



Specific course  
Course Title: Fundamental Analytical Chemistry  
Course Code: SCCH 262

Degree  Bachelor  Master  Doctoral  
Faculty of Science  
Department of Chemistry

---

## TQF 3 Course Specification

### Section 1 General Information

1. **Course Code and Course Title**      วทคม ๒๖๒ หลักการเคมีวิเคราะห์  
SCCH 262 Fundamental Analytical Chemistry
2. **Number of Credits**               2 (2 - 0 - 4)      (Theory 3 hours Practice 0 hour Self-study 6 hours/week)
3. **Curriculum and Course Type**
  - 3.1 **Name of curriculum**           Undergraduate level (International Program)
  - 3.2 **Type of Course**                 Specific course
4. **Course Coordinator and Instructor**
  - 4.1 **Course coordinator**   Dr. Tinnakorn Tiensing  
Department of Chemistry           Faculty of Science  
Phone: 02-2015110                   email: tinnakorn.tie@mahidol.ac.th
  - 4.2 **Instructor**                 Dr. Tinnakorn Tiensing  
email: [tinnakorn.tie@mahidol.ac.th](mailto:tinnakorn.tie@mahidol.ac.th), [tinnakorn.tie@mahidol.edu](mailto:tinnakorn.tie@mahidol.edu)
5. **Semester / Class Level**
  - 5.1 **Semester**                   1<sup>st</sup> Semester / 2<sup>nd</sup> year
  - 5.2 **Number of Students**   Approximately 60 students
6. **Pre-requisite**                   SCCH 152 / SCCH 161 / General Chemistry Course
7. **Co-requisite**                   none
8. **Study Site Location**         Salaya Campus Faculty of Science
9. **Date of Preparation/Latest Revision of the Course Specification**   4 July 2023



Specific course  
Course Title: Fundamental Analytical Chemistry  
Course Code: SCCH 262

Degree  Bachelor  Master  Doctoral  
Faculty of Science  
Department of Chemistry

---

## Section 2 Goals and Objectives

### 1. Course Goals

After completion of this course, student will be able to understand principle knowledge and theories in fundamental analytical chemistry, spectroanalytical chemistry, electrochemistry and basic statistics related to analytical chemistry. Student should be able to apply quantitative analysis concepts to their upper-level courses.

### 2. Objectives of Courses

#### 2.1 Course Objectives

After completion of this course, student will be able to:

- 1) Understand principle in fundamental analytical chemistry in the following topics; fundamental analytical chemistry and validation analytical method, reagents and sample preparation, error of the analysis and data evaluation using basic statistics, calculation concentration of the solution, calibration methods, volumetric and gravimetric analysis, fundamental of spectroanalytical chemistry (molecular absorption-emission spectrophotometry), potentiometry, ion-selective electrode and pH measurement, acid-base equilibrium and buffer concept and electrochemistry techniques
- 2) Choose concentration units for preparing reagent solutions
- 3) Apply knowledge to solve analytical problems or related field problems

#### 2.2 Course-Level Learning Outcomes: CLOs

After completion of this course, student should be able to:

- 1) CLO1 Describe principle in fundamental analytical chemistry in the following topics correctly; fundamental analytical chemistry and validation analytical method, reagents and sample preparation, error of the analysis and data evaluation using basic statistics, calculation concentration of the solution, calibration methods, volumetric and gravimetric analysis, fundamental of spectroanalytical chemistry (molecular absorption-emission spectrophotometry), potentiometry, ion-selective electrode and pH measurement
- 2) CLO2 Explain volumetric (titration methods) and gravimetric (precipitation methods) analysis, validation of analytical method, solution and sample preparation, error of the analysis correctly
- 3) CLO3 Demonstrate a use of concentration units for preparing reagent solutions and the analyte quantity in the sample appropriately
- 4) CLO4 Classify and clarify basic spectrophotometry, acid-base equilibrium and buffer concept and electrochemistry techniques correctly
- 5) CLO5 Integrate apply fundamental analytical chemistry knowledge gained to solve analytical and related field problems



Specific course  
Course Title: Fundamental Analytical Chemistry  
Course Code: SCCH 262

