

CHƯƠNG TRÌNH GIÁO DỤC ĐẠI HỌC UNDERGRADUATE PROGRAM

Tên chương trình: **Chương trình tiên tiến Kỹ thuật Hóa học**
Advanced Program in Chemical Engineering

Trình độ đào tạo: Đại học (Kỹ sư)
Undergraduate (Engineer)

Ngành đào tạo: Kỹ thuật Hóa học
Chemical Engineering

Loại hình đào tạo: Chính quy tập trung
Full-time

1 MỤC TIÊU ĐÀO TẠO – Educational Objectives

Mục tiêu của chương trình là tạo ra một chương trình đào tạo linh hoạt, mềm dẻo, cho phép sinh viên tiếp cận được các thành tựu phát triển mới nhất trong lĩnh vực Kỹ thuật Hóa học; cung cấp cho sinh viên các kiến thức kỹ thuật chuyên sâu, phát triển suy luận, nghiên cứu giải quyết các vấn đề chung của các khoa học kỹ thuật và công nghệ hóa học, chế biến dầu và khí. Các sinh viên sau khi tốt nghiệp ra trường có khả năng

- Áp dụng các kiến thức toán học, khoa học và kỹ thuật để giải quyết các vấn đề trong kỹ thuật hóa học, chế biến dầu và khí.
- Làm việc theo nhóm để thiết kế, đánh giá các thành phần, các hệ thống hoặc các quá trình công nghệ hóa học, chế biến dầu và khí.
- Có khả năng tự học, tự nghiên cứu, tư duy logic và phương pháp luận nghiên cứu khoa học
- Tham gia vào các nghiên cứu, học tập nâng cao, nắm bắt được các vấn đề cơ bản đương đại của Kỹ thuật Hóa học và chế biến dầu khí.
- Có thể làm việc trong nhiều lĩnh vực như trong nền công nghiệp dầu khí, công nghệ hóa học và môi trường.
- Có thể trình bày, trao đổi, giao tiếp một cách hiệu quả cả tiếng Anh và tiếng Việt.
- Thành thạo Anh ngữ và có thể làm việc ở môi trường quốc tế.
- Giải quyết các vấn đề đạo đức, chuyên môn và xã hội liên quan.

The objectives are to provide a flexible curriculum that enable students to keep up-to-date the latest developments in the field of chemical engineering and oil and gas processing, to provide distinctive knowledge in the area of engineering, and to

develop critical thinking for solving problems. The outcomes from the program are characterized by the following capabilities of students:

- Apply mathematics, science, and engineering to solve problems emerged in the chemical engineering and oil and gas processing fields.
- Work in multidisciplinary teams to design and evaluate components, systems or processes in the characterization of chemical engineering and oil and gas processing fields.
- Ability to self-study and research, to have logical thinking and scientific methodology. Address ethical, professional, and societal problems associated with the interactions between biological and non-biological systems.
- Engage in advanced study, life-long learning, and be aware of current issues in chemical engineering and oil and gas processing fields.
- Professional employment in areas such as petroleum industry, chemical and environmental.
- Communicate effectively.
- Effluent in English

2 THỜI GIAN ĐÀO TẠO THEO THIẾT KẾ - Program Duration

4 năm (4 years)

Gồm 1 kỳ học tăng cường tiếng Anh và 1 học kỳ làm luận văn tốt nghiệp

Including 1 quarter of Advance English Training and 1 quarter for thesis research and writing.

3 KHỐI LƯỢNG KIẾN THỨC TOÀN KHÓA – Required Total Credits

165 tín chỉ không kể chương trình bồi dưỡng nâng cao trình độ tiếng Anh học song song trong năm học thứ nhất, không bao gồm Giáo dục Thể chất và Giáo dục Quốc phòng.

Total credit is 165 which excludes English improvement program during the freshman and Physical and National Security Education.

