HANOI UNIVERSITY OF MINING AND GEOLOGY
ADVANCED PROGRAM

SOCIALIST REPUBLIC OF VIETNAM
Independence – Freedom - Happiness

COURSE SYLLABUS

1. Course title: Biomolecules
Course code: 102
Number of credits: 02
Number of hours: 45 hours
Theory: 30; Homeworks: 15;
Self-study: 45 hours;

2. Course management unit

2.1. Instructor (s):	**Instructor's code**
1. Assoc.Prof. Pham Xuan Nui	0603-09
2. Dr Nguyen Thi Linh	0603-08

2.2. Department: Oil refining and Petrochemistry
2.3. Faculty: Gas and Oil

3. Prerequisites (course code): CHE 128A, CHE 128B, CHE 129A.

4. Course objectives/goals/expectations (Relationship to learning outcomes)

4.1. Knowledge

4.1.1 Provides basic principles of biological organization, cellular chemistry.

4.1.2 Provides basic knowledge of molecular structures with emphasis on proteins and supramolecular assemblies.

4.1.3 Provides basic knowledge of general functions of proteins and supramolecular assemblies

4.2. Skills

Development of problem solving skills through analysis based biological organization, cellular chemistry

5. Course description

Topics covered include: Draw the general structure of an amino acid and classify amino acids based on their R groups. Describe the primary structure of proteins and draw the structure of the peptide bond. Discuss the importance of the three dimensional structure of a protein to its function. Describe the effect that enzymes have on the activation energy of a reaction. Discuss the role of the active site and the importance of enzyme specificity. Describe the difference between the lock-andkey model and the induced fit model of enzyme-substrate complex formation.

6. Organization/Structure of the course

Table 1. Course topics to be corved - tentative schedule

6.1. Theory			
Content	***Topics/ Activities***	***Hours***	***Objectives***

Chapter 1	**Basic principls of cellular chemistry**	**5**	
1.1	Introduction: Life is based on carbon	*1*	4.1.1
1.2	Chemical bonds	*1*	
1.3	Cell construction	*1*	
1.4	The properties of water	*1*	4.1.1
1.5	Biological energy	*1*	
1.6	Acid-base chemistry in biologycal system	*1*	
Chapter 2	**Lipids and Their Functions in Biochemical Systems**	**10**	4.1.1
2.1	Biological Functions of Lipids	*3*	
2.2	Glycerides, Nonglyceride Lipids,	*3*	
2.3	Biological Membranes: Fluid Mosaic Structure of Biological Membranes	*4*	
Chapter 3	**Protein struture and function**	**10**	4.1.2
3.1	Cellular Functions of Proteins		
3.2	The Amino Acids, The Peptide Bond	*3*	
3.3	The Primary, Secondary, and Tertiary Structure of Proteins		
3.4	An Overview of Protein Structure and Function		
Chapter 4	**Enzymes**	**10**	4.1.2
4.1	Nomenclature and Classification: Classification of Enzymes Nomenclature of Enzyme	*3*	
4.2	The Effect of Enzymes on the Activation Energy of a Reaction		
4.3	The Effect of Substrate Concentration on Enzyme-Catalyzed Reactions		
4.4	The Enzyme-Substrate Complex		
4.5	Specificity of the Enzyme-Substrate Complex	*2*	
4.6	The Transition State and Product Formation		
4.7	Regulation of Enzyme Activity		
4.8	Inhibition of Enzyme Activity	*3*	
Chapter 5	**Carbohydrate Metabolism, Aerobic Respiration and Energy Production**	**10**	4.1.3
5.1	ATP: The Cellular Energy Currency	*1*	
5.2	Overview of Catabolic Processes	*1*	
5.3	Glycolysis	*1*	
5.3	Conversion of Pyruvate to Acetyl CoA	*1*	

5.4	An Overview of Aerobic Respiration	*3*	
5.5	The Citric Acid Cycle (The Krebs Cycle) Reactions of the Citric Acid Cycle	*3*	

7. Method of instruction: Discussion

8. Requirements for student

- Attendance, respectful classroom participation: 80 %
- Homework, laboratory, and exams: Final exam, 90 mins
- Integrity:
- Classroom rules of conduct:
- Special needs:

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Group collaboration	Reports/Presentations	
4	Practice/Laboratory/ Internship	Reports/Presentations/Skills	
5	Midterms	Writing (60 minutes)	
6	Final exam	Writing (90 minutes)	60 %

Midterm 1: 60 minutes
Midterm 2: 60 minutes
Course project: TBA (if any)…
Final Exam: 90 minutes

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books: (at least 3 books)

[1] Roger L. Lundblad Fiona M. Macdonald. Biochemistry and Molecular Biology, Taylor and Francis Group, LLC, 2010.

[2] Denniston, Topping and Caret. General, Organic and Biochemistry, Fourth Edition, The McGraw–Hill Companies, 2003.

[3] Lewis Stevens, Avian Biochemistry and Molecular Biology, Senior Lecturer Stirling University, Scotland, 1996.

11. Instruction for self-study

Table 3. Contents to be prepared - tentative schedule

No	Topics/Activities	Theory (hours)	Homeworks (hours)	Laboratory (hours)	Total self-study	Requirements for student

					(hours)	
1	**Chapter 2. Lipids and Their Functions in Biochemical Systems** 2.4. Nonglyceride Lipids Sphingolipids 2.5. The Structure of Biological Membranes	8	5	0	4	+ Book **[2]**: Content, chapter 18
2	**Chapter 3. Protein struture and function** 3.5. Denaturation of Proteins 3.6. Dietary Protein and Protein Digestion	6	2	5	13	Book **[2]**: Content, chapter 19
3	**Chapter 4. Enzymes** Uses of Enzymes in Medicine	4	3	5	8	Book **[2]**: Content, chapter 20
4	**Chapter 5. Carbohydrate Metabolism, Aerobic Respiration and Energy Production** 5.6. Gluconeogenesis: The Synthesis of Glucose 5.7. Glycogen Synthesis and Degradation 5.8. The Degradation of Amino Acids	10	7			Book **[2]**: Content, chapter 21 Book **[2]**: Content, chapter 22

Hanoi, 30th May 2018

ADVANCE PROGRAM

TS. Công Ngọc Thắng

CHAIR OF DEPARTMENT

TS. Công Ngọc Thắng

HANOI UNIVERSITY OF MINING AND GEOLOGY
ADVANCED PROGRAM

SOCIALIST REPUBLIC OF VIETNAM
Independence – Freedom - Happiness

COURSE SYLLABUS

1. Course title: FUNDAMENTALS OF BIOMANUFACTURING

Course code: ECH 160

Number of credits: 02

Number of hours: Theory: 30 hrs; Homeworks:15 hrs; Self-study: 90 hrs;

2. Course management unit

2.1. Instructor (s): **Instructor's code**

PhD. Nguyen Thi Linh 0603-08

2.2. Department: Oil Refining and Petrochemistry

2.3. Faculty: Oil and Gas Faculty

3. Prerequisites (course code): BIS 102

4. Course objectives/goals/expectations (Relationship to learning outcomes):

4.1. Knowledge

4.1.1. To reinforce concepts presented in biomanufacturing courses.

4.1.2. To understand methods in cell biomass cultivation to produce organic compounds.

4.1.3. To know technologies in bioreactor monitoring and operation

4.1.4. To develop skills in estimation of processes in biomanufacturing

4.2. Skills

4.2.1. To develop skills in writting reports and solution of exercises

4.2.2. To develop skills in teamwork and self study

5. Course description:

This course covers concepts of biomanufacturing. The course supplies knowledge of methods in cell biomass cultivation and production of organic compounds from living cells. In this course you will learn about technologies in bioreactor monitoring and operation in large scale such as bioreactors operated in industry to produce organic compounds from nature. Learn about recovery, purification products by extraction, filtration and storage. The course provides skills in homework solution, teamwork and self study.

6. Organization/ Structure of the course:

Table 1. Course topics to be corved - tentative schedule

6.1. Theory			
Content	***Topics/ Activities***	***Hours***	***Objectives***
Chapter 1	**Chapter 1.** Principles of biomanufacturing	**2**	
1.1	Basic concepts	1	4.1.1

1.2	Cell construction	0.5	4.1.1
1.3	Cell nutrients	0.5	4.1.1
Chapter 2	Engineering principles for biomanufacturing	**15**	
2.1	Enzymes 2.1.1. Classification of enzymes: 2.1.2. Immobilized Enzyme Systems	0.5	4.1.3
2.2	2.2. Diffusional limitation in Immobilized Enzyme Systems	4.5	4.1.3, 4.2.1
2.3	Large- Scale production of enzymes	1	4.1.3, 4.2.2
2.4	Cell Growth (Cell Culture) 2.4.1. Basic concepts 2.4.2. Batch culture 2.4.3. Continuous culture	1	4.1.1, 4.2.2
2.5	Major metabolic pathways 2.5.1. Bioenergetics 2.5.2. Glucose metabolism: Glycolysis and the TCA cycle 2.5.3. Respiration 2.5.4. Metabolism of nitrogenous compounds 2.5.5. Metabolism of hydrocarbons	1	4.1.3, 4.2.2
2.6	Overview of biosynthesis	2	4.1.3, 4.2.1
2.7	Overview of autotrophic metabolism		
2.8	Characterictics of Batch culture 2.8.1. Growth patterns and kinetics in batch culture 2.8.2. Environmental conditions affect growth kinetics 2.8.3. Heat generation by microbial growth 2.8.4. Using some models to predict specific growth rate		
2.9	Kinetics in continous culture		

2.10	Stoichiometry of Microbial Growth and Product Formation		
2.11	Stoichiometric calculations		
2.12	Theoretical predictions of yield coefficients		
Chapter 3	Bioreactor monitoring and operation	**8**	4.1.4, 4.2.1, 4.2.2
3.1	Choosing the cultivation method	0.5	4.1.4
3.2	Modifying batch and contiuous reactors 3.2.1. Reactor with recycle 3.2.2. Multistage reactor systems	2	4.1.4, 4.2.1, 4.2.2
3.3	Fed- batch operation	1.5	4.1.4, 4.2.1, 4.2.2
3.4	Perfusion System	1	4.1.4, 4.2.2
Chapter 4	**Chapter 4.** Recovery and purification of products	**5**	
4.1	Recovery and purification of fermentation products	0.5	4.1.4
4.2	Separation of insoluble products 4.2.1. Filtration 4.2.2. Centrifugation 4.2.3. Coagulation and flocculation	3.5	4.1.4, 4.2.2
	Cell Disruption 4.3.1. Mechanical methods 4.3.2. Nonmechanical methods		4.1.4, 4.2.2
	4.4. Separation of soluble products 4.4.1. Liquid- liquid extraction 4.4.2. Aqueous two phase extraction 4.4.3. Precipitation 4.4.4. Adsorption 4.4.5. Dialysis		4.1.4, 4.2.2
6.2. Practice/Laboratory (if any)			
Content	***Topics/ Activities***	***Hours***	***Objectives***

7. Method of instruction: Theory, discussions, homeworks

8. Requirements for student:

- Attendance, respectful classroom participation: 80 %

- Homework: 03 homeworks and exams: 02 midterm exams and 01final exam

- Integrity: 100%

- Classroom rules of conduct: 80% attendance and integrity homewoks, midterm exams and final exam.

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Group collaboration	Reports/ Presentations	
5	Midterms	Writing/ Viva... (75 minutes)	
6	Final exam	Writing/Multiple-choice/Viva... (...minutes)	60 %

Midterm 1: 75 minutes

Midterm 2: 75 minutes

Final Exam: 90 minutes

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books: (at least 3 books)

[1]. Pauline M. Doran, *Bioprocess engineering principles*, 2nd edition, Elsevier, 2013

[2]. Anton Moser, *Bioprocess Technology*, Springer, 1988

[3]. Owen P. Ward , *Bioprocessing*, Springer, 1991

[4]. T. Scheper, *Advances in Biochemical Engineering/Biotechnology*, Springer, 2004

11. Instruction for self-study:

Table 3. Contents to be prepared - tentative schedule

No	Topics/ Activities	Theory (hours)	Homeworks (hours)	Laboratory (hours)	Total self-study (hours)	Requirements for student
1	**Chapter 1.** Principles of biomanufacturing 1.1. Basic concepts 1.2. Cell construction	4	0	0	8	+ Book [1]: Content part 1: section 2- Fundamentals of

	1.3. Cell nutrients					Biomanufacturing, + Recommended Reading: Book [2]- part 1 (page 1-35)
2	**Chapter 2.** Engineering principles for biomanufacturing 2.1. Enzymes 2.1.1. Classification of enzymes: 2.1.2. Immobilized Enzyme Systems 2.2.Diffusional limitation in Immobilized Enzyme Systems 2.3.Large- Scale production of enzymes 2.4. Cell Growth (Cell Culture) 2.4.1. Basic concepts 2.4.2. Batch culture 2.4.3. Continuous culture 2.5. Major metabolic pathways 2.5.1. Bioenergetics 2.5.2. Glucose metabolism: Glycolysis and the TCA cycle 2.5.3. Respiration 2.5.4. Metabolism of nitrogenous compounds 2.5.5. Metabolism of hydrocarbons 2.6. Overview of	13	10	0	52	+ Book [1]: Content part 2: section 3- Enzymes Section 5- Major Metabolic Pathways + Recommended Reading: Book [2]- section 3 (page 199-238) + Homework 1: exercises for large scale of enzymes + Homework 2: exercises for Charateristics of batch culture

	biosynthesis 2.7. Overview of autotrophic metabolism 2.8. Characterictics of Batch culture 2.8.1. Growth patterns and kinetics in batch culture 2.8.2. Environmental conditions affect growth kinetics 2.8.3. Heat generation by microbial growth 2.8.4. Using some models to predict specific growth rate 2.9. Kinetics in continous culture 2.10. Stoichiometry of Microbial Growth and Product Formation 2.11. Stoichiometric calculations 2.12. Theoretical predictions of yield coefficients					
3	**Chapter 3.** Bioreactor monitoring and operation 3.1. Choosing the cultivation method 3.2. Modifying batch and contiuous reactors 3.2.1. Reactor with recycle 3.2.2. Multistage reactor systems 3.3. Fed- batch operation	8	5		26	+ Book [1]: Content part 3: section 10- Scale up and control of boireactors + Recommended Reading: Book [2]- section 3-11 (page 289-315)

	3.4. Perfusion System					+ Homework 3: exercises for Fed batch operation
4	**Chapter 4.** Recovery and purification of products 4.1. Recovery and purification of fermentation products 4.2. Separation of insoluble products 4.2.1. Filtration 4.2.2. Centrifugation 4.2.3. Coagulation and flocculation 4.3. Cell Disruption 4.3.1. Mechanical methods 4.3.2. Nonmechanical methods 4.4. Separation of soluble products 4.4.1. Liquid- liquid extraction 4.4.2. Aqueous two phase extraction 4.4.3. Precipitation 4.4.4. Adsorption 4.4.5. Dialysis	5		0	10	+ Book [3]: Content part 5: section 2- Recovery and purification of products + Recommended Reading Book [4]- section 2 (page 38- 56) +Oral presentation: topics on biomanufacturing

Hanoi, 30th May, 2018

ADVANCE PROGRAM

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COURSE SYLLABUS

1. Course title: Design: Economic Analysis and Design
Course code: ECH 158C
Number of credits: 4
Number of hours: 45

2. Course management unit

2.1. Instructor (s):	**Instructor's code**
1. Prof. Ahmet Palazoglu	US03
2. Assoc Prof. Nguyen Anh Dung	0406-03

2.2. Department: Oil Refining and Petrochemistry
2.3. Faculty: Oil and Gas

3. Prerequisites (course code):

4. Course objectives/goals/expectations (Relationship to learning outcomes):
4.1. Knowledge
1. Conceptual design of chemical and biochemical processes.
2. Design, costing and profitability analysis of complete plants.
3. Use of computer-aided design techniques

4.2. Skills
4.2.1. Reading Technical Articles; Technical Writing
4.2.2. Data collection and analysis
4.2.3. Simulation using Aspen+

5. Course description:

The course will focus on the conceptual design of chemical processes, with emphasis on the flow-sheeting, costing and economic evaluation of complete industrial plants. A team project that addresses a real-world plant design problem will be assigned. The successful completion of the project will require thoughtful and creative integration of the knowledge and skill sets acquired in previous chemical engineering courses (thermodynamics, reaction kinetics, reactor design and separations), as well as extensive use of computer-aided design tools (Aspen Plus Process Simulation software). As chemical engineers, you will face the challenge of combining basic technical principles learned in the general chemical engineering curriculum with practical elements of economics, business practices and organization, along with principles of safety, environmental and sociological issues to design an integrated chemical process plant.

6. Organization/ Structure of the course:

Table 1. Course topics to be corved - tentative schedule

6.1. Theory			
Content	***Topics/ Activities***	***Hours***	***Objectives***

Lecture 1	Introduction	6	4.1.1
Lecture 2	Aspen Tutorial	14	4.1.1 and 4.1.2
Lecture 3	Discussion of Phase I (Existing technologies, Economic potential).	10	4.1.2
Lecture 4	Discussion of Phase II (MTBE Base Case Design and Simulation)	10	4.1.3
Lecture 5	Discussion of Phase III (MTBE-to-Isooctane Plant Retrofit)	10	4.1.3
Lecture 6	Economic evaluation	10	4.1.3

7. Method of instruction:

Conventional methods with TA.

Group discussion required.

8. Requirements for student:

- Attendance, respectful classroom participation: 80 %.
- Homework,

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Group collaboration	Reports/ Presentations	
4	Practice/Laboratory/ Internship	Reports/ Presentations/Skills	
5	Midterms	Writing/ Viva... (.....minutes)	
...	...	...	...
...	Final exam	Writing/Multiple-choice/Viva... (...minutes)	60 %

Final Exam: Essay

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books: (at least 3 books)

[1]. Process Design Principles: Synthesis, Analysis and Design, Seider, Seader & Lewin, 2nd Edition, Wiley, NY, 2004.

[2]. Plant Design and Economics for Chemical Engineers, Peters, Timmerhaus & West, 2003.

[3]. Gavin Towler, Ray Sinnott, Chemical Engineering Design: Principles, Practice and Economics of Plant and Process Design, Elsevier, 2008.