Degree  Bachelor  Master  Doctoral  
Faculty of Science  
Department of Chemistry

## Section 3 Course Description and Implementation

### 1. Course Description

บทนำหลักการเคมีวิเคราะห์ การเตรียมสารละลายและตัวอย่าง ความคลาดเคลื่อนของการวิเคราะห์ การวิเคราะห์ข้อมูล และสถิติพื้นฐานสำหรับเคมีวิเคราะห์ หน่วยของความเข้มข้นและการคำนวณ การตรวจสอบความใช้ได้ของวิธี วิธีการเทียบมาตรฐาน การวิเคราะห์เชิงปริมาณโดยเทคนิคการไทเทรต การวิเคราะห์เชิงน้ำหนัก บทนำการวิเคราะห์ทางเคมีเชิงแสง สเปกโทรโฟโตเมทรีของการดูดกลืน-คายแสงของโมเลกุล โพเทนทีโอเมทรี อิเล็กโตรดแบบตัวเลือกไอออนและการวัดพีเอช

An introduction to fundamental analytical chemistry; preparations of reagents and samples; error of the analysis; data analysis and basic statistics for analytical chemistry; concentration units and calculations; method validation; calibration methods; the volumetric analysis by titration methods; the gravimetric analysis; an introduction to spectroanalytical chemistry (molecular absorption-emission spectrophotometry); potentiometry: ion-selective electrode and pH measurement

### 2. Number of Hours per Semester

Lecture (hour)	Practical Laboratory (hour)	Self-study (hour)
30	0	60

### 3. Number of Hours per Week for Individual Advice

1 hour/week depends on studying topic which can be arranged by instructor via e-mail or other communication system.



Specific course  
 Course Title: Fundamental Analytical Chemistry  
 Course Code: SCCH 262

Degree  Bachelor  Master  Doctoral  
 Faculty of Science  
 Department of Chemistry

## Section 4 Development of Students' Learning Outcomes

### 1. A brief summary of the knowledge or skills expected to develop in students; the course-level expected learning outcomes (CLOs).

By the end of the course, students who successfully complete the course will be able to:

- 1) CLO1 Describe principle in fundamental analytical chemistry in the following topics correctly; fundamental analytical chemistry and validation analytical method, reagents and sample preparation, error of the analysis and data evaluation using basic statistics, calculation concentration of the solution, calibration methods, volumetric and gravimetric analysis, fundamental of spectroanalytical chemistry (molecular absorption-emission spectrophotometry), potentiometry, ion-selective electrode and pH measurement
- 2) CLO2 Explain volumetric (titration methods) and gravimetric (precipitation methods) analysis, validation of analytical method, solution and sample preparation, error of the analysis correctly
- 3) CLO3 Demonstrate a use of concentration units for preparing reagent solutions and the analyte quantity in the sample appropriately
- 4) CLO4 Classify and clarify basic spectrophotometry, acid-base equilibrium and buffer concept and electrochemistry techniques correctly
- 5) CLO5 Integrate apply fundamental analytical chemistry knowledge gained to solve analytical and related field problems

### 2. How to organize learning experiences to develop the knowledge or skills stated in number 1 and how to measure the learning outcomes

Course Code	Teaching and learning experience management				Learning outcomes measurements				
	Lecture	Classroom exercise	Assignment / Home work	Self-study / Problem based learning	Quiz	Evaluate from report home work	Solving exercise	Midterm examination	Final examination
SCCH 262 Fundamental Analytical Chemistry									
CLO1 Describe principle in fundamental analytical chemistry in the following topics correctly; fundamental analytical chemistry and validation analytical method, reagents and sample preparation,	✓	✓		✓	✗		✗	✗	✗



Specific course  
 Course Title: Fundamental Analytical Chemistry  
 Course Code: SCCH 262

Degree  Bachelor  Master  Doctoral  
 Faculty of Science  
 Department of Chemistry