4 NỘI DUNG CHƯƠNG TRÌNH – Curriculum

Cấu trúc chương trình đào tạo (Curriculum structure)

KHỐI KIẾN THỨC (Courses)			SỐ TC (No. Credits)
Các học phần bắt buộc (146 TC) <i>Compulsary courses (146 Credits)</i>	1	Kiến thức giáo dục đại cương <i>General Education (Mathematics, Physics, Chemistry, Biology, English, ...)</i>	65
	3	Kiến thức cơ sở ngành <i>Major core courses</i>	46
	4	Kiến thức chuyên ngành <i>Concentration courses</i>	30
	5	Thực tập tốt nghiệp và thiết kế tốt nghiệp <i>Graduation practice and Graduation Thesis</i>	6
Các học phần tự chọn (18 TC) <i>Elective courses (18 Credits)</i>	6	Các học phần tự chọn <i>Elective Courses</i>	18
Tổng cộng – Total			165

5 KẾ HOẠCH HỌC TẬP – CURRICULUM

5.1 KẾ HOẠCH HỌC TẬP – CURRICULUM

Bảng 1. Kế hoạch học tập Chương trình tiên tiến - Đại học Mở - Địa chất
(Table 1 – Curriculum of the Advance Program in Chemical Engineering at HUMG)

I. Kiến thức giáo dục đại cương

STT	Mã học phần	Tên học phần	Khối lượng	Số chuyên ngành học trong học kỳ								Ghi chú
			A(X-Y-Z)	1	2	3	4	5	6	7	8	
1. Kiến thức toán và khoa học, tự nhiên (Toán học, Vật lý, Hóa học, Sinh học)				46								
1	MAT 21A1	Phép tính 1- <i>Calculus 1</i>	3		x							
2	MAT 21B1	Phép tính 2 - <i>Calculus 2</i>	3		x							
3	MAT 21C1	Phép tính 3 - <i>Calculus 3</i>	3			x						
4	MAT 21D1	Phân tích Véc tơ - <i>Vector Analysis</i>	3			x						
5	MAT 22A	Đại số tuyến tính - <i>Linear</i>	3				x					

3	CHE 128A	Hóa hữu cơ 1 - <i>Organic Chemistry 1</i>	3			x							
4	ENG 45	Tính chất vật liệu - <i>Properties of Materials</i>	4			x							
5	CHE 128B	Hóa Hữu cơ 2 - <i>Organic Chemistry 2</i>	3				x						
6	ECH 140	Phương pháp toán học trong kỹ thuật hóa học và hóa sinh - <i>Mathematical methods in biochemical and chemical engineering</i>	4				x						
7	ECH 152A	Nhiệt động học 1 - <i>Thermodynamics 1</i>	3				x						
8	CHE 110A1	Hóa lý 1 - <i>Physical Chemistry 1</i>	2				x						
9	ECH 51	Cân bằng vật liệu - <i>Material Balance</i>	4				x						
10	ECH 141	Cơ học chất lỏng - <i>Transport Phenomena (Fluids)</i>	4					x					
11	CHE 129A	Thí nghiệm Hóa hữu cơ - <i>Organic Chemistry Laboratory</i>	2					x					
12	ECM 6	Phương pháp tính trong kỹ thuật hóa học và khoa học vật liệu - <i>Computers in Chemical Engineering & Materials Science</i>	4					x					
13	ECH 142	Truyền nhiệt - <i>Transport Phenomena (Heat)</i>	4					x					
14	ECH 152B	Nhiệt động học 2 - <i>Thermodynamics 2</i>	4					x					
15	CHE 110B1	Hóa lý 2 - <i>Physical Chemistry 2</i>	2					x					
16	CHMS Elective	Môn học lựa chọn trong Kỹ thuật Hóa học và Khoa học vật liệu - <i>Electives in Chemical Engineering & Materials Science</i>	2					x					
17	ECH 158A	Thiết kế 1 - <i>Design 1</i>	4						x				
18	ECH 143	Truyền khối - <i>Transport Phenomena (Mass)</i>	4						x				
19	ECH 155A	Thí nghiệm Kỹ thuật Hóa học - <i>Chemical Engineering Laboratory</i>	4						x				
20	ECH 146A	Động học - <i>Kinetics</i>	4						x				
21	ECH 157	Điều khiển quá trình - <i>Process Control</i>	4						x				
22	ECH 158B	Thiết kế 2 - <i>Design 2</i>	4							x			
23	ECH 155B	Thí nghiệm Kỹ thuật Hóa học - <i>Chemical Engineering Laboratory</i>	2							x			
24	CHMS Elective	Môn học lựa chọn trong Kỹ thuật Hóa học và Khoa học Vật liệu - <i>Electives in Chemical Engineering & Materials Science</i>	2							x			
25	ECH 158C	Thiết kế 3 - <i>Design 3</i>	4							x			

