized polymer under given synthesis conditions.

17. Advanced organic synthesis - 3(3,0,6)

- Evaluate the strategy for organic synthesis of a structure.

- Select effective synthesis methods.Present the reactants, catalysts, reaction conditions and write the mechanisms of related reactions.

- Present the theoretical basis of methods for determining biological activity."

18. Advanced Methods of Physical Analysis - 3(2,2,5)

- Provide learners with advanced and in-depth knowledge regarding the theoretical foundations and operational principles of contemporary physical analysis methods, encompassing XRD, TEM, SEM, DLS, BET, TGA, DSC, and DTA.

- Use the results derived from state-of-the-art physical analysis techniques to process data and evaluate material characteristics, as well as elucidate the influential factors impacting the results obtained from physical analysis methods.

- Employ the knowledge acquired in the course to critique specialized literature pertaining to material analysis.

19. Structural Analysis and Application - 3(2,2,5)

This course is designed to impart knowledge and practical skills in the field of mass spectrometry and NMR and their associated techniques. The curriculum encompasses the core principles of mass spectrometry instrumentation. It explores the application of mass spectrometry in the analysis of a diverse range of substances, from basic organic molecules to complex biomolecular structures. Furthermore, the course delves into the role of mass spectrometry as an analytical method in environmental chemistry and forensic science.

20. Research Course 1 - 4(4,0,8)

After finishing this course, learners are able to:

- Analysis of the theoretical basis for the formation of geopolymeric materials.

- Distinguish between industrial waste sources such as cement dust, silica powder, molded sand, and fly ash.

- Application of industrial waste sources to synthesize geopolymer materials.

21. Research Course 2 - 4(4,0,8)

- Apply theoretical basis to explain reaction mechanisms of polymer synthesis using NMP, RAFT, and ATRP methods.

- Able to direct the synthesis of copolymer chains using NMP, RAFT, and ATRP methods.

- Explain the formation of polymer chains on solid surfaces."

22. Research Course 3 - 4(4,0,8)

- Evaluation of synthesis methods and characterization methods of MOFs and composites based on MOFs in the field of adsorption and photocatalysis.

- Evaluate the effectiveness and applicability of MOFs and MOFs-based composites in solving problems in the fields of adsorption and photocatalysis.

- Review technical issues and provide constructive opinions to improve the performance and application of MOFs and MOFs-based composites in practical applications.

23. Organic Synthesis and Medicinal Chemistry - 3(3,0,6)

- Evaluate advanced research articles and experimental data related to organic synthesis and medicinal chemistry;

- Demonstrate ability to summarize knowlegde and communicate complex research findings effectively;

- Assess the effectiveness and safety of synthesized compounds through comprehensive in vitro and in vivo pharmacological assays and data analysing;

- Evaluate the advantages and disadvantages of chemical synthesis strategies for specific pharmaceutical products;

- Propose manufacturing processes, integrating experimental research and advanced synthetic methodologies to ensure product quality, safety, and efficacy.

24. Applied Nanomaterials - 2(2,0,4)

- Classifying nanomaterials, nanocomposites and evaluate their applicability;

- Selecting suitable methods of synthesizing nanomaterials and nanocomposites, choosing appropriate modern analytical techniques to study the properties of nanomaterials;

- Applying course knowledge to analyze, discuss and interpret data related to results obtained from modern physicochemical analysis methods such as structure, surface morphology, chemical composition surface, and specific surface area of nanomaterials. Forming logical thinking, checking and evaluating results obtained from modern physicochemical analysis methods;

- Develop teamwork skills, independent work, and Presentation skills.

25. Separation Methods and Applications - 2(2,0,4)

- Explain and apply methods for extracting a mixture of organic matter;

- Apply the principles of chromatography method to isolate organic compounds;

- Apply advanced and in-depth knowledge of extraction methods to select, analyze and evaluate a sample preparation process;

- Ability to apply logical thinking, test and evaluate organic compounds; search, synthesize references and critical thinking to draw expert conclusions in designing an appropriate sample preparation process; Professional presentations, effective communication and fulfillment of faculty work requirements.

26. Renewable energy - 2(2,0,4)

Provide students with the knowledge to:

- Identify renewable energy sources

- Assess the potential for using renewable energy sources

- Distinguish the roles and applications of energy storage systems

- Distinguish between energy conversion methods"

27. Electrochemical Applications in Chemical Engineering - 3(3,0,6)

- To interpret and study on electrode reactions which occur during electrolysis, voltage cells and other industry

- Knowing the corrosion phenomena and its prevention.

- Interpreting the Electrochemical phenomenon in photoelectrochemical reactions.

- To build a foundation for further study of specialized subjects and/or research in Chemical Engineering Major.

28. Master Thesis - 15(0,30,15)

Helps learners have the following abilities:

- Write a research proposal synthesizing chemical products or projects related to the Chemical Technology industry.