11. Instruction for self-study:

Table 3. Contents to be prepared - tentative schedule

No	Topics/ Activities	Theory	Homeworks	Laboratory	Total self-	Requirements

		(hours)	(hours)	(hours)	study (hours)	for student
1	Lecture 1 Introduction	4	0	0	4	
2	Lecture 2 Aspen Tutorial	6	2		8	
3	Lecture 3 Discussion of Phase I (Existing technologies, Economic potential).	5	3		8	
4	Lecture 4 Discussion of Phase II (MTBE Base Case Design and Simulation)	8	4		12	
5	Lecture 5 Discussion of Phase III (MTBE-to-Isooctane Plant Retrofit)	8	4		12	
6	Lecture 5 Economic evaluation	8	4		12	

Hanoi, ..30th.. May 2017

ADVANCE PROGRAM

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COURSE SYLLABUS

1. Course title: Process Control
Course code: ECH 157
Number of credits: 4
Number of hours: 60

2. Course management unit
2.1. Instructor (s): **Instructor's code**
1. Prof. Nael El Fara — US08
2. Assoc Prof. Nguyen Anh Dung — 0406-03

2.2. Department: Oil Refining and Petrochemistry
2.3. Faculty: Oil and Gas

3. Prerequisites (course code):

4. Course objectives/goals/expectations (Relationship to learning outcomes):

4.1. Knowledge
1. Explain the feedback concept applied to control; Explain and identify the three elements in a feedback loop; Be able to apply feedback manually to many chemical process examples; Optimization of process flowsheets to the profession.
2. Recognize some of the key control strategies and their differences 2. Learn how to identify controlled outputs, manipulated inputs and disturbances 3. Recognize examples of the seven (7) control objectives in chemical processes
3. Formulate dynamic models based on fundamental balances 2. Solve simple first-order linear dynamic models 3. Determine how key aspects of dynamics depend on process design and operation
4. Analytically solve linear dynamic models of first and second order 2. Predict important features of dynamic behavior from model without solving

4.2. Skills
4.2.1. Reading Technical Articles; Technical Writing
4.2.2. Data collection and analysis

5. Course description:
Fundamentals of dynamics and modeling of chemical processes. Design and analysis of feedback control of chemical processes

6. Organization/ Structure of the course:

Table 1. Course topics to be corved - tentative schedule

6.1. Theory			
Content	***Topics/ Activities***	***Hours***	***Objectives***

Lecture 1	INTRODUCTION TO PROCESS CONTROL	5	**4.1.1**
Lecture 2	CONTROL OBJECTIVES AND BENEFITS	**10**	4.1.1 and 4.1.2
Lecture 3	MATHEMATICAL MODELING PRINCIPLES	**15**	4.1.2
Lecture 4	MODELLING AND ANALYSIS FOR PROCESS CONTROL: I	**15**	4.1.3
Lecture 5	MODELLING AND ANALYSIS FOR PROCESS CONTROL: II	**15**	4.1.4

7. Method of instruction:

Conventional methods with TA.
Group discussion required.

8. Requirements for student:

- Attendance, respectful classroom participation: 80 %.
- Homework,

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Group collaboration	Reports/ Presentations	
4	Practice/Laboratory/ Internship	Reports/ Presentations/Skills	
5	Midterms	Writing/ Viva... (.....minutes)	
...	...	...	...
...	Final exam	Writing/Multiple-choice/Viva... (...minutes)	60 %

Final Exam: Writing

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books: (at least 3 books)

[1]. Mikleˇs, J., Fikar, M.: Process Modelling, Identification, and Control I. Models and dynamic characteristics of continuous processes. STU Press, Bratislava, 170pp, 2000. ISBN 80-227-1331-7

[2]. Manfred Schleicher, Frank Blasinger, Control Engineering: A guide for begineer, 3rd edition, JUMO GmbH & Co. KG, Fulda, Germany.

[3]. K.M. Hangos, J. Bokor, G. Szederkenyi, Analysis and Control of Nonlinear Process Systems, Springer, 2004.

11. Instruction for self-study:

Table 3. Contents to be prepared - tentative schedule

No	Topics/ Activities	Theory (hours)	Homeworks (hours)	Laboratory (hours)	Total self-study (hours)	Requirements for student
1	Lecture 1 INTRODUCTION TO PROCESS CONTROL	5	0	0	4	
2	Lecture 2 – CONTROL OBJECTIVES AND BENEFITS	10	2		8	
3	Lecture 3 - MATHEMATICAL MODELING PRINCIPLES	15	3		8	
4	Lecture 4 MODELLING AND ANALYSIS FOR PROCESS CONTROL: I	15	4		12	
5	Lecture 5 - MODELLING AND ANALYSIS FOR PROCESS CONTROL: II	15	4		12	

Hanoi, 30th May 2018

ADVANCE PROGRAM

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COURSE SYLLABUS

1. Course title:
Physical chemistry, part 1
Course code: CHE110A
Number of credits: 2
Number of hours: 30
Theory: 25; Homeworks: 5; Practice/Laboratory: 0;
Internship: 0; Self-study:60;

2. Course management unit
2.1. Instructor (s): **Instructor's code**
1. Assoc. Prof. Bùi Thị Lệ Thủy 0603-12
2.2. Department: Oil and Petrochemistry Department
2.3. Faculty: Oil and Gas Faculty

3. Prerequisites (course code): CHE2A, CHE2B

4. Course objectives/goals/expectations (Relationship to learning outcomes):
Students should gain the basic knowledge and principles of quantum mechanics, application of mechanics to some specific moving problem, explain the structure and spectra of hydrogen atom and similar ions, multiple electron atoms.
4.1. Knowledge
4.1.1 Introduction to quantum mechanics: the mechanics of classical mechanics, the particle nature of light, the operators, the principles of quantum mechanics, Shrodinger's method, Bohr's explanations. On the wave function, the information of the wave function, the octal principle of Heisenberg
4.1.2 Some applications of quantum theory to solve a number of specific problems: particle in the substrate, dual and multidimensional motion, harmonic motion, two-dimensional rotation
4.1.3 The application of quantum mechanics to explain the structure and spectrum of several atoms: hydrogen atoms and analogs (with an electron), their orbital and spectral structures, spectrum of multiple atoms.
4.2. Skills
4.2.1. Solve the problem of single solver transfer in the micro world.
4.2.2. Explain the structure and spectrum of simple atoms and ions, and of atoms with multiple electrons.
5. Course description:
Basic knowledge and principles of quantum mechanics, application of mechanics to some specific moving problem, explain the structure and spectra of hydrogen atom and similar ions, multiple electron atoms.

6. Organization/ Structure of the course:

Table 1. Course topics to be corved - tentative schedule

6.1. Theory			
Content	***Topics/ Activities***	***Hours***	***Objectives***
Chapter 1	**Quantum theory: introduction and principles**	8	**4.1.1,** 4.2.1
1.0	Review	1	4.1.1, 4.2.1
1.1	The failures of classical physics	1	4.1.1, 4.2.1
1.2	Wave–particle duality	1	4.1.1, 4.2.1
1.3	Operators	1	4.1.1, 4.2.1
1.4.	Quantum mechanics	4	4.1.1, 4.2.1
1.4.1	Some postulates	1	4.1.1, 4.2.1
1.4.2	The Born interpretation of the wave function	1	4.1.1, 4.2.1
1.4.3	The information in a wavefunction	1	4.1.1, 4.2.1
1.4.4	Uncertainty principle of Heisenberg	1	4.1.1, 4.2.1
Chapter 2	**Quantum theory: Technique and application**	10	4.1.2, 4.2.2
2.1	Particle in box	2	4.1.2, 4.2.2
2.2	Motion in two and more dimensions	2	4.1.2, 4.2.2
2.3	Harmonic motion:	2	4.1.2, 4.2.2
2.4	The energy levels of Harmonic motion	1	4.1.2, 4.2.2
2.5	Rotation in two dimensions	1	4.1.2, 4.2.2
Chapter 3	**Atomic structure and atomic spectra**	**12**	4.1.3, 4.2.3
3.1	Central potentials	1	4.1.3, 4.2.3
3.2	Hydrogen atom and similar ions	1	4.1.3, 4.2.3
3.3	Atomic orbitals and their energies	3	4.1.3, 4.2.3
3.4	Spectroscopic transitions and selection rules	1	4.1.3, 4.2.3
3.5	The structures of many-electron atoms	2	4.1.3, 4.2.3
3.6	The spectra of complex atoms	1	4.1.3, 4.2.3
3.7	Spin–orbit coupling	1	4.1.3, 4.2.3

3.8	Term symbols and selection rules	2	4.1.3, 4.2.3

7. Method of instruction:
- Introduction to the theory knowledge **and guild how to do the exercises**
- Discussion
8. Duties of student:
- Attendance, respectful classroom participation: 80 %
- Homework: 100%
- Special needs: 0

9. Course grading plan
9.1. Grading methods
Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Group collaboration	Reports/ Presentations	
4	Practice/Laboratory/ Internship	Reports/ Presentations/Skills	
5	Midterms	Writing: 60 minutes)	
6	Final exam	Writing: 90 minutes	60 %

Midterm 1: 60 minutes
Midterm 2: 60 minutes
Final Exam: 90 minutes

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books: (at least 3 books)

[1] Peter Atkins, Julio de Paula, Physical chemistry, 8th edition, W. H. Freeman and Company New York, 2006
[2] Donald A. McQuarrie and John D. Simon, Physical Chemistry - A Molecular Approach.
[3] Wolfgang Schaertl, Basic Physical Chemisrtry, 1st Edition, 2014

11. Instruction for self-study:

Table 3. Contents to be prepared - tentative schedule

No	Topics/ Activities	Theory	Homeworks	Laborator	Total self-	Requirements

		(hours)	(hours)	y (hours)	study (hours)	for student
1	Chapter 1. Quantum theory: introduction and principles 1.0 Review 1.1 The failures of classical physics 1.2 Wave–particle duality 1.3 Operators 1.4. Quantum mechanics 1.4.1 Some postulates 1.4.2 The Born interpretation of the wavefunction 1.4.3 The information in a wavefunction 1.4.4 Uncertainty principle of Heisenberg	20	20		40	+ Book [1], [2], [3]: Corresponding chapters + Reading assignments + Summary ....
2	Chapter 2 Quantum theory: Technique and application 2.1 Particle in box 2.2 Motion in two and more dimensions 2.3 Harmonic motion: 2.4 The energy levels of Harmonic motion 2.5 Rotation in	20	20	0	40	+ Book [1], [2], [3]: Corresponding chapters + Reading assignments + Summary ....

	two dimensions					
3	Chapter 3. Atomic structure and atomic spectra 3.1 Central potentials 3.2 Hydrogen atom and similar ions 3.3 Atomic orbitals and their energies 3.4 Spectroscopic transitions and selection rules 3.5 The structures of many-electron atoms 3.6 The spectra of complex atoms 3.7 Spin–orbit coupling 3.8 Term symbols and selection rules	20	20		40	+ Book [1], [2]: Corresponding chapters + Reading assignments + Summary ....

Hanoi, ..30th.. May... 2018

ADVANCE PROGRAM

TS. Công Ngọc Thắng

CHAIR OF DEPARTMENT

TS. Công Ngọc Thắng

MINISTRY OF EDUCATION AND TRAINING
HANOI UNIVERSITY OF MINING AND GEOLOGY
ADVANCED PROGRAM

SOCIALIST REPUBLIC OF VIETNAM
Independence – Freedom - Happiness

COURSE SYLLABUS

1. Course title: Materials in Engineering Design

Course code: EMS 180

Number of credits: 2

Total number of hours:

- Total studying hours: 90 hours
- Lectures: 30 hours
- Self-study: 60 hours

2. Course management unit

Instructor: Assoc. Prof. Tong Thi Thanh Huong

Instructor's code: 0603-06

Department: Oil Refining and Petrochemistry

Faculty: Oil and Gas

3. Prerequisites (course code):

Chemistry ENG-45 or consent of instructor

4. Course objectives/goals/expectations (relationship to learning outcomes):

4.1. Knowledge

- Introduce to students and provide a basic knowledge of methods to select the materials, shape and process.

4.2. Skills

4.2.1. Recognizing and interpretation the data from spectroscopy

4.2.2. Providing students with opportunities to develop basic skills in respect to group-working neatly and accurately and solving problems in accordance with applying appropriate operations.

5. Course description:

- Classes of materials and materials data in design.
- Materials indices in design and designing against failure.
- Selection of materials and manufacturing processes in design. Process data and indices. Materials and industrial design, materials and the environment.

6. Organization/ Structure of the course:

Table 1. Course topics

Content	Topic & Activities	Hours (Class)	Hours (Self-study)	Objectives
Chapter 1	**Introduction**	**1**	**3**	**4.2.2**
Chapter 2	**Material and material selection**	**9**	**27**	**4.2.1; 4.2.2**
	2.1. Families of materials	1	3	
	2.2. Material properties: general properties, mechanical properties, thermal properties, electrical properties.	3	9	
	2.3. Material property charts.	3	9	
	2.4. Material selection: 4 steps for material selection, requirement table, use the charts for material selection.	2	6	
	HW1			
Chapter 3	**Process and process selection**	**9**	**27**	**4.2.1; 4.2.2**
	3.1. The processes: shaping, joining, and finishing.	3	9	
	3.2. Four steps for process selection	3	9	
	3.3. The process-material matrix: how to use the matrix in process selection.	3	9	
	HW2			
MIDTERM		**1**	**3**	**4.2.1; 4.2.2**
Chapter 4	**Shape and shape selection**	**9**	**27**	**4.2.1; 4.2.2**
	4.1. Shape factors: with areas and section shapes.	3	9	
	4.2. Microscopic and macroscopic shapes.	3	9	
	4.3. Four quadrant charts and comparing structural sections.	3	9	
	HW3			

Final	**General Recap**	**1**	**3**	**4.2.1; 4.2.2**
Final Exam				**4.2.1; 4.2.2**

7. Methods of instruction:

- Lectures and discussions.
- Cooperative learning groups and independent study.
- Debates and problem solving.

8. Requirements for student:

- Attendance, respectful classroom participation: at least 80 % of lectures. Students are encouraged to attend every class with the desire to gain, grow, and develop the necessary concepts, skills and understanding needed to successfully pass the quizes, midterms and final exam.
- Homeworks, exams: Students are expected to complete all assignments and homeworks. Students must take part in the final exam.
- No open laptops or phones
- Questions welcome
- No late homework
- All assignments written with pen, NOT pencil—assignments written with pencil will not be accepted (including homework, midterms, final exam).
- For final exam: The only thing allowed is a pen/pencil, calculator (without internet capabilities) and a straight edge; note: one side – A4 sheet. We will supply everything else.
- Integrity: Students are expected to be in class on time ready to work and participate in activities and provide input.
- Classroom rules of conduct: Students must follow the HUMG rules regarding attendance. Students who are absent for 20 % consecutive lectures will be dropped from the class and final exam immediately.

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Group collaboration	Reports/ Presentations	
4	Practice/Laboratory/ Internship	Reports/ Presentations/Skills	

5	Midterm	Writing/ Viva... (.....minutes)	
...	...	...	...
...	Final exam	Writing/Multiple-choice/Viva... (...minutes)	60 %

Quizzes: writing, 30 minutes each.

Midterm: writing, 60 minutes

Final Exam: writing, 60 minutes

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books

[1]. M. F. Ashby, Materials Selection in Mechanical Design, 3rd edition, Butterworth-Heinemann, 2005.

[2]. Charles B. Fleddermann, Engineering Ethics, 3rd edition, Prentice Hall, 2007

[3]. M.M. Farag, Materials Selection for Engineering Design, Prentice Hall, 1997

Hanoi, 30th May 2018

ADVANCE PROGRAM

Công Ngọc Thắng

DEPARTMENT OF OIL REFINING AND PETROCHEMISTRY

Công Ngọc Thắng

MINISTRY OF EDUCATION AND TRAINING
HANOI UNIVERSITY OF MINING AND GEOLOGY
ADVANCED PROGRAM

SOCIALIST REPUBLIC OF VIETNAM
Independence – Freedom - Happiness

COURSE SYLLABUS

1. Course title: Instrumental Analysis

Course code: CHE 115

Number of credits: 2

Total number of hours:

- Total studying hours: 90 hours
- Lectures: 30 hours
- Self-study: 60 hours

2. Course management unit

Instructor: Assoc. Prof. Tong Thi Thanh Huong

Instructor's code: 0603-06

Department: Oil Refining and Petrochemistry

Faculty: Oil and Gas

3. Prerequisites (course code):

Chemistry 110A, 110B or consent of instructor

4. Course objectives/goals/expectations (relationship to learning outcomes):

4.1. Knowledge

- Introduce to students and provide students a basic knowledge of methods to analyse the compounds.
- Introduce to students knowledge to understand and be able to apply the theory and operational principles of analytical instruments

4.2. Skills

4.2.1. Recognizing and interpretation the data from spectroscopy

4.2.2. Providing students with opportunities to develop basic skills in respect to group-working neatly and accurately and solving problems in accordance with applying appropriate operations.

5. Course description:

- This course will provide a practical introduction and experience in the use of modern analytical instrumentation. Students will face a number of real world challenges and learn how to apply instrumental approaches to overcome them. Emphasis will be placed on instrumental operation/methods, and data interpretation for a range of chemical,

biological, environmental, and industrial samples.

- Recognize interferences in chemical and instrumental analysis.
- Comprehend the concept of and perform instrument and method calibration.
- Apply and assess concepts of availability and evaluation of analytical standards and formulate standardization methodology.
- Integrate a fundamental understanding of the underlining physical principles as they relate to specific instrumentation used for molecular spectrometry (IR and UV), magnetic resonance spectrometry, and mass spectrometry.

6. Organization/ Structure of the course:

Table 1. Course topics

Content	**Topic & *Activities***	**Hours (Class)**	**Hours (Self-study)**	***Objectives***
Chapter 1	**Introduction**	**2**	**6**	**4.2.2**
Chapter 2	**Infrared Spectroscopy (IR)**	**7**	**21**	**4.2.1; 4.2.2**
	2.1. Introduction IR	1	3	
	2.2. IR – Spectra Analysis of Hydrocarbons	3	9	
	2.3. IR – Spectra Analysis of Oxygen Compounds and Nitrogen Compounds	3	9	
Chapter 3	**Ultraviolet Spectroscopy (UV)**	**6**	**18**	**4.2.1; 4.2.2**
	3.1. Introduction UV	1	3	
	3.2. Effect of Conjugation	2	6	
	3.3. UV Spectra Analysis	3	9	
	HW1			
MIDTERM		**1**	**3**	**4.2.1; 4.2.2**
Chapter 4	**Nuclear Magnetic Resonance Spectroscopy**	**7**	**21**	**4.2.1; 4.2.2**
	4.1. (NMR) – Introduction and Basic Concepts	1	3	
	4.2. NMR Spectroscopy for liquid and solid compounds	3	9	
	4.3. NMR Analysis	3	9	

Chapter 5	**Mass Spectrometry (MS)**	**6**	**18**	**4.2.1; 4.2.2**
	5.1. Introduction and Basic Concepts	2	6	
	5.2. MS – Structure Analysis	4	12	
	HW2			
Final	**General Recap**	**1**	**3**	**4.2.1; 4.2.2**
Final Exam				**4.2.1; 4.2.2**

7. Methods of instruction:

- Lectures and discussions.
- Cooperative learning groups and independent study.
- Debates and problem solving.

8. Requirements for student:

- Attendance, respectful classroom participation: at least 80 % of lectures. Students are encouraged to attend every class with the desire to gain, grow, and develop the necessary concepts, skills and understanding needed to successfully pass the quizes, midterms and final exam.
- Homeworks, exams: Students are expected to complete all assignments and homeworks. Students must take part in the final exam.
- No open laptops or phones
- Questions welcome
- No late homework
- All assignments written with pen, NOT pencil—assignments written with pencil will not be accepted (including homework, midterms, final exam).
- For final exam: The only thing allowed is a pen/pencil, calculator (without internet capabilities) and a straight edge; note: one side – A4 sheet. We will supply everything else.
- Integrity: Students are expected to be in class on time ready to work and participate in activities and provide input.
- Classroom rules of conduct: Students must follow the HUMG rules regarding attendance. Students who are absent for 20 % consecutive lectures will be dropped from the class and final exam immediately.

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted

1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Group collaboration	Reports/ Presentations	
4	Practice/Laboratory/ Internship	Reports/ Presentations/Skills	
5	Midterm	Writing/ Viva... (.....minutes)	
...	...	...	...
...	Final exam	Writing/Multiple-choice/Viva... (...minutes)	60 %

Quizzes: writing, 30 minutes each.