II. 2 Chuyên ngành, thực tập và luận văn tốt nghiệp

II.2.1 Lọc hóa dầu

20

STT	Mã học phần	Tên học phần	Khối lượng A(X-Y-Z)	Số chuyên ngành học trong học kỳ								Ghi chú
				1	2	3	4	5	6	7	8	

4	ECH 161A	Kỹ thuật Hóa sinh - <i>Biochemical Engineering Fundamentals</i>	4
5	ECH 166A	Xúc tác – <i>Catalysis</i>	2
6	ECH 170	Hiện tượng bề mặt và keo tụ - <i>Introduction to Colloid and Surface Phenomena</i>	3
7	EMS 146	Động học - <i>Kinetics</i>	3
8	EMS 147A	Nguyên lý Khoa học vật liệu Polyme - <i>Principles of Polymer Materials Science</i>	2
9	EMS 181A	Chế tạo vật liệu - <i>Materials Processing</i>	2
10	ECM 146	Phân tách sinh học – <i>Bioseparations</i>	5
11	ECH 143A	Đồ án Quá trình và Thiết bị Công nghệ hóa học – <i>Topics on unit operations of chemical engineering</i>	2

2. Tối thiểu 6 TC trong học phần “Technical Electives” được lựa chọn từ một trong những học phần sau (Bảng 3) *At least 6 credits must be selected in the Technical Electives courses listed below*

Bảng 3. Danh sách môn học trong học phần “Technical Electives” – CTTT

Table 3. List of courses in the Technical Electives

STT	Mã môn học	Tên môn học	Số tín chỉ
1	CHE 110C	Hóa lý - <i>Physical Chemistry</i>	4
2	CHE115A	Phân tích dụng cụ - <i>Instrumental Analysis</i>	2
3	ECH 144	Lưu biến học và chế biến polyme - <i>Rheology and Polymer Processing</i>	3
4	ECH 160A	Chế biến sinh học - <i>Fundamentals of Biomanufacturing</i>	2
5	ECH 161A	Kỹ thuật Hóa sinh - <i>Biochemical Engineering Fundamentals</i>	4
6	ECH 166A	Xúc tác – <i>Catalysis</i>	2
7	ECH 170	Hiện tượng bề mặt và keo tụ - <i>Introduction to Colloid and Surface Phenomena</i>	3
8	EMS 147A	Nguyên lý Khoa học vật liệu và polyme - <i>Principles of Polymer Materials Science</i>	2
9	EMS 172	Tính chất quang, từ, điện của vật liệu - <i>Electronic, Optical and Magnetic Properties of Materials</i>	4
10	EMS 172L	Thí nghiệm Tính chất quang, từ, điện của vật liệu <i>Electronic, Optical and Magnetic Properties Laboratory</i>	2
11	EMS 180A	Vật liệu Thiết kế Kỹ thuật - <i>Materials in Engineering Design</i>	2
12	EMS 181	Chế biến vật liệu - <i>Materials Processing</i>	4
13	EMS 182	Phân tích sai hỏng - <i>Failure Analysis</i>	4

3. Tối thiểu 8 TC trong học phần “Major Electives” được lựa chọn từ một trong những học phần sau (Bảng 4) *At least 8 credits must be selected in the Major Electives*

listed below

Bảng 4. Danh sách môn học trong học phần “Major Electives” – CTTT

Table 4. List of courses in the Major Electives.

STT	Mã môn học	Tên môn học	Số tín chỉ
1	ADECH01A	Hóa học dầu mỏ - <i>Chemistry of Petroleum</i>	2
2	ADECH02A	Công nghệ lọc dầu - <i>Oil Refining Technology</i>	2
3	ADECH03A	Công nghệ chế biến khí - <i>Gas Conditioning and Processing</i>	2
4	ADECH04A	Công nghệ Hóa dầu - <i>Petrochemical Technology</i>	2
5	ADECH05A	Công nghệ nhiên liệu sạch - <i>Clean Fuel Technology</i>	2
6	ADECH02A1	Đề án Công nghệ lọc dầu - <i>Topics on Oil Refining Technology</i>	2
7	ADECH03A1	Đề án Công nghệ chế biến khí - <i>Topics on Gas Conditioning and Processing</i>	2
8	ADECH04A1	Đề án Công nghệ Hóa dầu - <i>Topics on Petrochemical Technology</i>	2