- Develop projects and research implementation processes related to the Chemical Technology industry.

- Evaluate, criticize and publish research results in the field of Chemical Technology, and at the same time implement research results into practical applications.

- Analyze and apply in-depth knowledge to solve practical problems or topical issues in the field of chemistry.

- Lifelong learning and practicing professional ethics"

29. Enterprise Partice - 6(0,12,6)

- Apply specialized knowledge to solve practical problems in the laboratory or at businesses or research institutes;

- Practice the specialized skills of a master's student and develop the working style and methods of a master's student in chemical engineering in professional activities;

- Build capabilities, analyze, synthesize, propose and solve problems along with soft skills.

- Build the ability to be autonomous, adaptable, self-directed and solve career-related tasks, preserving and promoting corporate identity and culture;

- Propose a scientific, technological and economic solution in scientific and technological activities at the internship unit."

30. Research Project - 9(0,18,9)

- Help students self-study scientific research documents and articles to orient their research;

- Design and analyze experiments to optimize factors affecting the chemical process using appropriate models from which to propose options in practical production;

- Proficient in using statistical software and experimental planning software for research and professional activities;

- Ability to apply knowledge from the module to conduct independent research, practice carefulness and honesty in research and professional activities.

8. PHOTOS OF FACILITIES







Figure 4. Analytical devices for teaching and research



Dropping point apparatus



Open cup flash point apparatus



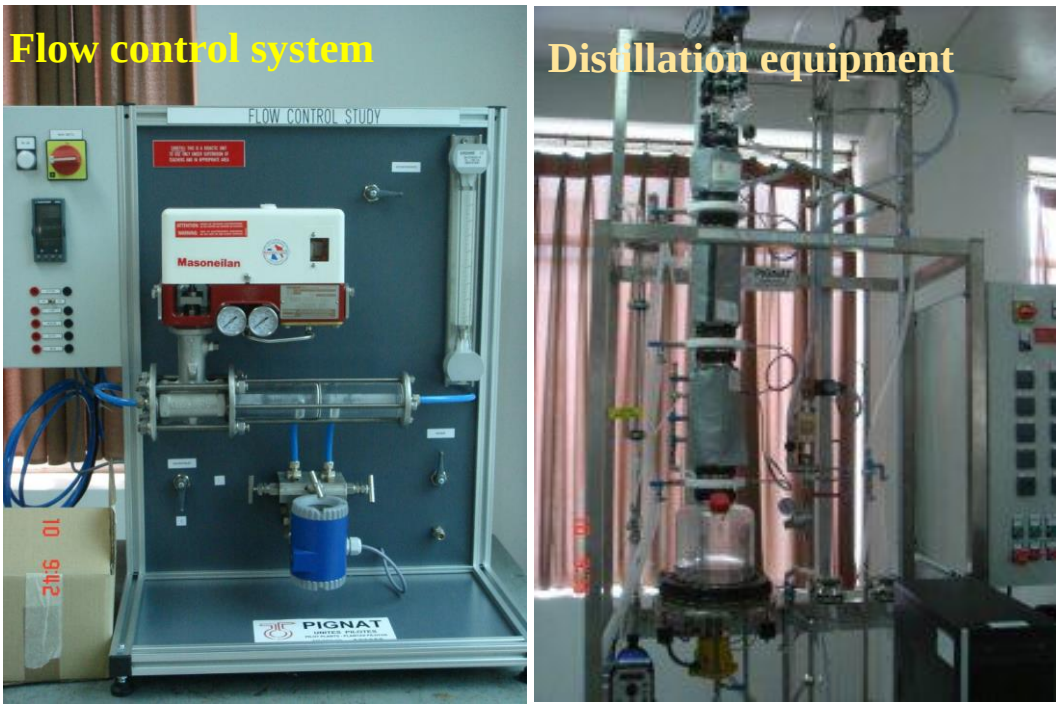


Figure 5. The equipments for teaching and research

9. ACTIVITIES IN THE TRAINING PROGRAM



Figure 6. Pictures in the teaching, learning, and practices



Figure 7. Field trip pictures



Figure 8. The international student internship at FCE - IUH



Figure 9. Pictures thesis defense of Chemical Engineering Students



Figure 10. Pictures of sport activities



Figure 11. Pictures of cultural and artistic activities



Figure 12. Pictures of other non – acadamic activities

10. OUTSTANDING ACHIEVEMENT



Figure 13. Scientific research awards



Figure 14. Education quality assurance

11. APPROVAL OF PROGRAMME SPECIFICATION

Programme specification was checked, approved and revised according to the process and regulations of the Inductrial University Industry of Ho Chi Minh city./.

Ho Chi Minh City, July 2022

Dean of FCE

ASSOC. PROF. DR. NGUYEN VAN CUONG