Midterm: writing, 60 minutes

Final Exam: writing, 60 minutes

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books

[1]. Skoog, Holler, Crouch; Principles of Instrumental Analysis, 6th Edition, Cengage Learning, 2017.

[2]. Introduction to Spectroscopy, 4th Edition; Donald L. Pavia, Gary M. Lampman, George S. Kriz, James R. Vyvyan. Brooks /Cole Cengage Learning. 2008.

[3]. Jyoti Kumar Sinha, Vibration Analysis, Instruments, and Signal Processing, CRC Press, 2015.

Hanoi, 30th May 2018

ADVANCE PROGRAME

Công Ngọc Thắng

DEPARTMENT OF OIL REFINING AND PETROCHEMISTRY

Công Ngọc Thắng

MINISTRY OF EDUCATION AND TRAINING
HANOI UNIVERSITY OF MINING AND GEOLOGY
ADVANCED PROGRAM

SOCIALIST REPUBLIC OF VIETNAM
Independence – Freedom - Happiness

COURSE SYLLABUS

1. Course title: Physical Chemistry B

Course code: CHE 110B

Number of credits: 2

Total number of hours:

- Total studying hours: 90 hours
- Lectures: 30 hours
- Self-study: 60 hours

2. Course management unit

Instructor (s): Assoc. Prof. Tong Thi Thanh Huong

Instructor's code: 0603-06

Department: Oil Refining and Petrochemistry

Faculty: Oil and Gas

3. Prerequisites (course code):

Chemistry 110A or consent of instructor

4. Course objectives/goals/expectations (relationship to learning outcomes):

4.1. Knowledge

- Introduce to students and provide students a basic knowledge of physical chemistry.
- Introduce to students and provide the basic structure of molecules, emphasis on Quantum Mechanics.

4.2. Skills

4.2.1. Determining the bonding and diatomic molecules

4.2.2. Determining the Bonding in Polyatomic Molecules and MO Theory

4.2.3. Determining the Symmetry in Chemistry in molecules and Properties of Group

4.2.4. Providing students with opportunities to develop basic skills in respect to group-working neatly and accurately and solving problems in accordance with applying appropriate operations.

5. Course description:

- Continuation of course 110A.
- The course is deigned to provide students with knowledge that emphasis on Quantum Mechanics: Chemical Bonding, Bonding in polyatomic molecules, and Group Theory

6. Organization/ Structure of the course:

Table 1. Course topics

Content	Topic & *Activities*	Hours (Class)	Hours (Self-study)	*Objectives*
Chapter 1	**Introduction**	**2**	**6**	**4.2.4**
Chapter 2	**Chem. Bond: diatomic molecules**	**6**	**18**	**4.2.1; 4.2.4**
	2.1. Bonding	2	6	
	2.2. Diatomic Molecules	3	9	
	HW1	1	3	
Chapter 3	**Bonding in polyatomic molecules**	**10**	**20**	**4.2.2; 4.2.4**
	3.1.Polyatomic structures	3	9	
	3.2. Bonding in Polyatomic Molecules	3	9	
	3.3. MO Theory	3	9	
	HW2	1	3	
MIDTERM		**1**		**4.2.1; 4.2.3; 4.2.4**
Chapter 4	**Group Theory**	**10**	**30**	**4.2.3; 4.2.4**
	4.1. Symmetry in Chemistry	3	9	
	4.2. Point group	3	9	
	4.3. Properties of Group	3	9	
	HW3	1	3	
Final	**General Recap**	**1**	**2**	**4.2.1; 4.2.2; 4.2.3; 4.2.4**
Final Exam				**4.2.1; 4.2.2; 4.2.3; 4.2.4**

7. Methods of instruction:

- Lectures and discussions.
- Cooperative learning groups and independent study.
- Debates and problem solving.

8. Requirements for student:

- Attendance, respectful classroom participation: at least 80 % of lectures. Students are encouraged to attend every class with the desire to gain, grow, and develop the necessary concepts, skills and understanding needed to successfully pass the quizes, midterms and final exam.
- Homeworks, exams: Students are expected to complete all assignments and homeworks. Students must take part in the final exam.
- No open laptops or phones
- Questions welcome
- No late homework
- All assignments written with pen, NOT pencil—assignments written with pencil will not be accepted (including homework, midterms, final exam).
- For final exam: The only thing allowed is a pen/pencil, calculator (without internet capabilities) and a straight edge; note: one side – A4 sheet. We will supply everything else.
- Integrity: Students are expected to be in class on time ready to work and participate in activities and provide input.
- Classroom rules of conduct: Students must follow the HUMG rules regarding attendance. Students who are absent for 20 % consecutive lectures will be dropped from the class and final exam immediately.

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Group collaboration	Reports/ Presentations	
4	Practice/Laboratory/ Internship	Reports/ Presentations/Skills	
5	Midterm	Writing/ Viva... (.....minutes)	
...	...	...	...
...	Final exam	Writing/Multiple-choice/Viva... (...minutes)	60 %

Quizzes: writing, 30 minutes each.

Midterm: writing, 60 minutes

Final Exam: writing, 60 minutes

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of

HUMG.

10. Text/ required books and other interesting books

[1]. D.onald A.Mc Quarrie and John.D.Simon; Physical Chemistry: **A Molecular Approach.** University Science Books, 1997, Chapters 9-15.

[2]. Peter Atkins, Physical Chemistry, 9th Edition, Oxford University Press, 2009.

[3]. James E. House, Fundamentals of quantum chemistry, 2nd Edition, Academic Press, 2004.

Hanoi, 30th May 2018

ADVANCE PROGRAME

Thang

Cong Ngoc Thang

DEPARTMENT OF OIL REFINING AND PETROCHEMISTRY

Thang

Cong Ngoc Thang

MINISTRY OF EDUCATION AND TRAINING
HANOI UNIVERSITY OF MINING AND GEOLOGY
ADVANCED PROGRAM

SOCIALIST REPUBLIC OF VIETNAM
Independence – Freedom - Happiness

COURSE SYLLABUS

1. Course title: Chemical Thermodynamics
Course code: ECH 152A
Number of credits: 3
Total number of hours: 135

Theory: 45;	Homeworks/Problems/Discussion: 0;	Practice/Laboratory: 0;
Internship: 0;	Topics: 0;	Self-study: 90;

2. Course management unit

2.1. Instructor (s):	**Instructor's code**
1. Dr. Cong Ngoc Thang (congngocthang@humg.edu.vn)	0603-11
2. Asso. Prof. Nguyen Anh Dung (nguyenanhdung@humg.edu.vn)	0603-04

2.2. Department: Oil Refining and Petrochemistry
2.3. Faculty: Oil and Gas

3. Prerequisites (course code):
ECH 80 (Chemical Engineering Profession).

4. Course objectives/goals/expectations (Relationship to learning outcomes):

4.1. Knowledge

4.1.1. To introduce students to and to provide students with basic knowledge of thermodynamics.
4.1.2. To introduce students to and to provide students with the basic laws and concepts of thermodynamics (The first and second laws; Applications of the first and second laws).
4.1.3. To introduce students to and to provide students with the methods for calculating volumetric properties of pure fluids and thermodynamic properties of fluids.
4.1.4. To introduce students to and to provide students with the methods for calculating the heat effects.

4.2. Skills

4.2.1. Recognizing, distinguishing, and evaluating the basic laws and concepts of thermodynamics.
4.2.2. Determining parameters, volumetric properties of pure fluids and thermodynamic properties of fluids.
4.2.3. Recognizing, analyzing, evaluating and defining informations relating to determining parameters, volumetric properties of pure fluids and thermodynamic properties of fluids.
4.2.4. Providing students with opportunities to develop basic skills in respect to group-working neatly and accurately and solving problems in accordance with applying the basic laws and concepts of thermodynamics.

5. Course description:

The course is designed to provide students with basic knowledge of thermodynamics: The scope of thermodynamics, Fundamental Quantities, Secondary Quantities, Internal energy, enthalpy, State and state functions, Steady state of processes, … The course provides students with the basic laws and other concepts of thermodynamics: The first and second laws; Applications of the first and second laws, ... The course also illustrates and demonstrates students with the methods for calculating thermodynamic parameters, volumetric properties of pure fluids and thermodynamic properties of fluids, the heat effects.

6. Organization/ Structure of the course:

Table 1. Course topics to be corved - tentative schedule

6.1. Theory			
Content	***Topics/ Activities***	***Hours***	***Objectives***
1	Introduction	1	4.1.1/4.2.1/4.2.2/4.2.4
2	Fundamental Quantities	2	4.1.3/4.2.1/4.2.2/4.2.3
3	Secondary Quantities	2	4.1.1/4.2.1/4.2.2/4.2.4
4	The first Law of Thermodynamics and Basic Concepts	3	4.1.2/4.2.1/4.2.2/4.2.3
5	Applications of the first Law	4	4.1.2/4.2.1/4.2.2/4.2.3
6	Volumetric Properties of Pure Fluids	9	4.1.2/4.2.1/4.2.2/4.2.3
7	**Midterm 1**	**1**	4.1.2/4.2.1/4.2.2/4.2.3
8	Heat Effects	6	4.1.2/4.2.1/4.2.2/4.2.4
9	The second Law of Thermodynamics	4	4.1.2/4.2.1/4.2.2/4.2.3
10	Applications of the second Law	6	4.1.2/4.1.3 4.2.1/4.2.2/4.2.3
11	**Midterm 2**	**1**	4.1.3/4.1.4 4.2.1/4.2.2/4.2.3
12	Thermodynamic Properties of Fluids	6	4.2.1/4.2.2/4.2.3/4.2.4
13	Discussion, Final Review Session (Optional)		4.1/4.2
14	**Final Exam**	**2**	

- General Overview/Syllabus, The scope of thermodynamics
- Fundamental Quantities
    1. Time, Length, Mass, Force
    2. Temperature
- Secondary Quantities
    1. Volume, Pressure
    2. Energy, Work, Heat
- The first Law and Basic Concepts
    1. Joule's experiment
    2. Internal energy, enthalpy
    3. The first law
    4. State and state functions
- Applications of the first law
    1. Steady state of processes
    2. The concept of equilibrium
    3. Phase rule

4. Reversibility
5. Heat capacity

- Properties of Pure Fluids
  1. PVT behavior
  2. Ideal gas, virial equation
  3. Applications of the virial equation
  4. Cubic equations of state
  5. Correlations
  6. Behavior of liquids
- Midterm 1
- Heat Effects
  1. Heat capacities as a function of temperature
  2. Heat capacities of solids and liquids
  3. Heat and phase changes
  4. Heat of reaction, temperature effect
- The second Law
  1. Different statements
  2. Heat engines
  3. Thermodynamical temperature scale
  4. Entropy
- Midterm 2
- Applications of the second law
  1. Entropy and irreversibility
  2. Third law
- Properties of Fluids
  1. Relationships between thermal properties
  2. Single phase systems
  3. Two phase systems
  4. Thermodynamic diagrams
- Discussion/ Final Review Session
- Final Exam

7. Methods of instruction:

- Lectures and discussions.
- Cooperative learning groups and independent study.
- Debates and problem solving.
- Problem sets will be emailed to students. In presenting the solution of a problem that requires analysis, students should state briefly in words at the beginning:
  - what is given
  - what is to be found
  - what the method of solution is

This preliminary information should be followed by the solution to the problem. The grading of the problems will be based on the preliminary information as well as on the solution.

8. Requirements for student:

- Attendance, respectful classroom participation: at least 80 % of lectures. Students are encouraged to attend every class with the desire to gain, grow, and develop the necessary concepts, skills and understanding needed to successfully pass the quizes, midterms and final exam.

- Homeworks, laboratory,...and exams: Students are expected to complete all assignments and homeworks. Students must take part in the final exam.

- Integrity: Students are expected to be in class on time ready to work and participate in activities and provide input.

- Classroom rules of conduct: Students must follow the **HUMG rules regarding attendance.** Students who are absent for 20 % consecutive lectures will be dropped from the class and final exam immediately.

- Special needs: *In all exams please distribute as equally as possible in the room to ideally leave free space between you and your neighbor. Close books. No notes are allowed in exams. Only non-programmable, non-graphing calculators are allowed in exams. Absolutely no cell phones in exams! Put them on silent during normal class.*

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Group collaboration	Reports/ Presentations	
4	Practice/Laboratory/ Internship	Reports/ Presentations/Skills	
5	Midterms	Writing/ Viva... (.....minutes)	
...	...	...	...
...	Final exam	Writing/Multiple-choice/Viva... (...minutes)	60 %

Quiz: Writing, 20 minutes
Midterm 1: Writing, 60 minutes
Midterm 2: Writing, 60 minutes
Course presentations: Viva, **TBA as announced**
Final Exam: Writing, 120 minutes
Midterms count as much as 20 % (midterms 10 % each)

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books: (at least 3 books)

[1] J. M. Smith, H. C. Van Ness, M. M. Abbott, Introduction to Chemical Engineering Thermodynamics, 7th Edition, McGraw Hill, New York, 2004.

[2] Michael J. Moran, Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 5th Edition, John Wiley & Sons, Inc, 2006.

[3] Yunus A. Cengel, Michael A. Boles, Thermodynamics – An Engineering Approach, 5th Edition, McGraw Hill, New York, 2006.

[4] Richard E. Sonntag, Claus Borgnakke, Gordon J. Van Wylen, Fundamentals of Thermodynamics, 6th Edition, John Wiley & Sons, Inc, 2013.

[5] William D, McCain, The properties of petroleum fluids, Second Edition, 1990.

[6] Nicholas P. Chopey, Handbook of chemical engineering calculations, Third Edition, 2003.

10. Instruction for self-study:

Table 3. Contents to be prepared - tentative schedule

No	Topics/ Activities	Theory (hours)	Homeworks/ Problems/ Discussion (hours)	Laboratory (hours)	Total self-study (hours)	Requirements for student
1	Introduction	1			2	+ Book **[1, 2, 3]**: Appropriate contents and chapters + Reading assignments**[2, 4]** + Summary ....
2	Fundamental Quantities	1.5	0.5		4	+ Book **[1, 2, 3]**: Content, chapter,... + Reading assignments**[2, 4]** + Summary ....
3	Secondary Quantities	1.5	0.5		4	+ Book **[1, 2, 3]**: Appropriate contents and chapters + Reading assignments**[2, 4]** + Summary ....
4	The first Law of Thermodynamics and Basic Concepts	2	1		6	+ Book **[1, 2, 3]**: Appropriate contents and chapters + Reading assignments**[2, 4]** + Summary ....
5	Applications of the first Law	2	2		8	+ Book **[1, 2, 3]**: Appropriate contents and chapters + Reading assignments**[2, 4]** + Summary ....
6	Volumetric Properties of Pure Fluids	6	3		18	+ Book **[1, 2, 3]**: Appropriate contents and chapters + Reading assignments**[2, 4, 5]** + Summary ....
7	**Midterm 1**	**1**			**2**	+ Book **[1, 2, 3]**: Appropriate contents and chapters + Reading assignments**[2, 4]** + Summary ....
8	Heat Effects	4	2		12	+ Book **[1, 2, 3]**: Content, chapter,... + Reading assignments**[2, 4]** + Summary ....
9	The second Law of Thermodynamics	3	1		8	+ Book **[1, 2, 3]**: Appropriate contents and chapters + Reading assignments**[2, 4]**

						+ Summary ....
10	Applications of the second Law	3	3		12	+ Book **[1, 2, 3]**: Appropriate contents and chapters + Reading assignments**[2, 4, 5]** + Summary ....
11	**Midterm 2**	**1**			**2**	+ Book **[1, 2, 3]**: Appropriate contents and chapters + Reading assignments**[2, 4,5]** + Summary ....
12	Thermodynamic Properties of Fluids	4	2		12	+ Book **[1, 2, 3]**: Appropriate contents and chapters + Reading assignments**[2, 4, 5]** + Summary ....
13	**Discussion,Final Review Session (Optional)**					+ Book **[1, 2, 3, 4, 5, 6]**: Appropriate contents and chapters
14	**Final Exam**	**2**				

TOPICS TO BE COVERED (SUMMARY)

No	Topics/ Activities	Hours (Class)	Hours (Self-study)
1	Introduction	1	2
2	Fundamental Quantities	2	4
3	Secondary Quantities	2	4
4	The first Law of Thermodynamics and Basic Concepts	3	6
5	Applications of the first Law	4	8
6	Volumetric Properties of Pure Fluids	9	18
7	**Midterm 1**	**1**	**2**
8	Heat Effects	6	12
9	The second Law of Thermodynamics	4	8
10	Applications of the second Law	6	12
11	**Midterm 2**	**1**	**2**
12	Thermodynamic Properties of Fluids	6	12
13	Discussion, Final Review Session (Optional)		
14	**Final Exam**	**2**	

Hanoi, 30th May 2018

ADVANCE PROGRAM

TS. Công Ngọc Thắng

CHAIR OF DEPARTMENT

TS. Công Ngọc Thắng

HANOI UNIVERSITY OF MINING AND GEOLOGY
ADVANCED PROGRAM

SOCIALIST REPUBLIC OF VIETNAM
Independence – Freedom - Happiness

COURSE SYLLABUS

1. Course title: Design: Economic Analysis and Design
Course code: ECH 158A
Number of credits: 3
Number of hours: 45

2. Course management unit
2.1. Instructor (s): **Instructor's code**
1. Prof. Ahmet Palazoglu US03
2. Assoc Prof. Nguyen Anh Dung 0406-03

2.2. Department: Oil Refining and Petrochemistry
2.3. Faculty: Oil and Gas

3. Prerequisites (course code):

4. Course objectives/goals/expectations (Relationship to learning outcomes):

4.1. Knowledge
1. Process and product creation and design.
2. Cost accounting and estimation.
3. Profitability analysis techniques.
4. Optimization of process flowsheets to the profession.

4.2. Skills
4.2.1. Reading Technical Articles; Technical Writing
4.2.2. Data collection and analysis

5. Course description:
Process and product creation and design. Cost accounting and estimation. Profitability analysis techniques. Optimization of process flowsheets

6. Organization/ Structure of the course:

Table 1. Course topics to be corved - tentative schedule

6.1. Theory			
Content	***Topics/ Activities***	***Hours***	***Objectives***
Lecture 1	The Desing Process	9	**4.1.1**
Lecture 2	Process Creation	**9**	4.1.1 and 4.1.2
Lecture 3	Cost Accounting & Capital Cost Estimation I	**9**	4.1.2
Lecture 4	Cost Accounting & Capital Cost Estimation II	**9**	4.1.3
Lecture 5	Annual Costs, Earnings &Profitability Analysis	**9**	4.1.4

7. Method of instruction:

Conventional methods with TA.

Group discussion required.

8. Requirements for student:

- Attendance, respectful classroom participation: 80 %.
- Homework,

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Group collaboration	Reports/ Presentations	
4	Practice/Laboratory/ Internship	Reports/ Presentations/Skills	
5	Midterms	Writing/ Viva... (.....minutes)	
...	...	...	...
...	Final exam	Writing/Multiple-choice/Viva... (...minutes)	60 %

Final Exam: Writing

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books: (at least 3 books)

[1]. W. D. Seider, J. D. Seader, and D. R. Lewis, Product and Process Design Principles, 2nd Edition, Wiley, NY, 2004.

[2]. David M. Himmelblau, James B. Riggs, Basic Principles and Calculations in Chemical Engineering, 7th Edition, Prentice Hall, 2004

[3]. Gavin Towler, Ray Sinnott, Chemical Engineering Design: Principles, Practice and Economics of Plant and Process Design, Elsevier, 2008.