VĂN PHÒNG
CHƯƠNG TRÌNH TIÊN TIẾN

Thang
TS. *Lông Ngọc Thảng*

HIỆU TRƯỞNG



GS.TS *Trần Thanh Hải*

HK1(26TC)	HK2(25TC)	HK3(28TC)	HK4(26TC)	HK5(26TC)	HK6(26TC)	HK7(24TC)	HK8(17TC)
HIS 1 20 Basic Principles of Marxism – Leninism 1 HIS 3 30 Revolutionary Way of Vietnam's Communist Party	ECH80 10 Chemical Engineering Profession MAT21A 30 Calculus 1 CHE 2A 40 Chemistry 1 MAT21B 30 Calculus 2 CHE 2B 50 Chemistry 2 ENL1 40 English 1 ENL 200 English Improvement Program	PHY 9A 40 Classical Physics 1 ENG 45 40 Properties of Materials MAT21C 30 Calculus MAT 21D 30 Vector Analysis CHE 2C 50 Chemistry ENL2 20 English 2	PHY 9C 40 Classical Physics 3 CHE 128B 30 Organic Chemistry 2 ECH 140 40 Mathematical methods in biochemical and chemical engineering MAT22A 30 Linear Algebra CHE 110A 20 Physical Chemistry 1 MAT22B 30 Differential Equations	ECM 6 40 Computers in Chemical Engineering CHE 129A 20 Organic Chemistry Laboratory ECH 141 40 Transport Phenomena (Fluids) ECH 152B 40 Thermodynamics 2 CHE 110B 20 Physical Chemistry 2 ECH 142 40 Transport Phenomena (Heat)	ECH 158A 40 Design 1 ECH 146 40 Kinetics ECH 143 40 Transport Phenomena (Mass) ECH 155A 40 Chemical Engineering Laboratory 1 ECH 157 40 Process Control TE 1 20 Technical Elective	ECH 158B 40 Design 2 ME 3 20 Major Elective HIS 2 30 Basic Principles of Marxism – Leninism 2 ECH 155B 20 Chemical Engineering Laboratory 1 PHIS 3 10 Physical Education 3 ECH 158C 40 Design 3 CE 2 20 CHMS Elective TE 3 20 Technical Elective ME 4 20 Major Elective HIS 5 20 General Laws	Manufacturing Internship Graduate Internship Thesis 60 Thesis GDQP 110 National Defence Education

Major Electives (ME) in Oil Refining and Petrochemistry Engineering: 8 credits

- ADECH 01A 20
Chemistry of Petroleum
- ADECH 02A 20
Oil Refining Technology
- ADECH 03A 20
Gas Conditioning and
Processing
- ADECH 04A 20
Petrochemical Technology
- ADECH 05A 20
Clean Fuel Technology
- ADECH02A1 20
Topics on Oil Refining
Technology
- ADECH03A1 20
Topics on Gas Conditioning
and Processing
- ADECH04A1 20
Topics on Petrochemical
Technology

Technical Electives for Chemical Engineering (TE): 6 credits

- CHE 110C 20
Physical Chemistry
- CHE115A 20
Instrumental Analysis
- ECH 144 30
Rheology and
Polymer Processing
- ECH 160A 20
Fundamentals of
Biomaterials
- ECH 166A 20
Catalysis
- ECH 170 30
Introduction to Colloid
and Surface Phenomena
- EMS 147A 20
Principles of Polymer
Materials Science
- EMS 172 40
Electronic, Optical and
Magnetic Properties of Materials
- EMS 172L 20
Electronic, Optical and
Magnetic Properties Laboratory
- EMS 180A 20
Engineering Design
Materials in
- EMS 181 40
Materials Processing
- EMS 182 40
Failure Analysis
- ECH 161A 40
Biochemical Engineering
Fundamentals