11. Instruction for self-study:

Table 3. Contents to be prepared - tentative schedule

No	Topics/ Activities	Theory (hours)	Homeworks (hours)	Laboratory (hours)	Total self-study (hours)	Requirements for student
1	Lecture 1 The Desing Process	4	0	0	4	
2	Lecture 2 – Process Creation	6	2		8	
3	Lecture 3 - Cost Accounting & Capital Cost	5	3		8	

	Estimation I					
4	Lecture 4 - Cost Accounting & Capital Cost Estimation II	8	4		12	
5	Lecture 5 - Annual Costs, Earnings &Profitability Analysis	8	4		12	

Hanoi, 30th May.. 2018

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COURSE SYLLABUS

1. Course title: Thermodynamics
Course code: ECH 152B
Number of credits: 4
Number of hours: 60

2. Course management unit

2.1. Instructor (s):	**Instructor's code**
1. Dr Ngo Thanh Hai	0406-08
2. Assoc Prof. Nguyen Anh Dung	0406-03

2.2. Department: Oil Refining and Petrochemistry
2.3. Faculty: Oil and Gas

3. Prerequisites (course code):

4. Course objectives/goals/expectations (Relationship to learning outcomes):
4.1. Knowledge
1. Vapor /liquid equilibrium
2. Fugacity and Fugacity Coefficient.
3. Applications of solution thermodynamics.
4. Chemical Reaction Equilibrium.

4.2. Skills
4.2.1. Reading Technical Articles; Technical Writing
4.2.2. Data collection and analysis

5. Course description:
Application of principles of kinetics, heat, and mass transfer to the analysis and design of chemical reaction systems. Application of principles of thermodynamics to chemical processes.

6. Organization/ Structure of the course:

Table 1. Course topics to be corved - tentative schedule

6.1. Theory			
Content	***Topics/ Activities***	***Hours***	***Objectives***
Lecture 1	Vapor /liquid equilibrium: Introduction	5	**4.1.1**
Lecture 2	Fugacity and Fugacity Coefficient.	**10**	4.1.2
Lecture 3	Applications of solution thermodynamics	**15**	4.1.2
Lecture 4	Chemical Reaction Equilibrium: I	**15**	4.1.4
Lecture 5	Chemical Reaction Equilibrium: II	**15**	4.1.4

7. Method of instruction:

Conventional methods with TA.

Group discussion required.

8. Requirements for student:

- Attendance, respectful classroom participation: 80 %.
- Homework,

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Group collaboration	Reports/ Presentations	
4	Practice/Laboratory/ Internship	Reports/ Presentations/Skills	
5	Midterms	Writing/ Viva... (.....minutes)	
...	...	...	...
...	Final exam	Writing/Multiple-choice/Viva... (...minutes)	60 %

Final Exam: Writing

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books: (at least 3 books)

[1]. Elements of Chemical Reaction Engineering, H. Scott Fogler, 4th Edition, Prentice Hall, NJ, 1999

[2]. Introduction to Chemical Engineering Thermodynamics, J. M Smith, 3rd Edition, McGraw Hill, 1975.

[3]. Gavin Towler, Ray Sinnott, Chemical Engineering Design: Principles, Practice and Economics of Plant and Process Design, Elsevier, 2008.

11. Instruction for self-study:

Table 3. Contents to be prepared - tentative schedule

No	Topics/ Activities	Theory (hours)	Homeworks (hours)	Laboratory (hours)	Total self-study (hours)	Requirements for student
1	Lecture 1 Vapor /liquid equilibrium: Introduction	5	0	0		
2	Lecture 2 – Fugacity and Fugacity	10	2		8	

	Coefficient.					
3	Lecture 3 - Applications of solution thermodynamics	15	3		8	
4	Lecture 4 Chemical Reaction Equilibrium: I	15	4		12	
5	Lecture 5 - Chemical Reaction Equilibrium: II	15	4		12	

Hanoi, 30th May.. 2018

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COURSE SYLLABUS

1. Course title: Material Balance
Course code: ECH 51
Number of credits: 4
Number of hours: 60

2. Course management unit
2.1. Instructor (s): **Instructor's code**
1. Prof. Brian Higgins US10
2. Assoc Prof. Nguyen Anh Dung 0406-03

2.2. Department: Oil Refining and Petrochemistry
2.3. Faculty: Oil and Gas

3. Prerequisites (course code):

4. Course objectives/goals/expectations (Relationship to learning outcomes):

4.1. Knowledge
1. Process and product creation and design.
2. Cost accounting and estimation.
3. Profitability analysis techniques.
4. Optimization of process flowsheets to the profession.

4.2. Skills
4.2.1. Reading Technical Articles; Technical Writing
4.2.2. Data collection and analysis

5. Course description:
Application of the principle of conservation of mass to single and multicomponent systems in chemical process calculations. Studies of batch, semi-batch, and continuous processes involving mass transfer, change of phase, stoichiometry and chemical reaction.

6. Organization/ Structure of the course:

Table 1. Course topics to be corved - tentative schedule

6.1. Theory			
Content	***Topics/ Activities***	***Hours***	***Objectives***
Lecture 1	Overview	5	**4.1.1**
Lecture 2	Units	**10**	4.1.1 and 4.1.2
Lecture 3	Conservation of Mass for! Single Component Systems!	**15**	4.1.2
Lecture 4	Multicomponent Systems: I	**15**	4.1.3
Lecture 5	Multicomponent Systems: II	**15**	4.1.4

7. Method of instruction:

Conventional methods with TA.

Group discussion required.

8. Requirements for student:

- Attendance, respectful classroom participation: 80 %.
- Homework,

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Group collaboration	Reports/ Presentations	
4	Practice/Laboratory/ Internship	Reports/ Presentations/Skills	
5	Midterms	Writing/ Viva... (.....minutes)	
...	...	...	...
...	Final exam	Writing/Multiple-choice/Viva... (...minutes)	60 %

Final Exam: Writing

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books: (at least 3 books)

[1]. W. D. Seider, J. D. Seader, and D. R. Lewis, Product and Process Design Principles, 2nd Edition, Wiley, NY, 2004.

[2]. David M. Himmelblau, James B. Riggs, Basic Principles and Calculations in Chemical Engineering, 7th Edition, Prentice Hall, 2004

[3]. Gavin Towler, Ray Sinnott, Chemical Engineering Design: Principles, Practice and Economics of Plant and Process Design, Elsevier, 2008.

11. Instruction for self-study:

Table 3. Contents to be prepared - tentative schedule

No	Topics/ Activities	Theory (hours)	Homeworks (hours)	Laboratory (hours)	Total self-study (hours)	Requirements for student
1	Lecture 1 Overview	5	0	0	4	
2	Lecture 2 – Units	10	2		8	
3	Lecture 3 - Conservation of	15	3		8	

	Mass for! Single Component Systems!					
4	Lecture 4 Multicomponent Systems: I	15	4		12	
5	Lecture 5 - Multicomponent Systems: II	15	4		12	

Hanoi, 30th May 2018

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COURSE SYLLABUS

1. Course title: Chemical Engineering Profession
Course code: ECH80
Number of credits: 1
Number of hours: 15

2. Course management unit
2.1. Instructor (s): **Instructor's code**
1. Prof. Tonya Kuhl — US09
2. Assoc Prof. Nguyen Anh Dung — 0406-03
2.2. Department: Oil Refining and Petrochemistry
2.3. Faculty: Oil and Gas

3. Prerequisites (course code):
4. Course objectives/goals/expectations (Relationship to learning outcomes):
4.1. Knowledge
This course is designed to develop an awareness of the role of chemical engineers in society. Students should become familiar with the breadth of potential careers in chemical engineering, and the professional and ethical responsibilities associated with those careers. Students should develop an appreciation of the need for life-long learning and the tools and opportunities for such learning. Students are expected to demonstrate knowledge of contemporary social issues and their relationship to the profession.
4.2. Skills
4.2.1. Reading Technical Articles; Technical Writing
4.2.2. Data collection and analysis
5. Course description:
Introduction to the professional opportunities and professional responsibilities of chemical engineers. Opportunities and needs for post-baccalaureate education. Relationship of chemical engineering as a profession to contemporary issues.
6. Organization/ Structure of the course:

Table 1. Course topics to be corved - tentative schedule

6.1. Theory			
Content	***Topics/ Activities***	***Hours***	***Objectives***
Lecture 1	What is a Chemical Engineer?	4	4.1
Lecture 2	AIChE Code of Ethics	5	4.1
Lecture 3	Engineering Ethics	6	4.1

7. Method of instruction:
Conventional methods with TA.

Group discussion required.

8. Requirements for student:

- Attendance, respectful classroom participation: 80 %.
- Homework,

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Group collaboration	Reports/ Presentations	
4	Practice/Laboratory/ Internship	Reports/ Presentations/Skills	
5	Midterms	Writing/ Viva... (.....minutes)	
...	...	...	...
...	Final exam	Writing/Multiple-choice/Viva... (...minutes)	60 %

Final Exam: Essay

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books: (at least 3 books)

[1]. Furusaki, S., Garside, J., and Fan, L. S. editors, The Expanding World of Chemical Engineering, 2nd Edition, Taylor and Francis, 2002

[2]. Kemper, J. D., and Sanders, B. R. Engineers and Their Profession, 5th Edition, 2001 Oxford Press.

11. Instruction for self-study:

Table 3. Contents to be prepared - tentative schedule

No	Topics/ Activities	Theory (hours)	Homeworks (hours)	Laboratory (hours)	Total self-study (hours)	Requirements for student
1	Lecture 1 - What is a Chemical Engineer?	4	0	0	4	
2	Lecture 2 - AIChE Code of Ethics	6	2		8	
3	Engineering Ethics	5	3		8	

Hanoi, .30th..May... 2018

ADVANCE PROGRAM

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COURSE SYLLABUS

1. Course title: Kinetics
Course code: ECH146
Number of credit: 4
Number of hours: 60

2. Course management unit
2.1. Instructor (s): **Instructor's code**
1. Dr. Ngô Hà Sơn 0603-14
2.2. Department: Oil Refining and Petrochemistry
2.3. Faculty: Oil and Gas

3. Prerequisites (course code):

4. Course objectives/goals/expectations (Relationship to learning outcomes):

4.1. Knowledge
4.1.1 Mole balances, design equations;
4.1.2. Rate Law
4.1.3. Stoichiometry
4.1.4. Isothermal Reactor Design
4.1.5. Pressure Drop
4.1.6. Analysis of Rate Data
4.2. Skills
4.2.1. Reading Technical Articles; Technical Writing
4.2.2. Data collection and analysis

5. Course description:
Application of principles of kinetics, heat, and mass transfer to the analysis and design of chemical reaction systems.

6. Organization/ Structure of the course:

Table 1. Course topics to be corved - tentative schedule

6.1. Theory			
Content	***Topics/ Activities***	***Hours***	***Objectives***
Lecture 1	Introduction, Mole balances	4	4.1.1
Lecture 2	Design equations, Rate versus X plots, Reactor staging	**8**	4.1.1 and 4.1.2
Lecture 3	Rate Law	**8**	4.1.2
Lecture 4	Stoichiometry Batch	6	4.1.3

Lecture 5	Stoichiometry Flow	8	4.1.3
Lecture 6	Isothermal reactor design	8	4.1.4
Lecture 7	Pressure drop	6	4.1.5
Lecture 8	Analysis of Rate Data	8	4.1.6
Lecture 9	Multiple Reactions	8	4.1.4, 4.1.6

7. Method of instruction:

Conventional methods with
Group discussion required.

8. Requirements for student:

- Attendance, respectful classroom participation: 80 %.
- Homework,

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Group collaboration	Reports/ Presentations	
4	Practice/Laboratory/ Internship	Reports/ Presentations/Skills	
5	Midterms	Writing/ Viva... (.....minutes)	
...	...	...	...
...	Final exam	Writing/Multiple-choice/Viva... (...minutes)	60 %

Midterm : 120 minutes
Final Exam: 120 minutes

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books: (at least 3 books)

[1]. H. Scott Fogler, Elements of Chemical Reaction Engineering, 4th Edition, Prentice Hall PTR, 2006.
[2]. Octave Lavenspiel, Chemical Reaction Engineering, Wiley, 1999.
[3]. Ronald W.Messen, Charles A. Mims, Bradley A. Saville, Introduction to Chemical Reaction Engineering and Kinetics, Wiley, 1999.

11. Instruction for self-study:

Table 3. Contents to be prepared - tentative schedule

No	Topics/ Activities	Theory (hours)	Homeworks (hours)	Laboratory (hours)	Total self-study (hours)	Requirements for student
1	Lecture 1	2	0	0	2	[1]Preface, Prequisites, Appendix B
2	Lecture 2	6	2		8	Chapter 1, P1-9A, Appendix A, from the Web, Chapter 2 Sections 2.1, 2.2, and 2.3
3	Lecture 3	6	2		8	Chapter 2, Chapter 3
4	Lecture 4	4	2		6	Chapter 4
5	Lecture 5	6	2		8	Chapter 4, Section 4.1
6	Lecture 6	6	2		8	Chapter 5, Sections 5.1, 5.2 and 5.3
7	Lecture 7	4	2		6	Chapter 5, Sections 5.4 and 5.5
8	Lecture 8	6	2		8	Chapter 7
9	Lecture 9	6	2		8	Chapter 6

Hanoi, .30th..May.. 2018

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COURSE SYLLABUS

1. Course title: CHEMICAL ENGINEERING LABORATORY 155A

Course code: ECH 155A

Number of credits: 04

Number of hours: Theory: 18 hrs; Practice/Laboratory: 72 hrs; Self-study: 180 hrs;

2. Course management unit

2.1. Instructors: **Instructor's code**

Prof. Tonya Kuhl

PhD. Pham Trung Kien 0603-07

2.2. Department: Oil Refining and Petrochemistry

2.3. Faculty: Oil and Gas Faculty

3. Prerequisites (course code): ECH 129A

4. Course objectives/goals/expectations (Relationship to learning outcomes):

4.1. Knowledge

4.1.1. To develop skills in experimentation, with strict adherence to safety guidelines, careful planning, proper record keeping, effective teamwork, and timely performance.

4.1.2. To reinforce concepts presented in chemical engineering courses by experimentation with equipment and methods that are designed to generate reliable data. The data are subjected to statistical analysis and evaluation of errors and can be compared with theory and/or literature results to establish their reliability and potential usefulness.

4.1.3. To develop skills in communication by using experimental results as the basis for the preparation of written and oral reports.

4.2. Skills

4.2.1. To develop skills in writing reports, analysis experimental data and skills in science report presentation.

4.2.2. To develop skills in teamwork and self-study.

5. Course description:

Goals of the Experiment Column Draining Experiment and Darcy's Law: The key engineering question in this experiment is: how long will it take for the water to drain completely? The student will have the opportunity to study porous media of different permeabilities to develop constitutive models through scaling analysis, demonstrate the effect of porosity/permeability on draining dynamics; perform a detailed error analysis, and determine the reproducibility of the data. The fundamental goals of the experiment are to provide the student with experience in modeling data, non-dimensionalizing models, error analysis, and basic report writing.

Goals of the Laboratory: Viscosity Lab: Determine the specific weight and the viscosity of two liquids at room temperature. Determine a relationship between the coefficient of drag and the Reynolds number. Compare your findings to established literature values and relationships.
The purpose of the written report is to provide a summary of techniques used in the experiment and to present and evaluate the results and compare them with results of established theories and/or literature values.

6. Organization/ Structure of the course:

Table 1. Course topics to be corved - tentative schedule

6.1. Theory			
Content	***Topics/ Activities***	***Hours***	***Objectives***
Experiment 1	Error Analysis of experimental data Column Draining Experiment and Darcy's Law Theoretical background on Draining and Darcy's Law Guidelines for written report, oral presentation	9	4.1.1, 4.1.2, 4.1.3, 4.2.1. 4.2.2
Experiment 2	Viscosity Lab Theoretical background on Viscosity Guidelines for written report, oral presentation	9	4.1.1, 4.1.2, 4.1.3, 4.2.1. 4.2.2
6.2. Practice/Laboratory (if any)			
Content	***Topics/ Activities***	***Hours***	***Objectives***
Experiment 1	Error Analysis of experimental data Column Draining Experiment and Darcy's Law Determine flow rate of water with time, get data for error analysis and writing report and oral presentation	*36*	4.1.1, 4.1.2, 4.1.3, 4.2.1. 4.2.2
Experiment 2	Viscosity Laboratory Determine the specific weight and the viscosity of two liquids at room temperature. Determine a relationship between the coefficient of drag and the Reynolds number. Compare your findings to established literature values and relationships.	*36*	4.1.1, 4.1.2, 4.1.3, 4.2.1. 4.2.2

7. Method of instruction: Practice, Laboratory, Experimentation

8. Requirements for student:

- Attendance, respectful classroom participation: 100 %

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	40 %
3	Group collaboration	Written Reports/ Presentations	
6	Final exam	Oral presentation	50 %

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books: (at least 3 books)

Laboratory Handouts

11. Instruction for self-study:

Table 3. Contents to be prepared - tentative schedule

No	Topics/ Activities	Theory (hours)	Homeworks (hours)	Laboratory (hours)	Total self-study (hours)	Requirements for student
1	Error Analysis of experimental data Column Draining Experiment and Darcy's Law Determine flow rate of water with time, get data for error analysis and writing report and oral presentation	9		36	90	Students MUST read the laboratory handout for each laboratory by Monday the week that experiment is to be performed. Lectures will

						reinforce the written material and provide time for group discussions, experimental planning, and preparation of data spread sheets. Students are encouraged to bring their laptops to class and the laboratories.
2	Viscosity Laboratory Determine the specific weight and the viscosity of two liquids at room temperature. Determine a relationship between the coefficient of drag and the Reynolds number. Compare your findings to established literature values and relationships.	9		36	90	All experiments will be performed by groups rather than by individuals. Written reports are to be prepared independently by each student for each experiment. Individual written reports are required for the first three experiments All written reports must be prepared with a word processor . A variety of

						A variety of computer tools are available for computation, statistical analysis, and the preparation of graphs, charts, equations, and tables. Students are expected to develop the necessary skills to use these tools routinely.

Hanoi, 30th May 2018

ADVANCE PROGRAM

TS. Công Ngọc Thắng

CHAIR OF DEPARTMENT

TS. Công Ngọc Thắng

NOI UNIVERSITY OF MINING AND GEOLOGY
ADVANCED PROGRAM

SOCIALIST REPUBLIC OF VIETNAM
Independence – Freedom - Happiness

COURSE SYLLABUS

1. Course title:
Design B, Separations and Unit Operations
Course code: ECH 158B
Number of credits: 04
Number of hours: 60
Theory: 30; Homeworks: 6; Practice/Laboratory:.....;
Internship:.....; Topics:.....; Self-study: 120;

2. Course management unit
2.1. Instructor (s): **Instructor's code**
1. Prof. Ahmet Palazoglu
2. Dr. Toan Vu 0603-13
2.2. Department: Oil Refining and Petrochemistry/ Chemical Engineering at UC Davis
2.3. Faculty: Oil & Gas/ UC Davis

3. Prerequisites (course code): ECH 158A

4. Course objectives/goals/expectations (Relationship to learning outcomes):

4.1. Knowledge

Senior design experience with multiple realistic constraints. Heuristic and rigorous design of chemical process equipment.

4.2. Skills

After completing this course, students will be able to design/ to calculate/ to access the design of a process or equipments installed in chemical plants.