Electives in Chemical Engineering & Materials Science (CE): 4 credits

- ECH 166A 20
Catalysis
- CHE 110C 40
Physical Chemistry
- ECH 144 30
Rheology and Polymer
Processing
- ECH 160A 20
Fundamentals of
Biomaterials
- ECH 161A 40
Biochemical Engineering
Fundamentals
- ECH 143A 20
Topics on Unit Operations of
Chemical Engineering
- ECH 170 30
Introduction to Colloid
and Surface Phenomena
- EMS 147A 20
Principles of Polymer
Materials Science
- EMS 181 40
Failure Analysis
- ECM146 50
Bioseparations

Chú thích (Notes)

Mã học phần
(Code)

Số tín chỉ
(Credit)

ECH 152A 20

CURRICULUM MAPPING (KẾ HOẠCH HỌC TẬP CHUẨN) – ADVANCED PROGRAM IN CHEMICAL ENGINEERING (CHƯƠNG TRÌNH TIẾN TIẾN KỸ THUẬT HÓA HỌC)-K9-2020

HK1(26TC)	HK2(27TC)	HK3(28TC)	HK4(26TC)	HK5(26TC)	HK6(26TC)	HK7(23TC)	HK8(17TC)
HIS 6 30 Philosophy of Marxism - Leninism	ECH80 10 Chemical Engineering Profession	PHY 9A 40 Classical Physics 1	PHY 9C 40 Classical Physics 3	ECM 6 40 Computers in Chemical Engineering	ECH 158A 40 Design 1	ECH 158B 40 Design 2	Manufacturing Internship
HIS 7 20 Political Economics of Marxism - Leninism	MAT21A 30 Calculus 1	ENG 45 40 Properties of Materials	CHE 128B 30 Organic Chemistry 2	CHE 129A 20 Organic Chemistry Laboratory	ECH 146 40 Kinetics	ME 3 20 Major Elective	Graduate Internship Thesis 60
	CHE 2A 40 Chemistry 1	MAT21C 30 Calculus	ECH 140 40 Mathematical methods in biochemical and chemical engineering	ECH 141 40 Transport Phenomena (Fluids)	ECH 143 40 Transport Phenomena (Mass)	HIS 9 20 History of Vietnam's Communist Party	Thesis
	MAT21B 30 Calculus 2	MAT 21D 30 Vector Analysis	MAT22A 30 Linear Algebra	ECH 152B 40 Thermodynamics 2	ECH 155A 40 Chemical Engineering Laboratory 1	ECH 155B 20 Chemical Engineering Laboratory 1	GDQP 110 National Defence Education
	CHE 2B 50 Chemistry 2	CHE 2C 50 Chemistry	CHE 110A 20 Physical Chemistry 1	CHE 110B 20 Physical Chemistry 2	ECH 157 40 Process Control	PHIS 3 10 Physical Education 3	
ENL 200 English Improvement Program	ENL1 40 English 1	ENL2 20 English 2	MAT22B 30 Differential Equations	ECH 142 40 Transport Phenomena (Heat)	TE 1 20 Technical Elective	ECH 158C 40 Design 3	
PHIS 1 10 Physical Education 1	PHIS 2 10 Physical Education 2	PHY 9B 40 Classical Physics 2	ECH 152A 30 Thermodynamics 1	BIS 102 20 Biomolecules	ME 2 20 Major Elective	CE 2 20 CHMS Elective	
	HIS 4 20 Ho Chi Minh's Thought	CHE 128A 30 Organic Chemistry 1	ECH 51 40 Material Balances	CE 1 20 CHMS Elective	TE 2 20 Technical Elective	TE 3 20 Technical Elective	
	ECM 5 20 Analysis in Chemical Engineering			ME 1 20 Major Elective		ME 4 20 Major Elective	
	HIS 8 20 Scientific Socialism					HIS 5 20 General Laws	

Major Electives (ME)

in Oil Refining and

Petrochemistry

Engineering: 8 credits

ADECH 01A 20

Chemistry of Petroleum

ADECH 02A 20

Oil Refining Technology

ADECH 03A 20

Gas Conditioning and Processing

ADECH 04A 20

Petrochemical Technology

ADECH 05A 20

Clean Fuel Technology

ADECH02A1 20

Topics on Oil Refining Technology

ADECH03A1 20

Topics on Gas Conditioning and Processing

ADECH04A1 20

Topics on Petrochemical Technology

Technical Electives for Chemical Engineering (TE):