5. Course description:

Separation by filtration, distillation and extraction. Synthesis of reactor and separation networks, heat and power integration

6. Organization/ Structure of the course:

Table 1. Course topics to be corved - tentative schedule

6.1. Theory			
Content	***Topics/ Activities***	***Hours***	***Objectives***
Chapter 1	Materials and Fabrication Selection	12	4.1, 4.2
1.1	Factors Contributing to Corrosion		

1.2	Combating Corrosion		
1.3	Properties of Materials		
1.4	Tabulated Data for Selecting Materials of Construction		
1.5	Selection of Materials		
1.6	Fabrication of Equipment		
Chapter 2	Materials – Handling Equipment – Design and Costs	12	4.1, 4.2
2.1	Basic Concepts of Fluid Transport		
2.2	Piping in Fluid Transport Processes		
2.3	Pumping of Fluids		
2.4	Compression and Expansion of Fluids		
2.5	Agitation and Mixing of Fluids		
2.6	Flow Measurement of Fluids		
2.7	Storage and Containment of Fluids		
Chapter 3	Reactor Equipment – Design and Costs	12	4.1, 4.2
3.1	Reactor Principles		
3.2	Development of Chemical Reaction Rate Expressions		
3.3	Reaction and Reactor Performance		
3.4	Reactor and Catalyst Equipment		
Chapter 4	Heat-Transfer Equipment – Design and Costs	12	4.1, 4.2
4.1	Basic Theory of Heat Transfer in Exchangers		
4.2	Determination of Heat-Transfer Coefficients		
4.3	Determination of Pressure Drop in Heat Exchangers		
4.4	Selection of Heat Exchanger Type		
4.5	Design of Key Heat Exchanger Types		
4.6	Optimum Design of Heat Exchangers		
4.7	General Methods for Design of Heat Exchangers		
Chapter 5	Separation Equipment – Design and Costs	12	4.1, 4.2
5.1	Selection of Suitable Separation Processes		
5.2	Equipment Design and Costs for Separating Homogeneous Mixtures		
5.3	Separation by Distillation		
5.4	Separation by Absorption and Stripping		
5.5	Separation by Extraction		
5.6	Separation Using Membranes		
5.7	Separation by Adsorption		
5.8	Equipment Design and Costs for Separating		

7. Method of instruction:

- Lectures and discussion in class;
- Homeworks;

8. Student Tasks:

- Attendance: at least 80%;
- Patticipation/ willingness to joint discussions;
- All homework fulfilments on time ;
- Midterms and final exam attandence.

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers: 3	30 %
3	Midterms	Writing 60 minutes for one test	
4	Final exam	Writing 120 minutes	60 %

Midterm 1: 60 minutes
Midterm 2: 60 minutes
Final Exam: 120 minutes

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Textbooks and other books relevent

Textbook:

1) M.S. Peters, K.D. Timmerhaus, R.E. West, *Plant Design and Economics for Chemical Engineers*, 5th Ed., Mc Graw Hill, 2003;

Other textbook for reference:

1) R. K. SINNOTT, *Chemical Engineering Design* in CHEMICAL ENGINEERING series by Coulson & Richardson's, Vol. 6, 4th Ed., Elsevier Butterworth-Heinemann, 2005
2) Robert A. Meyers, Handbook of Petroleum refining processes, Third Edition, Mc Graw – Hill, 2006.
3) Davis S. J. Jones, Peter R. Pujado, Handbook of petroleum processing, Springer, The Netherlands, 2006.

11. Instruction for self-study:

Table 3. Contents to be prepared - tentative schedule

No	Topics/ Activities	Theory (hours)	Homeworks (hours)	Laboratory (hours)	Total self-study (hours)	Requirements for student
1	**Aspen Hysys Plus**	4	0	0	4	

Hanoi, 30th May 2018

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ADVANCED PROGRAM

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COURSE SYLLABUS

1. Course title: CHEMICAL ENGINEERING LABORATORY 155B

Course code: ECH 155B

Number of credits: 02

Number of hours: Theory: 9 hrs; Practice/Laboratory: 36 hrs; Self-study: 90 hrs;

2. Course management unit

2.1. Instructor:	**Instructor's code**
PhD. Pham Trung Kien	0603-07
PhD. Nguyen Thi Linh	0603-08

2.2. Department: Oil Refining and Petrochemistry

2.3. Faculty: Oil and Gas Faculty

3. Prerequisites (course code): ECH 155A

4. Course objectives/goals/expectations (Relationship to learning outcomes):

4.1. Knowledge

4.1.1. To develop skills in experimentation, with strict adherence to safety guidelines, careful planning, proper record keeping, effective teamwork, and timely performance.

4.1.2. To reinforce concepts presented in chemical engineering courses by experimentation with equipment and methods that are designed to generate reliable data. The data are subjected to statistical analysis and evaluation of errors and can be compared with theory and/or literature results to establish their reliability and potential usefulness.

4.1.3. To develop skills in communication by using experimental results as the basis for the preparation of written and oral reports.

4.2. Skills

4.2.1. To develop skills in writing reports, analysis experimental data and skills in science report presentation.

4.2.2. To develop skills in teamwork and self-study.

5. Course description:

Experiment 1: Radial Capillary Penetration into Fibrous Media: In this experiment we will measured the rate of capillary penetration into fibrous media (i.e., the wicking velocity of liquid into paper) to determine the effective permeability of the paper. Relative permeability and capillary pressures are very important in crude oil extraction and reservoir engineering.

The fundamental goals of the experiment are to provide hands-on experience in determining relative permeabilities, data collection, modeling, error analysis, and memo report writing.

Experiment 2: Shell and Tube Heat Exchangers: In this experiment you will study the efficiency

of shell and tube heat exchanges. The objectives of this experiment are:

- To perform an energy balance of a shell and tube heat exchanger
- To investigate the difference between co-current and countercurrent flows
- To determine the overall heat transfer coefficient for a shell and tube heat exchanger
- To investigate the effect flow rates on heat exchanger efficiency and overall heat transfer coefficient

The fundamental goals of the experiment are to provide the student with experience in modeling data, non-dimensionalizing models, error analysis, and basic report writing.

The purpose of the written report is to provide a summary of techniques used in the experiment and to present and evaluate the results and compare them with results of established theories and/or literature values.

6. Organization/ Structure of the course:

Table 1. Course topics to be corved - tentative schedule

6.1. Theory			
Content	***Topics/ Activities***	***Hours***	***Objectives***
Experiment 1	Radial Capillary Penetration into Fibrous Media Theoretical background on Radial Capillary Penetration into Fibrous Media Radial Capillary Penetration into Fibrous Media Guidelines for written report, oral presentation	4.5	4.1.1, 4.1.2, 4.1.3, 4.2.1. 4.2.2
Experiment 2	**Shell and Tube Heat Exchangers** Theoretical background on heat transfer, energy balance of a shell and tube heat exchanger, the difference between co-current and countercurrent flows, the overall heat transfer coefficient for a shell and tube heat exchanger, the effect flow rates on heat exchanger efficiency and overall heat transfer coefficient Guidelines for written report, oral presentation	4.5	4.1.1, 4.1.2, 4.1.3, 4.2.1. 4.2.2
6.2. Practice/Laboratory (if any)			
Content	***Topics/ Activities***	***Hours***	***Objectives***
Experiment 1	Radial Capillary Penetration into Fibrous	*18*	4.1.1, 4.1.2, 4.1.3,

	The Activities of the experiment are to provide hands-on experience in determining relative permeabilities, data collection, modeling, error analysis, and memo report writing.		4.2.1. 4.2.2
Experiment 2	**Shell and Tube Heat Exchangers** To Perform an energy balance of a shell and tube heat exchanger To investigate the difference between co-current and countercurrent flow To determine the overall heat transfer coefficient for a shell and tube heat exchanger To investigate the effect flow rates on heat exchanger efficiency and overall heat transfer coefficient	*18*	4.1.1, 4.1.2, 4.1.3, 4.2.1. 4.2.2

7. Method of instruction: Practice, Laboratory, Experimentation

8. Requirements for student:

- Attendance, respectful classroom participation: 100 %

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	
3	Group collaboration	Written Reports/ Presentations	40 %
6	Final exam	Oral presentation	50 %

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books: (at least 3 books)

Laboratory Handouts

11. Instruction for self-study:

Table 3. Contents to be prepared - tentative schedule

No	Topics/ Activities	Theory (hours)	Homeworks (hours)	Laboratory (hours)	Total self-study (hours)	Requirements for student
1	Error Analysis of experimental data Radial Capillary Penetration into Fibrous The Activities of the experiment are to provide hands-on experience in determining relative permeabilities, data collection, modeling, error analysis, and memo report writing.	4.5		18	45	Students MUST read the laboratory handout for each laboratory by Monday the week that experiment is to be performed. Lectures will reinforce the written material and provide time for group discussions, experimental planning, and preparation of data spread sheets. Students are encouraged to bring their laptops to class and the laboratories.
2	**Shell and Tube Heat Exchangers** To Perform an energy balance of a shell and tube heat exchanger To investigate the	4.5		18	45	All experiments will be performed by groups rather than by individuals.

	cocurrent and countercurrent flow To determine the overall heat transfer coefficient for a shell and tube heat exchanger To investigate the effect flow rates on heat exchanger efficiency and overall heattransfer coefficient .					are to be prepared independently by each student for each experiment. Individual written reports are required for the first three experiments All written reports must be prepared with a word processor . A variety of computer tools are available for computation, statistical analysis, and the preparation of graphs, charts, equations, and tables. Students are expected to develop the necessary skills to use these tools routinely.

Hanoi, 30th May 2018

ADVANCE PROGRAM

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MINISTRY OF EDUCATION AND TRAINING
HANOI UNIVERSITY OF MINING AND GEOLOGY
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COURSE SYLLABUS

1. Course title: Mass Transfer for Biochemical and Chemical Engineers (Transport Phenomena – Mass Transfer)

Course code: ECH143
Number of credits: 4
Total number of hours: 180

Theory: 45;	Homeworks/Problems/Discussion: 15;	Practice/Laboratory: 0;
Internship: 0;	Topics: 0;	Self-study: 120;

2. Course management unit

2.1. Instructor (s):	**Instructor's code**
1. Dr. Cong Ngoc Thang (email: congngocthang@humg.edu.vn).	0603-11
2. Dr. Toan Vu Van (email: vuvantoan@humg.edu.vn).	0603-13

2.2. Department: Oil Refining and Petrochemistry
2.3. Faculty: Oil and Gas/ Advanced program office

3. Prerequisites (course codes):

ECH51 (Material Balances), **ECH141** (Fluid Mechanics for Biochemical and Chemical Engineers).

You must have taken ECH 141 (Fluid Mechanics). Convection plays a dominant role in mass transfer and often is much greater than mass transfer by molecular diffusion. Thus you need to understand fluid mechanics. Further, you need to know solutions of ordinary differential and partial differential equations, such as separation of variables, boundary conditions, Sturm-Liouville eigenvalue problems, similarity transforms, Laplace transforms and Bessel functions (ECH140). You must know tensor analysis.

4. Course objectives/goals/expectations (Relationship to learning outcomes):

4.1. Knowledge

4.1.1. To introduce students to and to provide students with basic knowledge of mass transfer and mass transfer processes of interest to chemical engineers and materials scientists.

4.1.2. To introduce students to and to provide students with the applications of differential, integral equations for calculating the mass rate, mass flux, mass transfer coefficient and overall mass transfer coefficient.

4.1.3. To introduce students to and to provide students with the methods for calculating the mass balances as a basis for development of mathematical models.

4.1.4. To introduce students to and to provide students with basic knowledge of testing and designing methods of mass exchangers.

4.2. Skills

4.2.1. Recognizing, distinguishing, and evaluating the basic knowledge of mass transfer and mass transfer processes of interest to chemical engineers and materials scientists.

4.2.2. Determining designing and operating parameters and applying differential, integral equations for calculating the mass rate, mass flux, mass transfer coefficient and overall mass transfer coefficient.

4.2.3. Recognizing, analyzing, evaluating and defining informations relating to determining the mass balances as a basis for development of mathematical models.

4.2.4. Providing students with opportunities to develop basic skills in respect to group-working neatly and accurately and solving problems in accordance with applying appropriate mass transfer phenomena.

5. Course description:

The course is designed to provide students with basic knowledge of mass transfer and mass transfer equipments in applications to chemical and biochemical engineering.For more details, the course provides students with the introduction to mass transfer and its applications and development of problem solving skills and also the use of mathematics to represent simple physical and chemical phenomena relating to mass transfer and mass transfer processes, including diffusion equations for binary and multicomponent systems, diffusion coefficients, convective-diffusion equation, Stefan-Maxwell equations, Stefan diffusion tube, diffusion in solids, mass transfer across an interface, mass transfer coefficients, laminar flow mass transfer, mass transfer in fluid-fluid systems, mass transfer with chemical reaction, mass transfer and reaction in catalysts, boundary layer analysis. The course also illustrates and demonstrates students with the methods for calculating the mass balances as a basis for development of mathematical models and designing methods of unit operations and equipments of chemical engineering (gas absorption, distillation, liquid/liquid extraction, adsorption, mass exchangers or processing towers).

6. Organization/ Structure of the course:

Table 1. Course topics to be corved - tentative schedule

6.1. Theory			
Content	***Topics/ Activities***	***Hours***	***Objectives***
1	**Introduction**	**1**	4.1.1/4.1.2/4.2.1/4.2.2
2	Diffusion equations for binary systems	3	4.1.3/4.2.1/4.2.2/4.2.3
3	Diffusion coefficients	3	4.1.3/4.2.1/4.2.2/4.2.3
4	Convective-diffusion equation	3	4.1.2/4.2.1/4.2.2/4.2.3
5	Multicomponent systems	3	4.1.2/4.2.1/4.2.2/4.2.3
6	Stefan-Maxwell equations	3	4.1.1/4.1.2/4.1.3/4.2.1
7	Stefan diffusion tube	2	4.1.2/4.2.1/4.2.2/4.2.3
8	Diffusion in solids	1	4.1.2/4.2.1/4.2.2/4.2.3
9	**Midterm 1**	**1**	4.2.4
10	Mass transfer across an interface	5	4.1.1/4.1.2/4.1.3 4.2.1/4.2.2/4.2.3
11	Mass transfer coefficients	3	4.1.1/4.1.2/4.1.3/ 4.2.1/4.2.2/4.2.3
12	Laminar flow mass transfer	2	4.1.1/4.1.2/4.1.3/4.1.4 4.2.1/4.2.2/4.2.3/4.2.4
13	Mass transfer in fluid-fluid systems	3	4.1.1/4.1.2/4.1.3/4.1.4 4.2.1/4.2.2/4.2.3
14	Mass transfer with chemical reaction	2	4.1.1/4.1.2/4.1.3/4.1.4 4.2.1/4.2.2/4.2.3
15	Mass transfer and reaction in catalysts	1	4.1.1/4.1.2/4.1.3/4.1.4 4.2.1/4.2.2/4.2.3

16	Boundary layer analysis	3	4.1.1/4.1.2/4.1.3/4.1.4 4.2.1/4.2.2/4.2.3
17	**Midterm 2**	**1**	4.2.4
18	Gas absorption	4	4.1.1/4.1.2/4.1.3/4.1.4 4.2.1/4.2.2/4.2.3
19	Distillation	5	4.1.1/4.1.2/4.1.3/4.1.4 4.2.1/4.2.2/4.2.3
20	Liquid/liquid extraction	3	4.1.1/4.1.2/4.1.3/4.1.4 4.2.1/4.2.2/4.2.3
21	Adsorption	3	4.1.1/4.1.2/4.1.3/4.1.4 4.2.1/4.2.2/4.2.3
22	Topic Presentation (Mass exchangers)	5	4.1.1/4.1.2/4.1.3/4.1.4 4.2.1/4.2.2/4.2.3/4.2.4
23	**Final Review Session (Optional)**		
24	**Final Exam**	**2**	

7. Methods of instruction:

- Lectures and discussions.
- Cooperative learning groups and independent study.
- Debates and problem solving.
- Homework problem sets will be distributed in class or homework files will be sent to your email. Some homework will be graded. In presenting the solution of a problem that requires analysis, students should state briefly in words at the beginning:
  - what is given
  - what is to be found
  - what the method of solution is

This preliminary information should be followed by the solution to the problem. The grading of the problems will be based on the preliminary information as well as on the solution.

8. Requirements for students:

- Attendance, respectful classroom participation: at least 80 % of lectures. Students are encouraged to attend every class with the desire to gain, grow, and develop the necessary concepts, skills and understanding needed to successfully pass the quizes, midterm and final exam.
- Homeworks, laboratory,…and exams: Students are expected to complete all assignments and homeworks. Students must take part in the final exam.
- Integrity: Students are expected to be in class on time ready to work and participate in activities and provide input. The most productive learning atmosphere occurs when you ask questions. You are encouraged to ask questions in class. Questions and answers help to clarify *concepts*, and you are encouraged to share *concepts* and *ideas* concerning homework problems. However, the work that you submit for a grade in this course *must be your own*, i.e., **you must be the sole master and owner of the material that you submit for course credit.**
- Classroom rules of conduct: Students must follow the **HUMG rules regarding attendance.** Students who are absent for 20 % consecutive lectures will be dropped from the class and final exam immediately.
- Special needs: *In all exams please distribute as equally as possible in the room to ideally leave free space between you and your neighbor. Close books. No notes are allowed in all exams. Only non-programmable, non-graphing calculators are allowed in exams. Absolutely no cell phones in exams! Put them on silent during normal class.* Answers to the homework problems and the grading key for the quizzes and exams will be available or discussed in class. **If a personal emergency**

occurs, contact the instructor **before** any examination. During an examination or quiz, all personal belongings must be stored under your chair during exams. If you have a disability that has an impact on your learning, we encourage you to talk with me about it on a confidential basis so that we might collectively devise a strategy to overcome whatever barriers may exist. The classroom will be a place of orderly discussion of contents of the course. If you wish to discuss personal matters with your neighbor, *you must do so elsewhere*. **If you want to sleep, the classroom is not the place for it.**

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Group collaboration	Reports/ Presentations	
4	Practice/Laboratory/ Internship	Reports/ Presentations/Skills	
5	Midterms	Writing/ Viva... (.....minutes)	
...	...	...	...
...	Final exam	Writing/Multiple-choice/Viva... (...minutes)	60 %

Quizzes: Writing, 20 minutes each.
Midterm 1: Writing, 60 minutes
Midterm 2: Writing, 60 minutes
Course presentations: Viva, **TBA**
Final Exam: Writing, 120 minutes

Midterms count as much as 20 % (midterms 10 % each)

The examinations will cover both the lecture material and the assigned reading in the posted notes.

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books: (at least 3 books)

[1] Robert E. Treybal, Mass-Transfer Operations, Third Edition, Mc Graw – Hill, 1981.

[2] R. Byron Bird, Warren E. Stewart, Edwin N. Lightfoot. Transport Phenomena, Revised Second Edition, John Wiley & Sons, Inc, 2007.

[3] Warren L McCabe, Julian C. Smith, Peter Harriott, Unit operations of chemical engineering, Fifth Edition, Mc Graw – Hill, 1993.

[4] Frank P. Incropera, David P. Dewitt, Theodore L. Bergman, Adrienne S. Lavine. Fundamentals of Heat and Mass Transfer, Six Edition, John Wiley & Sons, Inc, 2007.

[5] Carl R. Branan, Rules of Thumb for Chemical Engineers, Third Edition, GPP.