6 credits

EMS 180A 20

Materials in Engineering Design

EMS 181 40

Materials Processing

EMS 182 40

Failure Analysis

ECH 161A 40

Biochemical Engineering Fundamentals

EMS 172 40

Electronic, Optical and Magnetic Properties of Materials

EMS 172L 20

Electronic, Optical and Magnetic Properties Laboratory

ECH 166A 20

Catalysis

ECH 170 30

Introduction to Colloid and Surface Phenomena

EMS 147A 20

Principles of Polymer Materials Science

EMS 172 40

Electronic, Optical and Magnetic Properties of Materials

EMS 172L 20

Electronic, Optical and Magnetic Properties Laboratory

CHE 110C 20

Physical Chemistry

CHE115A 20

Instrumental Analysis

ECH 144 30

Rheology and Polymer Processing

ECH 160A 20

Fundamentals of Biomaterials

ADECH03A1 20

Topics on Gas Conditioning and Processing

ADECH04A1 20

Topics on Petrochemical Technology

Electives in Chemical Engineering & Materials Science (CE): 4 credits

ECH 166A 20

Catalysis

CHE 110C 40

Physical Chemistry

ECH 144 30

Rheology and Polymer Processing

ECH 160A 20

Fundamentals of Biomaterials

ECH 161A 40

Biochemical Engineering Fundamentals

ECH 143A 20

Topics on Unit Operations of Chemical Engineering

ECH 170 30

Introduction to Colloid and Surface Phenomena

EMS 147A 20

Principles of Polymer Materials Science

EMS 181 40

Failure Analysis

ECM146 50

Bioseparations

Chú thích (Notes)

Mã học phần (Code)

Số tín chỉ (Credit)

ECH 152A 20

A RENEWED WORKING AGREEMENT

Between

HANOI UNIVERSITY OF MINING AND GEOLOGY

HANOI, VIETNAM

And

The COLLEGE of ENGINEERING,

THE UNIVERSITY OF CALIFORNIA, DAVIS

DAVIS, CALIFORNIA, USA

PREAMBLE AND OBJECTIVES OF THE AGREEMENT

Hanoi University of Mining and Geology (HUMG) and the Department of Chemical Engineering (CHE), University of California, Davis (UC Davis) initiated implementing education in chemical engineering at HUMG, to be referred to as the Advanced Program in Chemical Engineering, HUMG and the cooperation agreed upon has been going well.

On the basis of the previous success, both parties agree to continue the relation by reaching the following objectives:

Where financially feasible and consistent with the policies of both institutions and all other applicable legislation, the parties agree to pursue mutual interest in the following activity of building capacity in undergraduate education.

Several areas for potential cooperation have been identified and discussed, and UC Davis and HUMG agree to have UC Davis initiate providing technical support, training and consultancy in implementing an academic B. Sc. program in Chemical Engineering at HUMG (Advanced Program in Chemical Engineering, HUMG).

Adapt Chemical Engineering and Curriculum from UC Davis to HUMG

The UC Davis curriculum for the chemical engineering major will be adapted for HUMG by mutual consent of the faculty. HUMG and UC Davis faculty will modify the curriculum to contain the main content of the UC Davis curriculum and make changes suitable to Vietnam's (VN) prevailing chemical engineering profession and practices.

UC Davis will provide assistance to implement necessary adaptation of a new four - year undergraduate curriculum in Chemical Engineering and Technology at HUMG in 2019.

Both HUMG and UC Davis recognize the intent of this agreement as being to develop a curriculum that meets international standards.

HUMG will provide resources to edit and place course syllabi and lecture notes on the World Wide Web as well as provide teaching assistant support to manage the courses taught at HUMG.

Involvement of UC Davis

UC Davis will train and mentor HUMG faculty in specified chemical engineering and technology courses at UC Davis. HUMG faculty members will have the opportunity to discuss course materials, lectures, homework assignments and examinations with UC Davis faculty. HUMG faculty may also work with teaching assistants assigned to courses.

UC Davis will appoint a project consultant and manager to work with HUMG on assessing needs and determining appropriate resources to facilitate the curriculum adaptation and delivery process. This is typically the Chair of the Department of CHE at UC Davis.