11. Instruction for self-study:

Table 3. Contents to be prepared - tentative schedule

No	Topics/ Activities	Theory (hours)	Homeworks/ Problems/	Total self-	Requirements for student

			Discussion (hours)	study (hours)	
1	**Introduction**	**1**		**2**	+ Book **[1]**: Chapter 1 (The mass transfer operations); + Book **[2]**: Chapter 17 (Diffusivity and the mechanisms of mass transport); + Book **[3]**: Chapter 21 (Principles of Diffusion and mass transfer between phases); + Book **[4]**: Chapter 14 (Diffusion mass transfer); + Summary
2	Diffusion equations for binary systems	3		6	+ Book **[1]**: Chapter 2, 3 + Book **[2]**: Chapter 17 + Book **[3]**: Chapter 21 + Book **[4]**: Chapter 14 + Summary
3	Diffusion coefficients	2	1	6	+ Book **[1]**: Chapter 3 + Book **[2]**: Chapter 17 + Book **[3]**: Chapter 21 + Book **[4]**: Chapter 14 + Summary
4	Convective-diffusion equation	2.5	0.5	6	+ Book **[1]**: Chapter 3 + Book **[2]**: Chapter 17 + Book **[3]**: Chapter 21 + Book **[4]**: Chapter 14 + Summary
5	Multicomponent systems	2	1	6	+ Book **[2]**: Chapter 19 + Book **[3]**: Chapter 21 + Book **[4]**: Chapter 14 + Summary
6	Stefan-Maxwell equations	2	1	6	+ Book **[2]**: Chapter 17 + Book **[3]**: Chapter 21 + Book **[4]**: Chapter 14 + Summary
7	Stefan diffusion tube	1	1	4	+ Book **[2]**: Chapter 18 + Summary
8	Diffusion in solids	0.5	0.5	2	+ Book **[1]**: Chapter 4 + Book **[2]**: Chapter 17, 18 + Summary
9	**Midterm 1**	**1**		2	+ Book **[1, 2, 3, 4]**: Appropriate contents and chapters + Summary
10	Mass transfer across an interface	3	2	10	+ Book **[1]**: Chapter 3 + Book **[2]**: Chapter 17 + Book **[3]**: Chapter 21 + Book **[4]**: Chapter 14 + Summary
11	Mass transfer coefficients	2	1	6	+ Book **[1]**: Chapter 3 + Book **[2]**: Chapter 17 + Book **[3]**: Chapter 21 + Book **[4]**: Chapter 14 + Summary
12	Laminar flow mass	2		4	+ Book **[1]**: Chapter 3

	transfer				+ Book **[2]**: Chapter 17 + Book **[3]**: Chapter 21 + Book **[4]**: Chapter 14 + Summary
13	Mass transfer in fluid-fluid systems	3		6	+ Book **[1]**: Chapter 3 + Book **[2]**: Chapter 17 + Book **[3]**: Chapter 21 + Book **[4]**: Chapter 14 + Summary
14	Mass transfer with chemical reaction	2		4	+ Book **[2]**: Chapter 18 + Book **[4]**: Chapter 14 + Summary
15	Mass transfer and reaction in catalysts	1		2	+ Book **[2]**: Chapter 18 + Book **[4]**: Chapter 14 + Summary
16	Boundary layer analysis	2	1	6	+ Book **[1]**: Chapter 5 + Book **[3]**: Chapter 21 + Book **[4]**: Chapter 14 + Summary
17	**Midterm 2**	**1**		2	+ Book **[1, 2, 3, 4]**: Appropriate contents and chapters + Summary
18	Gas absorption	3	1	8	+ Book **[1]**: Chapter 8 + Book **[2]**: Chapter 18 + Book **[3]**: Chapter 22 + Book **[5]**: Chapter 4 + Summary
19	Distillation	4	**1**	10	+ Book **[1]**: Chapter 9 + Book **[3]**: Chapter 18, 19 + Book **[5]**: Chapter 3 + Summary
20	Liquid/liquid extraction	2	1	6	+ Book **[1]**: Chapter 10 + Book **[3]**: Chapter 20 + Summary
21	Adsorption	2	1	6	+ Book **[1]**: Chapter 11 + Book **[3]**: Chapter 25 + Summary
22	Topic Presentation (Mass exchangers)	3	2	10	+ Book **[1, 2, 3, 4]**: Appropriate contents and chapters + Summary
23	**Final Review Session (Optional)**				+ Book **[1, 2, 3, 4]**: Appropriate contents and chapters + Summary
24	**Final Exam**	**2**			+ Book **[1, 2, 3, 4]**: Appropriate contents and chapters + Summary

TOPICS TO BE COVERED (SUMMARY)

No	Topics/ Activities	Hours (Class)	Hours (Self-study)
1	**Introduction**	**1**	**2**
2	Diffusion equations for binary systems	3	6

3	Diffusion coefficients	3	6
4	Convective-diffusion equation	3	6
5	Multicomponent systems	3	6
6	Stefan-Maxwell equations	3	6
7	Stefan diffusion tube	2	4
8	Diffusion in solids	1	2
9	**Midterm 1**	**1**	2
10	Mass transfer across an interface	5	10
11	Mass transfer coefficients	3	6
12	Laminar flow mass transfer	2	4
13	Mass transfer in fluid-fluid systems	3	6
14	Mass transfer with chemical reaction	2	4
15	Mass transfer and reaction in catalysts	1	2
16	Boundary layer analysis	3	6
17	**Midterm 2**	**1**	2
18	Gas absorption	4	8
19	Distillation	5	10
20	Liquid/liquid extraction	3	6
21	Adsorption	3	6
22	Topic Presentation (Mass exchangers)	5	10
23	**Final Review Session (Optional)**		
24	**Final Exam**	**2**	

Hanoi, 30th May 2018

ADVANCE PROGRAM

TS. Công Ngọc Thắng

CHAIR OF DEPARTMENT

TS. Công Ngọc Thắng

MINISTRY OF EDUCATION AND TRAINING
HANOI UNIVERSITY OF MINING AND GEOLOGY
ADVANCED PROGRAM

SOCIALIST REPUBLIC OF VIETNAM
Independence – Freedom - Happiness

COURSE SYLLABUS

1. Course title: Heat Transfer for Biochemical and Chemical Engineers (Transport Phenomena – Heat Transfer)

Course code: ECH142

Number of credits: 4

Total number of hours: 180

Theory: 45;	Homeworks/Problems/Discussion: 15;	Practice/Laboratory: 0;
Internship: 0;	Topics: 0;	Self-study: 120;

2. Course management unit

2.1. Instructor (s):	**Instructor's code**
1. Dr. Cong Ngoc Thang (email: congngocthang@humg.edu.vn).	0603-11
2. Dr. Toan Vu Van (email: vuvantoan@humg.edu.vn).	0603-13

2.2. Department: Oil Refining and Petrochemistry

2.3. Faculty: Oil and Gas/ Advanced program office

3. Prerequisites (course codes):

ECH51 (Material Balances), **ECH141** (Fluid Mechanics for Biochemical and Chemical Engineers).

4. Course objectives/goals/expectations (Relationship to learning outcomes):

4.1. Knowledge

4.1.1. To introduce students to and to provide students with basic knowledge of heat transfer and heat transfer processes of interest to chemical engineers and materials scientists.

4.1.2. To introduce students to and to provide students with the applications of differential, integral equations for calculating the heat rate, heat flux, heat transfer coefficient and overall heat transfer coefficient.

4.1.3. To introduce students to and to provide students with the methods for calculating the heat balances as a basis for development of mathematical models.

4.1.4. To introduce students to and to provide students with basic knowledge of testing and designing methods of heat exchangers.

4.2. Skills

4.2.1. Recognizing, distinguishing, and evaluating the basic knowledge of heat transfer and heat transfer processes of interest to chemical engineers and materials scientists.

4.2.2. Determining designing and operating parameters and applying differential, integral equations for calculating the heat rate, heat flux, heat transfer coefficient and overall heat transfer coefficient.

4.2.3. Recognizing, analyzing, evaluating and defining informations relating to determining the heat balances as a basis for development of mathematical models.

4.2.4. Providing students with opportunities to develop basic skills in respect to group-working neatly and accurately and solving problems in accordance with applying appropriate heat transfer phenomena.

5. Course description:

The course is designed to provide students with basic knowledge of conduction, convection, and radiation of thermal energy in applications to chemical and biochemical engineering; derivation of thermal and mechanical energy equations; thermal boundary layers; macroscopic balances; and applications: heat transfer in tubes, channels, and integrated circuits, and analysis of heat exchangers. For more details, the course provides students with the introduction to heat transfer and its applications and development of problem solving skills and also the use of mathematics to represent simple physical and chemical phenomena relating to heat transfer and heat transfer processes, including conduction, convection, radiation, and combined heat transfer. The course also illustrates and demonstrates students with the methods for calculating the heat balances as a basis for development of mathematical models and designing methods of heat exchangers.

6. Organization/ Structure of the course:

Table 1. Course topics to be corved - tentative schedule

6.1. Theory			
Content	***Topics/ Activities***	***Hours***	***Objectives***
1	Introduction	3	4.1.1/4.2.1/4.2.2
2	Steady, One-dimensional Heat Conduction	10	4.1.3/4.2.1/4.2.2/4.2.3
3	Two-dimensional, Steady Heat Conduction	2	4.1.3/4.2.1/4.2.2/4.2.3
4	Transient Heat Conduction	3	4.1.2/4.2.1/4.2.2/4.2.3
5	**Midterm 1**	**1**	4.1.2/4.2.1/4.2.2/4.2.3
6	The Basic Equations of Momentum and Energy Transport	7	4.1.1/4.1.2/4.1.3/4.2.1
7	Turbulent Flow	3	4.1.2/4.2.1/4.2.2/4.2.3
8	Macroscopic Balances	6	4.1.2/4.2.1/4.2.2/4.2.3
9	**Midterm 2**	**1**	4.1.2/4.2.1/4.2.2/4.2.3
10	Thermal Radiation	9	4.1.1/4.1.2/4.1.3 4.2.1/4.2.2/4.2.3
11	Design of Heat Exchangers	3	4.1.1/4.1.2/4.1.3/ 4.2.1/4.2.2/4.2.3
12	Topic Presentation (Heat Exchangers)	12	4.1.1/4.1.2/4.1.3/4.1.4 4.2.1/4.2.2/4.2.3/4.2.4
13	**Final Review Session (Optional)**		4.1.1/4.1.2/4.1.3/4.1.4 4.2.1/4.2.2/4.2.3/4.2.4
14	**Final Exam**	**2**	

0 General Overview/Syllabus, The scope of heat transfer

1 Introduction

1. The continuum postulate
2. The laws of continuum physics
3. Mechanisms of energy transport
4. Units
5. Design objectives

2 Steady, One-dimensional Heat Conduction

1. The fundamental energy postulate
2. Steady heat conduction
3. Steady, one-dimensional heat conduction
4. Extended surfaces-the rectangular fin

5. The annular fin
6. Fin effectiveness
7. Order-of -magnitude analysis
8. An application of order-of-magnitude analysis

3 Two-dimensional, Steady Heat Conduction
1. Coordinates
2. Solutions

4 Transient Heat Conduction
1. The governing equation for transient heat conduction
2. Transient heat conduction

5 Midterm 1

6 The Basic Equations of Momentum and Energy Transport
1. Kinematics
2. The laws of mechanics
3. The energy principle
4. The thermal energy equation
5. The thermal energy equation for general flow processes
6. Dimensional analysis for forced-convection heat transfer
7. Dimensional analysis for free convection
8. Boundary layer analysis of free convections

7 Turbulent Flow
1. Time averages
2. Time-averaged form of the transport equations
3. Turbulent momentum and energy transport
4. Turbulent transport coefficients
5. Hydrodynamic mixing length theory

8 Macroscopic Balances
1. The macroscopic mass balance
2. The macroscopic momentum balance
3. The macroscopic thermal energy balance
4. Film heat transfer coefficients
5. Dimensional analysis for heat transfer

9 Midterm 2

10 Thermal Radiation
1. Electromagnetic radiation
2. The photon transport equation
3. Radiant energy transfer at surfaces
4. Black body radiation
5. Non-black bodies
6. Radiant Energy Exchange

11 Design of Heat Exchangers
1. Heat Exchanger Types
2. The methods of heat exchanger design

12 Topic Presentation

13 Final Review Session

14 Final Exam

7. Methods of instruction:

- Lectures and discussions.
- Cooperative learning groups and independent study.

- Debates and problem solving.
- Homework problem sets will be distributed in class or homework files will be sent to your email. Some homeworks will be graded. In presenting the solution of a problem that requires analysis, students should state briefly in words at the beginning:
  - what is given
  - what is to be found
  - what the method of solution is

This preliminary information should be followed by the solution to the problem. The grading of the problems will be based on the preliminary information as well as on the solution.

8. Requirements for student:

- Attendance, respectful classroom participation: at least 80 % of lectures. Students are encouraged to attend every class with the desire to gain, grow, and develop the necessary concepts, skills and understanding needed to successfully pass the quizes, midterm and final exam.
- Homeworks, laboratory,…and exams: Students are expected to complete all assignments and homeworks. Students must take part in the final exam.
- Integrity: Students are expected to be in class on time ready to work and participate in activities and provide input.
- Classroom rules of conduct: Students must follow the **HUMG rules regarding attendance.** Students who are absent for 20 % consecutive lectures will be dropped from the class and final exam immediately.
- Special needs: *In all exams please distribute as equally as possible in the room to ideally leave free space between you and your neighbor. Close books. No notes are allowed in exams. Only non-programmable, non-graphing calculators are allowed in exams. Absolutely no cell phones in exams! Put them on silent during normal class.*

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Group collaboration	Reports/ Presentations	
4	Practice/Laboratory/ Internship	Reports/ Presentations/Skills	
5	Midterms	Writing/ Viva... (.....minutes)	
...	...	...	...
...	Final exam	Writing/Multiple-choice/Viva... (...minutes)	60 %

Quizzes: Writing, 20 minutes each.
Midterm 1: Writing, 60 minutes
Midterm 2: Writing, 60 minutes
Course presentations: Viva, **TBA**
Final Exam: Writing, 120 minutes

Midterms count as much as 20 % (midterms 10 % each)

The examinations will cover both the lecture material and the assigned reading in the posted notes.

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books: (at least 3 books)

[1] Stephen Whitaker. Fundamental Principles of Heat Transfer, Reprint Edition, Robert E. Krieger Publishing Company, INC, 1983.

[2] Frank P. Incropera, David P. Dewitt, Theodore L. Bergman, Adrienne S. Lavine. Fundamentals of Heat and Mass Transfer, Six Edition, John Wiley & Sons, Inc, 2007.

[3] R. Byron Bird, Warren E. Stewart, Edwin N. Lightfoot. Transport Phenomena, Revised Second Edition, John Wiley & Sons, Inc, 2007.

[4] Warren L McCabe, Julian C. Smith, Peter Harriott, Unit operations of chemical engineering, Fifth Edition, Mc Graw – Hill, 1993.

[5] Kuppan Thulukkanam, Heat exchanger design handbook, Second Edition, CRC Press, 2013.

[6] Carl R. Branan, Rules of Thumb for Chemical Engineers, Third Edition, GPP.

11. Instruction for self-study:

Table 3. Contents to be prepared - tentative schedule

No	Topics/ Activities	Theory (hours)	Homeworks/ Problems/ Discussion (hours)	Total self-study (hours)	Requirements for student
1	Introduction	3		6	+ Book **[1, 2]**: Chapter 1, 2 (Introduction, Introduction to Conduction); + Book **[3]**: Chapter 9 (Introduction, Introduction to Conduction); + Summary
2	Steady, One-dimensional Heat Conduction	8	2	20	+ Book **[1, 2]**: Chapter 2, 3 (Steady, One-dimensional Heat Conduction) + Book **[4]**: Chapter 10 + Summary
3	Two-dimensional, Steady Heat Conduction	1	1	4	+ Book **[1, 2]**: Chapter 3, 4 (Two-dimensional, Steady Heat Conduction) + Book **[4]**: Chapter 10 + Summary
4	Transient Heat Conduction	2	1	6	+ Book **[1]**: Chapter 4 (Transient Heat Conduction); + Book **[2]**: Chapter 5 (Transient Conduction); + Book **[3]**: Chapter 12 (Unsteady heat Conduction); + Summary
5	**Midterm 1**	**1**		**2**	+ Book **[1, 2, 3, 4]**: Appropriate contents and chapters + Summary
6	The Basic Equations of Momentum and Energy	5	2	14	+ Book **[1]**: Chapter 5 (The Basic Equations of Momentum

	Transport				and Energy Transport) + Summary
7	Turbulent Flow	2	1	6	+ Book **[1]**: Chapter 6 (Turbulent Flow); + Book **[2]**: Chapter 6 (Introduction to Convection); Chapter 7 (External Flow); Chapter 8 (Internal Flow); Chapter 10 (Boiling and Condensation); + Book **[4]**: Chapter 11, 12, 13 + Summary
8	Macroscopic Balances	4	2	12	+ Book **[1]**: Chapter 7 (Macroscopic Balances); + Summary
9	**Midterm 2**	**1**		**2**	+ Book **[1, 2, 3, 4]**: Appropriate contents and chapters + Summary
10	Thermal Radiation	7	2	18	+ Book **[1]**: Chapter 8 (Thermal Radiation); + Book **[2]**: Chapter 12 (Radiation: Processes and Properties); Chapter 13 (Radiation Exchange Between Surfaces); + Summary .
11	Design of Heat Exchangers	2	1	6	+ Book **[2]**: Chapter 11 (Heat Exchangers); + Book **[4]**: Chapter 15 (heat exchange equipment); + Book **[5]**: Chapter 1, 2, 3, 4, 5, 7 + Book **[6]**: Chapter 2 + Summary
12	Topic Presentation (Heat Exchangers)	9	3	24	+ Book **[2]**: Chapter 11 (Heat Exchangers); + Book **[4]**: Chapter 15 (heat exchange equipment) + Book **[5]**: Chapter 1, 2, 3, 4, 5, 7 + Book **[6]**: Chapter 2 + Summary .
13	**Final Review Session (Optional)**				
14	**Final Exam**	**2**			+ Book **[1, 2, 3, 4, 5]**: Appropriate contents and chapters + Summary

TOPICS TO BE COVERED (SUMMARY)

No	Topics/ Activities	Hours (Class)	Hours (Self-study)
1	Introduction	3	6

2	Steady, One-dimensional Heat Conduction	10	20
3	Two-dimensional, Steady Heat Conduction	2	4
4	Transient Heat Conduction	3	6
5	**Midterm 1**	**1**	**2**
6	The Basic Equations of Momentum and Energy Transport	7	14
7	Turbulent Flow	3	6
8	Macroscopic Balances	6	12
9	**Midterm 2**	**1**	**2**
10	Thermal Radiation	9	18
11	Design of Heat Exchangers	3	6
12	Topic Presentation (Heat Exchangers)	12	24
13	**Final Review Session (Optional)**		
14	**Final Exam**	**2**	

Hanoi, 30th May 2018

ADVANCE PROGRAM

Thang

TS. Công Ngọc Thắng

CHAIR OF DEPARTMENT

Thang

TS. Công Ngọc Thắng

HANOI UNIVERSITY OF MINING AND GEOLOGY
ADVANCED PROGRAM

SOCIALIST REPUBLIC OF VIETNAM
Independence – Freedom - Happiness

COURSE SYLLABUS

1. Course title:
Transport Phenomena (Fluids)
Course code: ECH 141
Number of credits: 04
Number of hours: 180
Theory: 48; Homeworks: 12; Practice/Laboratory:.....;
Internship:.....; Topics:.....; Self-study: 120;

2. Course management unit
2.1. Instructor (s): **Instructor's code**
1. Dr. Toan Vu 0603-13
2.
2.2. Department: Oil Refining and Petrochemistry
2.3. Faculty: Oil & Gas

3. Prerequisites (course code): ECH 140 (Mathematical Methods in Biochemical and Chemical Engineering), ECH 51 (Material Balances)

4. Course objectives/goals/expectations (Relationship to learning outcomes):

4.1. Knowledge
- Hydrostatics;
- Newton's law of viscosity, principles and applications of fluid mechanics.

4.2. Skills

After completing this course, students will be able to:
- Use the knowledge of fluid mechanics to idetify/ define the shear stress, shear rate, and absolute viscosity and identify common classes of fluids, to apply macroscopic mass, energy, and momentum balances on chemical engineering flow processes and systems.
- Use the extended Bernoulli equation and macroscopic energy balance to evaluate frictional factor and pressure drop and size common fluid flow devices (e.g. pumps, piping, and valves).
- Develop microscopic mass and momentum balances for chemical engineering systems. Use the Navier-Stokes equations and equation of continuity to evaluate shear stress profile, velocity profile, and friction factor for simple one-dimensional flows. Perform scaling analysis on the Navier-Stokes equations to non-dimensionalize them.