UC Davis's faculty members in Department of Chemical Engineering will continue to assist Vietnamese partners in HUMG to adapt of the available curriculum of Advanced Program in Chemical Engineering from 5 years program to 4 years program as well as instruction of courses and to mentor HUMG faculty members. HUMG will provide international and domestic travel as well as accommodations during the entire stay in Hanoi for mentors and the consultant.

Development of HUMG Faculty members

With UC Davis' consent, HUMG will assign faculty members who may implement teaching for the program for professional development in course design and delivery at UC Davis. This will include, but is not limited to, writing lecture notes, lesson plan development, course management, and student evaluation.

HUMG will provide international and domestic travel and living costs for HUMG faculty while visiting UC Davis.

Long-term and short-term exchanges of faculty and staff

Sabbaticals, faculty or technical staff development leaves, visiting professorships, research collaboration, and exchange of books, magazines, internet/library access and other academic information and, in general, other activities in areas of mutual interest are contemplated. The parties agree to provide facilities normally made available to visiting scholars.

Programs relating to research activities

Where feasible, development of joint research programs and research collaborations will be undertaken.

Student activities

- Undergraduate students

Students from UC Davis may acquire internships or take their credit in HUMG for any areas of interest, and HUMG agrees to provide adequate advising and tutors for such special programs. HUMG will support accommodation for these students. UC Davis students would be responsible for their travel and local expenses.

Students from Advanced Program in Chemical Engineering of HUMG, who can afford all the fees and payments themselves, may have opportunity to come to UC Davis to enroll in the chemical engineering program for one or two quarters through the UC Davis Extension Global Studies Program. All the credits taken in during their stay in UC Davis will be recognized by HUMG.

- Graduate students

Technical staff and graduate students from HUMG who meet regular admission requirements at UC Davis may be admitted to graduate degree granting programs associated with Chemical Engineering. The terms of attendance, fees and courses of study will be determined individually for each student by the two institutions.

Graduate students at HUMG may come to UC Davis to carry out research for 3 to 6 months based on their own payment. UC Davis will try their best to find financial support for these students to extend their stay to 9 or 12 months.

- Combined Bachelor of Science and Master of Science Degree Program ('Combined Program')

The Combined Program would bring potential HUMG students to UC Davis for a Master of Science Degree (MS). The Program is restricted to a maximum of 5 students per year. Top ranked students from the Advanced Program in Chemical Engineering at HUMG may apply for this Program in chemical engineering and related majors. The Combined Program is intended to provide a pathway for HUMG students to come to UC Davis to complete bachelor program at UC Davis (and receive their Bachelor degree in HUMG) and then be eligible for continuing to a MS degree at UC Davis (1 or 2 additional years at UC Davis). The details of this program are articulated as follows:

1. The students in the Combined Program from will earn a BS degree in Advanced Program in Chemical Engineering at HUMG followed by a MS degree at UC Davis.
2. To start the Combined Program, the HUMG students will arrive at UC Davis in September and enroll in undergraduate courses for the Fall, Winter, and Spring quarters to complete the final years of their Advanced Program in Chemical Engineering at HUMG. They may enroll through the Global Studies Program at UC Davis Extension and upon completion of the coursework, their grades will be credited towards their HUMG BS degree. No UC Davis degree will be granted based on this coursework.
3. The Combined Program students will apply for admission to the MS program in Chemical Engineering or a related major by January 15th (or the advertised application deadline) of the academic year of their arrival at UC Davis. They will be recommended for admission upon satisfactory achievement of the standards for admission of the UC

Davis graduate program to which they apply, as well as their English proficiency with a minimum total score of 80 (100 expected) based on the speaking, reading, listening and writing categories of the internet-based TOEFL test. Campus requirements state that a minimum undergraduate GPA of 3.0 on a 4.0 scale is required for graduate admissions (3.20 GPA is expected by the Chemical Engineering Program), and applicants must have taken the GRE General Test. Average scores for admitted applicants can be found on CHMS website (<http://chms.engineering.ucdavis.edu/graduates/prospective/index.html>). Beyond minimum standards of admission, the applicants are expected to demonstrate a competitive record to be admitted to the MS program and each application will be evaluated by the appropriate faculty admissions committee.