5. Course description: Principles and applications of fluid mechanics in chemical and biochemical engineering. Hydrostatics. The stress tensor and Newton's law of viscosity

6. Organization/ Structure of the course:

Table 1. Course topics to be corved - tentative schedule

Content	*Topics/ Activities*	*Hours*	*Objectives*
Chapter 1	Introduction	12	4.1, 4.2
1.1	The continuum postulate		
1.2	Types of flow		
1.3	Units		
1.4	Fluid properties		
Chapter 2	Fluid statics and one-dimetional laminar flow	12	4.1, 4.2
2.1	The material volume		
2.2	Fluid statics		
2.3	Barometers		
2.4	Manometers		
2.5	Forces on submerged plane surfaces		
2.6	Forces on submerged curved surfaces		
2.7	Buoyancy forces		
2.8	One-dimetional laminar flow		
Chapter 3	Kinematics	12	4.1, 4.2
3.1	Material and spatial coordinates		
3.2	The divergence theorem		
3.3	The transport theorem		
3.4	Conservation of mass		
3.5	Streamlines, path lines and streak lines		
Chapter 4	The differential equations of motion	12	4.1, 4.2
4.1	The viscous stress tensor		
4.2	Newton's law of viscosity		
4.3	The equations of motion		
4.4	Applications of the differential equations of motion		
Chapter 5	Macroscopic balances	12	4.1, 4.2
5.1	The macroscopic mass balance		
5.2	The macroscopic momentum balance		
5.3	The macroscopic energy balance		
5.4	Bernoulli's equation		
5.5	Sudden expansion in a pipe		
5.6	Sudden contraction in a pipe		
5.7	Applications of momentum balance		

7. Method of instruction:

- Lectures and discussion in class;
- Homeworks;

8. Requirements for student:

- Attendance: at least 80%;
- Patticipation/ willingness to joint discussions;
- All homework fulfilments on time;
- Midterms and final exam attandence.

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Midterms	Writing 60 minutes for each exam: 02 tests	
4	Final exam	Writing 120 minutes	60 %

Midterm 1: 60 minutes
Midterm 2: 60 minutes
Final Exam: 120 minutes

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books: (at least 3 books)

Textbook:

1) Stephen Whitaker, *Introduction to Fluid Mechanics*, Krieger Pub Co, 1992

Other textbook for refference:

2) R.B. Bird, W.E. Stewart, E.N. Lightfoot, Transport Phenomena, 2rd Ed. John Wiley & Sons, 2007
3) Y. Nakayama and R.F. Boucher, Introduction to Fluid Mechanics, Butterworth-Heinemann, 2000

11. Instruction for self-study:

Table 3. Contents to be prepared - tentative schedule

No	Topics/ Activities	Theory (hours)	Homeworks (hours)	Laboratory (hours)	Total self-study (hours)	Requirements for student
1	Use Bernoulli's equation to explain some applications in daily life (spraying perfume, venturi meter, ..)	4	0	0	4	+ Book [1, 2, 3] + Internet
2	Calculate the floating percentage of objects	4	2	5	13	+ Book [1, 2, 3]

Hanoi, 30th May 2018

ADVANCE PROGRAM

TS. Công Ngọc Thắng

CHAIR OF DEPARTMENT

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HANOI UNIVERSITY OF MINING AND GEOLOGY
ADVANCED PROGRAM

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COURSE SYLLABUS

1. Course title: CATALYSIS
Course code: 166
Number of credits: 02
Number of hours: 30 hours
Theory: 30; Homeworks: 15;
Self-study: 30 hours;

2. Course management unit
2.1. Instructor (s):

	Instructor's code
1. Assoc.Prof. Pham Xuan Nui	0603-09
2. Dr Nguyen Thi Linh	0603-08

2.2. Department: Oil refining and Petrochemistry
2.3. Faculty: Gas and Oil

3. Prerequisites (course code): CHE 128A, CHE 128B, CHE 129A, CHE 110A, CHE 110B

4. Course objectives/goals/expectations (Relationship to learning outcomes)

4.1. Knowledge

4.1.1 Understanding of fundamental principles of catalysts

4.1.2 Understanding of fundamental phenomena and fundamentals of industrial catalytic processes.

4.2. Skills

4.2.1 Development of problem solving skills through analysis based on fundamental principles, including analysis of industrial catalytic processes.

4.2.2 Develop skills in catalytic preparation process.

5. Course description

Topics covered include catalysis: introduction and fundamental catalytic phenomena. Introduction to catalyst materials, properties and preparation. Catalyst materials including actives phases, supports and promoter, molecular sieves and zeolites. Catalyst properties including catalyst engineering, physical, mechanical and chemical properties, dynamic (Catalytic) properties. Catalyst deactivation: causes, mechanisms and treatment. And introduction to industrial practice including hydrogen production and synthesis gas reaction, hydogenation and dehydrogenation of organic compounds, petroleum refining and processing, and environmetal catalysis.

6. Organization/Structure of the course

Table 1. Course topics to be corved - tentative schedule

6.1. Theory			
Content	***Topics/ Activities***	***Hours***	***Objectives***
Chapter 1	**Introduction and Fundamental Catalytic Phenomena**	**12**	
1.1	Homogeneous catalysis (Gas-phase catalysis)	2	4.1.1
1.1.1	Acid – base catalysis		
1.1.2	Chemistry, kinetics and mechanisms		
1.2	Enzyme catalysis	2	4.1.1
1.2.1	Introduction: enzyme catalysis		
1.2.2	Chemistry, kinetics and mechanisms		
1.3	Heterogeneous catalysis		4.1.1
1.3.1	Steps in a Heterogeneous Catalytic Reaction	2	
1.3.2	Adsorption and Desorption		
1.3.3	Reaction and Diffusional Resistances for a Catalytic Reaction		
1.3.4	Kinetics of Catalytic Surface Reactions		
1.3.5	Effects of Surface Structure and Support on Catalytic Activity		
1.4	Molecular sieves and zeolites	2	
1.4.1	Active phase, supports and promoters		
1.4.2	Dynamic (catalytic) properties		
1.4.3	Physical, mechanical and chemical properties		
1.5	Catalyst characterization (Determining physical properties of catalyst)	2	
1.5.1	Surface area, pore size and pore volume – particle size and size distribution		
1.5.2	Determining chemical of catalyst (chemical composition – chemical structure and morphology)		
1.5.3	Dispersion and crystallite size of catalytic species; surface acidity-reactivity		
1.6	Catalyst selection	2	
1.6.1	Catalytic activity		
1.6.2	Selectivity of catalyst		
1.7	Catalyst preparation and forming		4.2.2
Chapter 2	**Catalyst Deactivation: Causes, Mechanisms, and Treatment**	**5**	4.1.1
2.1	Poisoning	1	
2.2	Fouling, Coking, and Carbon Deposition	1	
2.3	Thermal Degradation and Sintering	1	
2.4	Prevention and Regenerative Treatment of Catalyst Decay	2	

2.4.1	Prevention of Catalyst Decay		
2.4.2	Regeneration of Deactivated Catalysts		
Chapter 3	**Industrial Practice**	**13**	4.1.2
3.1	Petroleum Refining and Processing	5	
3.1.1	Petroleum Refining		
3.1.2	Hydrotreating		
3.1.3	Catalytic Cracking		
3.1.4	Hydrocracking		
3.1.5	Naphtha Reforming		
3.1.6	Isomerization		
3.1.7	Alkylation		
3.1.8	Reformulated Gasoline and Methyl-*t*-Butyl Ether		
3.2	Environmental Catalysis	2	
3.3	Catalytic Oxidations of Inorganic and Organic Compounds	2	
3.4	Hydrogenation and Dehydrogenation of Organic Compounds	2	
3.5	Hydrogen Production and Synthesis Gas Reactions	2	

6.2. Practice/Laboratory (if any)

Content	*Topics*	*Hours*	*Objectives*
Chapter 1	.....	.....	4.1.1
Unit 1	.....		
Unit 2	.....		
.....	.....		
Chapter 2	.....	.....	
Unit 1	.....		
Unit 2	.....		
Chapter 3	**Industrial Practice**	**8**	**4.2.1**
.....	.....		.....

7. Method of instruction: Discussion

8. Requirements for student

- Attendance, respectful classroom participation: 80 %
- Homework, laboratory, and exams: Final exam, 90 mins
- Integrity:
- Classroom rules of conduct:
- Special needs:

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Group collaboration	Reports/Presentations	

4	Practice/Laboratory/ Internship	Reports/Presentations/Skills	
5	Midterms	Writing (60 minutes)	
6	Final exam	Writing (90 minutes)	60 %

Midterm 1: 60 minutes
Midterm 2: 60 minutes
Course project: TBA (if any)...
Final Exam: 90 minutes

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books: (at least 3 books)

[1] C.H. Bartholomew and R.J. Farrauto, Fundamentals of industrial catalytic processes, Second Edition, 2006, John Wiley & Sons, Inc., Hoboken, New Jersey.

[2] Charles N. Satterfield, Heterogeneous Catalysis in Industrial Practicle, Second Edition, Mc Graw-Hill, Inc. 1991

[3] Dmitry Murzin, Tapio Salmi, Catalytic Kinetics, September 2005, Elsevier Science & Technology Books.

11. Instruction for self-study

Table 3. Contents to be prepared - tentative schedule

No	Topics/Activities	Theory (hours)	Homeworks (hours)	Laboratory (hours)	Total self-study (hours)	Requirements for student
1	**Chapter 1: Introduction and Fundamental Catalytic Phenomena** 1.5. Catalyst characterization 1.5.1 Surface area, pore size and pore volume – particle size and size distribution	4	5	0	5	+ Book [1]: Content, chapter 1
2	**Chapter 2: Catalyst Deactivation: Causes, Mechanisms, and Treatment** 2.1 Modeling and Design of	6	5	0	5	Book [1]: Content, chapter 2

	Deactivation Processes 2.2. Experimental Assessment of Deactivation Kinetics 2.3 Reactor and Process Design and Operation with Deactivating Catalyst					
3	**Chapter 3: Industrial Practice** 3.1. Production of Hydrogen and Synthesis Gas via Steam Reforming 3.2. Fischer-Tropsch Synthesis 3.3. Hydrogenation Catalyst and Reactor Technologies	5	5	0	6	Book **[1]**, **[2]**: Content, chapter 3
		15	15		15	

Hanoi, 30th May 2018

ADVANCE PROGRAM

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HANOI UNIVERSITY OF MINING AND GEOLOGY
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COURSE SYLLABUS

1. Course title: Chemistry – Part C
Course code: CHEM2C
Number of credits: 5
Number of hours: 75
Theory: 26 Homeworks + Midterm + Final exam: 19 Practice/Laboratory: 30
Internship: 0 Topics: 0 Self-study: 120

2. Course management unit
2.1. Instructor (s): **Instructor's code**
1. TS. Công Tiến Dũng 0103-03
email: congtiendung@humg.edu.vn; phone number: 0926988868
2. TS. Vũ Kim Thư 0103-16
email: vukimthu@humg.edu.vn; phone number: 0983327276
2.2. Department: Chemistry
2.3. Faculty: Basic Sciences

3. Prerequisites (course code): CHEM 2B

4. Course objectives/goals/expectations (Relationship to learning outcomes):

4.1. Knowledge
4.1.1 Acids and bases
4.1.2 Applications of Aqueous Equilibria
4.1.3 Spontaneity, Entropy, and Free Energy
4.1.4 Electrochemistry
4.1.5 Experimental part of general chemistry
4.2. Skills
4.2.1 Integrate concepts/equations and apply them to chemical problems associated with the topics covered
4.2.2 Ability to calculate pH value of an aqueous solution; explain the property of acidic/basic/neutral solution
4.2.3 Control the factors affecting on aqueous equilibria; calculate the concentration of ions basing on the equilibrium
4.2.4 Understand and have ability to determine and condition a process to be spontaneous or nonspontaneous
4.2.5 Ability to balance oxidation – reduction reaction; calculate the potential of Galvanic cells
4.2.6 Setup experimental works in the lab; make the chemical solutions from stock solutions
4.2.7. Ability to analyze concentration of chemicals by volumetric method and spectrophotometric method; make titration and solve problems relating to equilibrium.

5. Course description: CHEM2C is the third course of a three-quarter general chemistry sequence for science and engineering majors, as well as pre-professionals in health-related studies. The primary goals of this curriculum are for you to understand the nature of science through the perspective of this central field; to develop a firm grounding in the chemical language, principles, and applications that underlie our physical and biological world, and that may serve as a foundation for understanding the molecular underpinnings of the chemical sub-disciplines, as well as the related fields of biology, medicine, materials science, and engineering; to cultivate independent learning and the intellectual skills needed to pose good questions, evaluate problems systematically, construct logical arguments, and convey ideas effectively. More specifically, our discussions will focus on *aqueous ionic equilibria, thermodynamics, electrochemistry, and experimental works in the laboratory.*

6. Organization/ Structure of the course:

Table 1. Course topics to be corved - tentative schedule

6.1. Theory			
Content	***Topics/ Activities***	***Hours***	***Objectives***
Chapter 14	**Acids and Bases**	**10**	4.1.1 4.2.1 4.2.2
14.1	The Nature of Acids and Bases	6	
14.2	Acid Strength		
14.3	The pH Scale		
14.4	Calculating the pH of Strong Acid Solutions		
14.5	Calculating the pH of Weak Acid Solutions		
14.6	Bases		
14.7	Polyprotic Acids		
14.8	Acid–Base Properties of Salts		
14.9	The Effect of Structure on Acid–Base Properties		
14.10	Acid–Base Properties of Oxides		
14.11	The Lewis Acid–Base Model		
14.12	Strategy for Solving Acid–Base Problems: A Summary		
	For Review • Key Terms • Questions and Exercises	4	
Chapter 15	**Applications of Aqueous Equilibria**	**11**	4.1.2 4.2.3
15.1	Solutions of Acids or Bases Containing a Common Ion	7	
15.2	Buffered Solutions		
15.3	Buffering Capacity		
15.4	Titrations and pH Curves		
15.5	Acid–Base Indicators		
15.6	Solubility Equilibria and the Solubility Product		
15.7	Precipitation and Qualitative Analysis		
15.8	Equilibria Involving Complex Ions		
	For Review • Key Terms • Questions and Exercises	4	

Midterm 1	Include chapters 14 & 15	**1**	
Chapter 16	**Spontaneity, Entropy, and Free Energy**	**9**	
16.1	Spontaneous Processes and Entropy	6	4.1.3 4.2.4
16.2	Entropy and the Second Law of Thermodynamics		
16.3	The Effect of Temperature on Spontaneity		
16.4	Free Energy		
16.5	Entropy Changes in Chemical Reactions		
16.6	Free Energy and Chemical Reactions		
16.7	The Dependence of Free Energy on Pressure		
16.8	Free Energy and Equilibrium		
16.9	Free Energy and Work		
	For Review • Key Terms • Questions and Exercises	3	
Chapter 17	**Electrochemistry**	**11**	
17.1	Galvanic Cells	7	4.1.4 4.2.5
17.2	Standard Reduction Potentials		
17.3	Cell Potential, Electrical Work, and Free Energy		
17.4	Dependence of Cell Potential on Concentration		
17.5	Batteries		
17.6	Corrosion		
17.7	Electrolysis		
17.8	Commercial Electrolytic Processes		
	For Review • Key Terms • Questions and Exercises	4	
Midterm 2	Include chapters 16 & 17	**1**	

6.2. Practice/Laboratory

Content	*Topics/ Activities*	*Hours*	*Objectives*
	Experimental part	*30*	4.1.1 4.2.6 4.2.7
Unit 1	General Guide	5	
Unit 2	Reaction of copper		
Unit 3	Spectrophotometry	5	
Unit 4	Volumetric analysis	5	
Unit 5	Strong acid – strong base titration		
Unit 6	Acid dissociation constant and titration of a weak acid	5	
Unit 7	Polyprotic systems		
Unit 8	Chemical equilibrium	5	
Unit 9	Solubility products		
Unit 10	Redox titrations	5	
Unit 11	EDTA titrations		

Course topics to be corved - tentative schedule (Brief form)

No	Topic/Activity	Official (hours)	Self-study (hours)
1	Theoretical part		
2	Acids and Bases	10	20
3	Applications of Aqueous Equilibria	11	22
4	Midterm 1	1	2
5	Spontaneity, Entropy, and Free Energy	9	18
6	Electrochemistry	11	22
7	Midterm 2	1	2
8	Experimental part		
9	General Guide	5	5
10	*Reaction of copper*		
11	*Spectrophotometry*	5	5
12	*Volumetric analysis*	5	5
13	*Strong acid – strong base titration*		
14	*Acid dissociation constant and titration of a weak acid*	5	5
15	*Polyprotic systems*		
16	*Chemical equilibrium*	5	5
17	*Solubility products*		
18	*Redox titrations*	5	5
19	*EDTA titrations*		
20	Final report of experiments		
21	Final exam	2	4
	Sum	75	120

7. Method of instruction: The students will be guided to prepare for the topics before coming to the class. The theoretical part will be introduced and incorporated with solving exercises and problems in the class. Students can be asked for studying in groups under guidance of the lecturers.

8. Requirements for student:

- Attendance, respectful classroom participation: ≥ 80%
- A student must complete all labs and submit a laboratory report for all of the assigned laboratory work in order to attend to final exam.
- Final exam: compulsory participation
- Integrity: Dishonesty can lead to a falling grade
- Prepare for the contents in Table 3

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance	Hours/ Total lecturing hours	10 %
2	Homeworks	Homework numbers/ Total homework numbers	30 %
3	Group collaboration	Reports/ Presentations	
4	Practice/Laboratory/	Reports/ Presentations/Skills	

	Internship		
5	Midterms	Writing/ Viva (50 minutes)	
6	Final exam	Writing (120 minutes)	60 %

Midterm 1: 50 minutes
Midterm 2: 50 minutes
Course project: To be arranged (if any)
Final Exam: 120 minutes

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/required books and other interesting books:

[1]. Steven S. Zumdahl, Sunsan A. Zumdahl. *Chemistry*, Seventh edition, Houghton Mifflin Company, Boston, New York, 2007.