4. Upon successful admission and completion of all graduate coursework and MS degree requirements, the Combined Program students will earn a UC Davis MS degree diploma. In order to obtain a MS degree at UC Davis, a GPA greater than or equal to 3.0 calculated from only UC Davis classes taken after admission to graduate status is required, as well as the successful completion of a thesis or comprehensive exam, and satisfaction of the residency requirements set forth by the Office of Graduate Studies (3 quarters of full time enrollment).
5. The students in the Combined Program may have the option to continue for a PhD degree at UC Davis if they demonstrate a sufficiently high level of achievement in their MS degree program.
6. The Combined Program students will be responsible for paying the required tuition and the other fees to UC Davis throughout their graduate study. The faculty members at HUMG and UC Davis and students will explore all fellowship possibilities as well as outside funding agencies and industrial partners who may be able to support this program.
7. It is ultimately the responsibility of the students to secure their accommodations, however the UC Davis will assist the Combined Program students to find appropriate accommodations.
8. Once enrolled as MS students, the Combined Program students will have graduate student status and the associated privileges.
9. While at UC Davis, the Combined Program students must maintain a course load which satisfies the minimum requirements for an F-1 visa, as specified by the U.S. government. Currently, this is 12 units including ECH 290 and ECH 299 units.
10. Both institutions agree that disagreements and problems arising from the activities based on this agreement will be solved collaboratively.

CERTIFICATION OF BS DEGREE AND DIPLOMA

The diploma for the Advanced Program in Chemical Engineering at HUMG will be issued by HUMG and due to the possible appearance of conferring a degree from UC Davis, it cannot be

signed by a UC Davis faculty member. However, besides the diploma, a formal letter will be given to each graduating student. It will have the following language:

Congratulations on completing the Advanced Degree Program in Chemical Engineering at HUMG. The curriculum for this program was developed in close collaboration between HUMG and the University of California, Davis.

The letter will be signed by UC Davis as follows:

Chair of CHE at UC Davis

Dean of the College of Engineering, UC Davis

PROCEDURES

The languages of the communication are Vietnamese and English. The English version of the agreement is authoritative.

This working agreement becomes valid when signed by the Rector of HUMG, Vietnam and Chair of the Department of Chemical Engineering, UC Davis, Dean of the College of Engineering, UC Davis and the Associate Dean of Continuing and Professional Education, UC Davis. This agreement will remain in effect until one party notifies the other of its wish to terminate. The agreement will be terminated at the end of the quarter during which the termination request is received.

An Oversight Committee coordinates the activities under this agreement. The Rector of HUMG and the Chair of CHE at UC Davis will comprise the Oversight Committee. By mutual agreement, additional members may be appointed.

The annual work plan will be approved and coordinated by the Oversight Committee. Research progress and data used for research will be reported annually to the Oversight Committee. Every researcher is obliged to exchange data and results.

The contracting parties agree that proposed changes to the agreement's content or validity are to be communicated in writing to the partners' institution.

It is understood that all financial arrangements will depend upon the availability of funds; however, the parties agree to seek appropriate funding to facilitate the implementation of this agreement.

ANNUAL WORK PROTOCOL

Work plans and budgets will be determined each year and the implementation will depend upon the availability of funds. The plans will indicate the goals for the year and set out the funding mechanisms and participant level.

An annual report of activities will be made to each institution and funding agency. The format of the report will be determined by the activities work plan.

The term of this agreement shall be from December 15, 2018 through December 14, 2023.

Having read this agreement and being fully aware of its contents, the parties hereby affix their signatures:

Jennifer Sinclair Curtis

Dean, College of Engineering

University of California, Davis

Jennifer Sinclair Curtis

Signature

Date: 8/20/2019

Tonya Kuhl

Chair

Chemical Engineering Department.

University of California, Davis

Tonya Kuhl

Signature

Date: 8/21/19

Tran Thanh Hai

Rector

Hanoi University of Mining and Geology



Signature

Date: 9/19/2019

Cong Ngoc Thang

Deputy Head of Chemical Eng. Department

Deputy Head of Advanced Training Program

Hanoi University of Mining and Geology

Thang

Signature

Date: 8/29/2019

Anneli Adams

Associate Dean

UC Davis Continuing and Professional Education.

University of California, Davis

Anneli Adams

Signature

Date: *8/27/2019*