[2]. Martin S. Silberberg. *Principles of general chemistry*, Mc Graw Hill Company, New York, 2007.

[3]. Ralph H. Petrucci .... *General chemistry: Principles and modern applications*, tenth edition, Pearson Canada, Toronto, 2011.

[4]. Department of Chemistry, University of California – Davis. *Chemistry 2A – Laboratory* Manual, Davis, CA 95616, Winter 2013.

[5] Department of Chemistry, University of California – Davis. *Chemistry 2B – Laboratory* Manual, Davis, CA 95616, Winter 2013.

[6] Department of Chemistry, University of California – Davis. *Chemistry 2C – Laboratory* Manual, Davis, CA 95616, Winter 2013.

11. Instruction for self-study:

Table 3. Contents to be prepared - tentative schedule

No	Topics/ Activities	Theory (hours)	Homeworks (hours)	Lab (hours)	Total self-study (hours)	Requirements for student
1	**Chapter 14: Acids and Bases** 14.1. The Nature of Acids and Bases 14.2. Acid Strength 14.3. The pH Scale 14.4. Calculating the pH of Strong Acid Solutions 14.5. Calculating the pH of Weak Acid Solutions 14.6. Bases 14.7. Polyprotic Acids 14.8. Acid–Base Properties of Salts 14.9. The Effect of Structure on Acid–Base Properties	6	4	0	20	Study chapter 14 of book [1]; chapter 17, 18 of book [2]; chapter 15,16 of book [3]

	14.10. Acid–Base Properties of Oxides 14.11. The Lewis Acid–Base Model 14.12. Strategy for Solving Acid–Base Problems: A Summary * For Review • Key Terms • Questions and Exercises					
2	**Chapter 15: Applications of Aqueous Equilibria** 15.1. Solutions of Acids or Bases Containing a Common Ion 15.2. Buffered Solutions 15.3. Buffering Capacity 15.4. Titrations and pH Curves 15.5. Acid–Base Indicators 15.6. Solubility Equilibria and the Solubility Product 15.7. Precipitation and Qualitative Analysis 15.8. Equilibria Involving Complex Ions * For Review • Key Terms • Questions and Exercises	7	4	0	22	Study chapter 15 of book [1]; chapter 19 of book [2]; chapter 17, 18 of book [3]
3	**Midterm 1**					
4	**Chapter 16: Spontaneity, Entropy, and Free Energy** 16.1. Spontaneous Processes and Entropy 16.2. Entropy and the Second Law of Thermodynamics 16.3. The Effect of Temperature on Spontaneity 16.4. Free Energy 16.5. Entropy Changes in Chemical Reactions 16.6. Free Energy and Chemical Reactions 16.7. The Dependence of Free Energy on Pressure 16.8. Free Energy and Equilibrium 16.9. Free Energy and Work * For Review • Key Terms • Questions and Exercises	6	3	0	18	Study chapter 16 of book [1]; chapter 20 of book [2]; chapter 19 of book [3]

5	**Chapter 17: Electrochemistry** 17.1. Galvanic Cells 17.2. Standard Reduction Potentials 17.3. Cell Potential, Electrical Work, and Free Energy 17.4. Dependence of Cell Potential on Concentration 17.5. Batteries 17.6. Corrosion 17.7. Electrolysis 17.8. Commercial Electrolytic Processes * For Review • Key Terms • Questions and Exercises	7	4	0	22	Study chapter 17 of book [1]; chapter 21 of book [2]; chapter 20 of book [3]
6	**Midterm 2**	1	0		2	
7	**Experimental part**			30	30	
	Unit 1: General Guide			5	5	Study book [4], pp. 1-13
	Unit 2: Reaction of copper					Study book [4], pp. 17-22
	Unit 3: Spectrophotometry			5	5	Study book [4], pp. 35-54
	Unit 4: Volumetric analysis			5	5	Study book [4], pp. 25-34
	Unit 5: Strong acid – strong base titration					Study book [5], pp. 27-36
	Unit 6: Acid dissociation constant and titration of a weak acid			5	5	Study book [5], pp. 37-46
	Unit 7: Polyprotic systems					Study book [5], pp. 47-54
	Unit 8: Chemical equilibrium			5	5	Study book [4], pp. 35-54
	Unit 9: Solubility products					Study book [5], pp. 65-76
	Unit 10: Redox titrations			5	5	Study book [6], pp. 1-22
	Unit 11: EDTA titrations					Study book [6], pp. 23-30

Hanoi, 30th May, 2018

ADVANCE PROGRAM

TS. Công Ngọc Thắng

CHAIR OF DEPARTMENT

Cao Tiến Dũng

HANOI UNIVERSITY OF MINING AND GEOLOGY
ADVANCED PROGRAM

SOCIALIST REPUBLIC OF VIETNAM
Independence – Freedom - Happiness

COURSE SYLLABUS

1. Course title: Chemistry 2A
Course code: CHE 2A
Number of credits: 4
Number of hours: 180
Theory: 33; Homeworks + Midterm + Final exam: 27; Practice/Laboratory: 0;
Internship: 0; Topics: 0; Self-study: 150

2. Course management unit
2.1. Instructor (s): **Instructor's code**

1. PhD. Vu Kim Thu, 0103-16
email: vukimthu@humg.edu.vn; phone number: 0983327276
2. PhD. Cong Tien Dung 0103-03
email: congtiendung@humg.edu.vn; phone number: 0926988868

2.2. Department: Chemistry

2.3. Faculty: Basic Sciences

3. Prerequisites (course code): High school chemistry and physics strongly recommended; satisfactory score on diagnostic examinations

4. Course objectives/goals/expectations (Relationship to learning outcomes):

4.1. Knowledge
4.1.1. Chemical Foundations
4.1.2. Atoms, Molecules, and Ions
4.1.3. Stoichiometry
4.1.4. Types of Chemical Reactions and Solution Stoichiometry
4.1.5. Gases
4.1.6. Thermochemistry
4.1.7. Atomic Structure and Periodicity

4.2. Skills
4.2.1. Understand the concepts of chemistry so that you can better appreciate the world around you and can be more effective in whatever career you choose. Integrate concepts/equations and apply them to chemical problems associated with the topics covered

4.2.2. Mastery with SI units, conversions, scientific notation, and algebraic mathematics.

4.2.3. Understand Atomic structure, Atoms combine to form molecules by sharing electrons to form covalent bonds, Formation of ions, The periodic table organizes elements in order of increasing atomic number and know obviously how to read the chemical name of compounds.

4.2.4. Understand and apply to practice fluently for all the basic concepts as Stoichiometry, Mole, Concentrations, Molecular formula, Characteristics of a chemical equation, Stoichiometry calculations and Yield.

4.2.5. Ability to read, understand, and determine the polar molecule, hydration, solubility, electrolytes, Acids and bases, Molarity, Dilution, Types of equations that describe solution reactions, Solubility rules, Important types of solution reactions, Titrations, and Oxidation–reduction reactions.

4.2.6. Knowledge of the kinetic theory of gases and use of the various gas laws. Calculate pressure and molar volumes of ideal as well as real gases.

4.2.7. Understand all the relative concerning concept of Thermochemistry as Energy, Work, Heat, Enthalpy. Determine the efficiency of heat engines. Derive the basic thermodynamic relations and to state the approximations and the applicability. Calculate the thermodynamic functions of components in pure compounds and simple mixtures.

4.2.8. Basic understanding the electron and the atom as it relates to structure and quantum mechanics. Ability to read, understand, and interpret the periodic table and related electronic, physical, and chemical trends.

5. Course description:

CHEM 2A is the first course of a three-quarter general chemistry sequence for science and engineering majors, as well as pre-professionals in health-related studies. The course is designed to provide students with basic knowledge of general chemistry: Chemical Foundations; Atoms, Molecules, and Ions; Stoichiometry; Types of Chemical Reactions and Solution Stoichiometry; Gases; Thermochemistry; and Atomic Structure and Periodicity. The main goal of this part is to help you understand the concepts of chemistry so that you can better appreciate the world around you and can be more effective in whatever career you choose.

Notes Homework

- Homework assignments will be collected and graded. Students will be required to demonstrate assigned exercises or problems in front of the class by writing on the board and describing their work step by step, as noted in the first session. The number of homework demonstrations will be communicated the first day of class.

6. Organization/ Structure of the course:

Table 1. Course topics to be corved - tentative schedule

Content	*Topics/ Activities*	*Hours*	*Objectives*
Chapter 1	**Chemical Foundations**	**5**	
1.1	Chemistry: An Overview	3	4.1.1 4.2.1 4.2.2
1.2	The Scientific Method		
1.3	Units of Measurement		
1.4	Uncertainty in Measurement		
1.5	Significant Figures and Calculations		
1.6	Dimensional Analysis		

1.7	Temperature		
1.8	Density		
1.9	Classification of Matter		
	For Review • Key Terms • Question and Exercises	7	
Chapter 2	**Atoms, Molecules, and Ions**	**8**	
2.1	The Early History of Chemistry	5	
2.2	Fundamental Chemical Laws		
2.3	Dalton's Atomic Theory		
2.4	Early Experiments to Characterize the Atom		4.1.2
2.5	The Modern View of Atomic Structure: An Introduction		4.2.1 4.2.3
2.6	Molecules and Ions		
2.7	An Introduction to the Periodic Table		
2.8	Naming Simple Compounds		
	For Review • Key Terms • Question and Exercises	3	
Chapter 3	**Stoichiometry**	**7**	
3.1	Counting by Weighing	4	
3.2	Atomic Masses		
3.3	The Mole		
3.4	Molar Mass		
3.5	Percent Composition of Compounds		
3.6	Determining the Formula of a Compound		4.1.3
3.7	Chemical Equations		4.2.1
3.8	Balancing Chemical Equations		4.2.4
3.9	Stoichiometric Calculations: Amounts of Reactants and Products		
3.10	Calculations Involving a Limiting Reactant		
	For Review • Key Terms • Questions and Exercises	3	
Midterm 1	Include chapters 1, 2 & 3	**1**	
Chapter 4	**Types of Chemical Reactions and Solution Stoichiometry**	**8**	
4.1	Water, the Common Solvent	5	
4.2	The Nature of Aqueous Solutions: Strong and Weak Electrolytes		
4.3	The Composition of Solutions		
4.4	Types of Chemical Reactions		
4.5	Precipitation Reactions		4.1.4
4.6	Describing Reactions in Solution		4.2.1
4.7	Stoichiometry of Precipitation Reactions		4.2.5
4.8	Acid–Base Reactions		
4.9	Oxidation–Reduction Reactions		
4.10	Balancing Oxidation–Reduction Equations		
	For Review • Key Terms • Questions and Exercises	3	
Chapter 5	**Gases**	**8**	
5.1	Pressure	5	4.1.5

5.2	The Gas Laws of Boyle, Charles, and Avogadro		4.2.1 4.2.6
5.3	The Ideal Gas Law		
5.4	Gas Stoichiometry		
5.5	Dalton's Law of Partial Pressures		
5.6	The Kinetic Molecular Theory of Gases		
5.7	Effusion and Diffusion		
5.8	Real Gases		
5.9	Characteristics of Several Real Gases		
5.10	Chemistry in the Atmosphere		
	For Review • Key Terms • Questions and Exercises	3	
Chapter 6	**Thermochemistry**	**9**	
6.1	The Nature of Energy	5	4.1.6 4.2.1 4.2.7
6.2	Enthalpy and Calorimetry		
6.3	Hess's Law		
6.4	Standard Enthalpies of Formation		
6.5	Present Sources of Energy		
6.6	New Energy Sources		
	For Review • Key Terms • Questions and Exercises	4	
Midterm 2	Include chapters 4, 5 & 6	**1**	
Chapter 7	**Atomic Structure and Periodicity**	**10**	
7.1	Electromagnetic Radiation	6	4.1.7 4.2.1 4.2.8
7.2	The Nature of Matter		
7.3	The Atomic Spectrum of Hydrogen		
7.4	The Bohr Model		
7.5	The Quantum Mechanical Model of the Atom		
7.6	Quantum Numbers		
7.7	Orbital Shapes and Energies		
7.8	Electron Spin and the Pauli Principle		
7.9	Polyelectronic Atoms		
7.10	The History of the Periodic Table		
7.11	The Aufbau Principle and the Periodic		
7.12	Periodic Trends in Atomic Properties		
7.13	The Properties of a Group: The Alkali Metals		
	For Review • Key Terms • Questions and Exercises	4	
*	**Final Exam**	3	

Course topics to be corved - tentative schedule (Brief form)

No.	Title	Official (hours)	Self-study (hours)
1	Chemical Foundations	5	10
2	Atoms, Molecules, and Ions	8	16
3	Stoichiometry	7	14
4	*Midterm 1*	1	2

5	Types of Chemical Reactions and Solution Stoichiometry	8	16
6	Gases	8	16
7	Thermochemistry	9	18
8	*Midterm 2*	1	2
9	Atomic Structure and Periodicity	10	20
10	Final Exam	3	6
	Sum	**60**	**120**

7. Method of instruction:

The students will be guided to prepare for the topics before coming to the class. The theoretical part will be introduced and incorporated with solving exercises and problems in the class. Students can be asked for studying in groups under guidance of the lecturers.

8. Requirements for student:

- Attendance, respectful classroom participation: ≥ 80% (C points)
- A student must complete at least 80% homework exercises (B1 points)
- Midterm 1 and 2 (B2 points)
- Oral Test: compulsory participation (B3 points)
- Final exam: compulsory participation (A points)
- Integrity: Dishonesty can lead to a falling grade
- Prepare for the contents in Table 3

9. Course grading plan

9.1. Grading methods

Table 2. Course grading plan

No	Grading components	Regulations/Rules	Weighted
1	Attendance (C)	Hours/ Total lecturing hours ≥ 80%	10 %
2	Homeworks (B1)	Homework numbers/ Total homework numbers ≥ 80%	30 %
3	Midterms (B2)	Writing (50 minutes)	
4	Oral Test (B3)	Answer for prepared questions	
5	Final exam (A)	Writing (120 minutes)	60 %

Midterm 1: 50 minutes
Midterm 2: 50 minutes
Course project: To be arranged (if any)
Final Exam: 120 minutes
Average point = 0.6*A + 0.3*(B1+B2+B3)/3+0.1*C

9.2. Grading scale system

The 10-scale grading system, which can be converted into 4-scale system (letter or number grade), is to be used in accordance with the Regulation of Credit-based Academic System of HUMG.

10. Text/ required books and other interesting books: (at least 3 books)

[1]. Steven S. Zumdahl, Sunsan A. Zumdahl. *Chemistry*, Seventh edition, Houghton Mifflin Company, Boston, New York, 2007.

[2]. Martin S. Silberberg. *Principles of general chemistry*, Mc Graw Hill Company, New York, 2007.
[3]. Ralph H. Petrucci .... *General chemistry: Principles and modern applications*, tenth edition, Pearson Canada, Toronto, 2011.

11. Instruction for self-study:

Table 3. Contents to be prepared - tentative schedule

No	Topics/ Activities	Theory (hours)	Homeworks (hours)	Laboratory (hours)	Total self-study (hours)	Requirements for student
1	**Chapter 1: Chemical Foundations** 1.1. Chemistry: An Overview 1.2. The Scientific Method 1.3. Units of Measurement 1.4. Uncertainty in Measurement 1.5. Significant Figures and Calculations 1.6. Dimensional Analysis 1.7. Temperature 1.8. Density 1.9. Classification of Matter For Review • Key Terms • Question and Exercises.	3	2	0	10	Study chapter 1 of books **[1]**, **[2]** and **[3]**
2	**Chapter 2: Atoms, Molecules, and Ions** 2.1. The Early History of Chemistry 2.2. Fundamental Chemical Laws 2.3. Dalton's Atomic Theory 2.4. Early Experiments to Characterize the Atom 2.5. The Modern View of Atomic Structure: An Introduction 2.6. Molecules and Ions 2.7. An Introduction to the Periodic Table 2.8. Naming Simple Compounds For Review • Key Terms • Question and Exercises	5	3	0	16	Study chapter 2 of books **[1]**, **[2]** and **[3]**
3	**Chapter 3: Stoichiometry** 3.1. Counting by Weighing 3.2. Atomic Masses 3.3. The Mole 3.4. Molar Mass 3.5. Percent Composition of Compounds 3.6. Determining the Formula of a Compound	4	3	0	14	Study chapter 3 of books **[1]**, **[2]** and **[3]**

	3.7. Chemical Equations 3.8. Balancing Chemical Equations 3.9. Stoichiometric Calculations: Amounts of Reactants and Products 3.10. Calculations Involving a Limiting Reactant For Review • Key Terms • Questions and Exercises					
*	**Midterm 1**	1	0	0	2	
4	**Chapter 4: Types of Chemical Reactions and Solution Stoichiometry** 4.1. Water, the Common Solvent 4.2. The Nature of Aqueous Solutions: Strong and Weak Electrolytes 4.3. The Composition of Solutions 4.4. Types of Chemical Reactions 4.5. Precipitation Reactions 4.6. Describing Reactions in Solution 4.7. Stoichiometry of Precipitation Reactions 4.8. Acid–Base Reactions 4.9. Oxidation–Reduction Reactions 4.10. Balancing Oxidation–Reduction Equations For Review • Key Terms • Questions and Exercises	5	3	0	16	Study chapter 4 of books **[1]**, **[2]** and chapter 4 & 5 of book **[3]**
5	**Chapter 5: Gases** 5.1. Pressure 5.2. The Gas Laws of Boyle, Charles, and Avogadro 5.3. The Ideal Gas Law 5.4. Gas Stoichiometry 5.5. Dalton's Law of Partial Pressures 5.6. The Kinetic Molecular Theory of Gases 5.7. Effusion and Diffusion 5.8. Real Gases 5.9. Characteristics of Several Real Gases 5.10. Chemistry in the Atmosphere For Review • Key Terms • Questions and Exercises	5	3	0	16	Study chapter 5 of books **[1]**, **[2]** and chapter 6 of book **[3]**
6	**Chapter 6: Thermochemistry** 6.1. The Nature of Energy	5	4	0	18	Study chapter 6 of books **[1]**, **[2]**

	6.2. Enthalpy and Calorimetry 6.3. Hess's Law 6.4. Standard Enthalpies of Formation 6.5. Present Sources of Energy 6.6. New Energy Sources For Review • Key Terms • Questions and Exercises					and chapter 7 of book **[3]**
*	**Midterm 2**	1	0	0	2	
7	**Chapter 7: Atomic Structure and Periodicity** 7.1. Electromagnetic Radiation 7.2. The Nature of Matter 7.3. The Atomic Spectrum of Hydrogen 7.4. The Bohr Model 7.5. The Quantum Mechanical Model of the Atom 7.6. Quantum Numbers 7.7. Orbital Shapes and Energies 7.8. Electron Spin and the Pauli Principle 7.9. Polyelectronic Atoms 7.10. The History of the Periodic Table 7.11. The Aufbau Principle and the Periodic 7.12. Periodic Trends in Atomic Properties 7.13. The Properties of a Group: The Alkali Metals For Review • Key Terms • Questions and Exercises	6	4	0	20	Study chapter 7 of book **[1]**; chapter 7 & 8 of book **[2]** and chapter 8 & 9 of book **[3]**
*	**Final Test**	3	0	0	6	
SUM					**120**	

Hanoi, 30th May 2018

ADVANCE PROGRAM

TS. Công Ngọc Thắng

CHAIR OF DEPARTMENT

Công Tiến Dũng