Course Code	Teaching and learning experience management				Learning outcomes measurements				
	Lecture	Classroom exercise	Assignment / Home work	Self-study / Problem based learning	Quiz	Evaluate from report home work	Solving exercise	Midterm examination	Final examination
SCCH 262 Fundamental Analytical Chemistry									
error of the analysis and data evaluation using basic statistics, calculation concentration of the solution, calibration methods, volumetric and gravimetric analysis, fundamental of spectroanalytical chemistry (molecular absorption-emission spectrophotometry), potentiometry, ion-selective electrode and pH measurement									
CLO2 Explain volumetric (titration methods) and gravimetric (precipitation methods) analysis, validation of analytical method, solution and sample preparation, error of the analysis correctly	✓	✓		✓	✗		✗	✗	✗
CLO3 Demonstrate a use of concentration units for preparing reagent solutions and the analyte quantity in the sample appropriately	✓	✓	✓	✓	✗	✗	✗	✗	✗
CLO4 Classify and clarify basic spectrophotometry, acid-base equilibrium and buffer concept and electrochemistry techniques correctly	✓			✓					✗
CLO5 Integrate apply fundamental analytical chemistry knowledge gained to solve analytical and related field problems	✓		✓	✓		✗		✗	✗



Specific course  
Course Title: Fundamental Analytical Chemistry  
Course Code: SCCH 262

Degree  Bachelor  Master  Doctoral  
Faculty of Science  
Department of Chemistry

## Section 5 Lesson Plan and Evaluation

### 1. Lesson Plan

Week	Topics/Details	Number of hours		Teaching activities/ media	Instructors
		Classroom sessions	Practice sessions		
1	(1) Introduction to analytical chemistry, Sampling and sample preparation Errors in Analysis	2	0	<u>Teaching activities</u> (1) Lecture (2) Problems solving (3) Demonstrate using excel program  <u>Teaching media</u> (1) PowerPoint slides (2) Spreadsheet software	Dr. Tinnakorn Tiensing
2	(2) Data evaluation & Using Excel in Data Analysis, Method Validation	2	0	<u>Teaching activities</u> (1) Lecture (2) Problems solving (3) Demonstrate using excel program  <u>Teaching media</u> (1) PowerPoint slides (2) Spreadsheet software	Dr. Tinnakorn Tiensing
3	(3) Concentration systems and preparation reagent solutions	2	0	<u>Teaching activities</u> (1) Lecture (2) Problems solving  <u>Teaching media</u> (1) PowerPoint slides	Dr. Tinnakorn Tiensing
4	(4) Gravimetric and volumetric analysis	2	0	<u>Teaching activities</u> (1) Lecture (2) Problems solving  <u>Teaching media</u> (1) PowerPoint slides	Dr. Tinnakorn Tiensing
5	(5) Titration methods and reactions of the titration	2	0	<u>Teaching activities</u> (1) Lecture (2) Problems solving  <u>Teaching media</u> (1) PowerPoint slides	Dr. Tinnakorn Tiensing



Specific course

Course Title: Fundamental Analytical Chemistry

Course Code: SCCH 262

Degree  Bachelor  Master  Doctoral

Faculty of Science

Department of Chemistry

Week	Topics/Details	Number of hours		Teaching activities/ media	Instructors
		Classroom sessions	Practice sessions		
6	(5) Titration methods and reactions of the titration	2	0	<u>Teaching activities</u> (1) Lecture (2) Problems solving  <u>Teaching media</u> (1) PowerPoint slides	Dr. Tinnakorn Tiensing
7	(6) Application of the titration methods	2	0	<u>Teaching activities</u> (1) Lecture (2) Problems solving (3) Assignments  <u>Teaching media</u> (1) PowerPoint slides	Dr. Tinnakorn Tiensing
8	<b>Midterm examination</b>	-	-	Written examination	
9	(7) Acid-base equilibrium and buffer concept	2	0	<u>Teaching activities</u> (1) Lecture (2) Problems solving  <u>Teaching media</u> (1) PowerPoint slides	Dr. Tinnakorn Tiensing
10	(7) Acid-base equilibrium and buffer concept	2	0	<u>Teaching activities</u> (1) Lecture (2) Problems solving (3) Assignments  <u>Teaching media</u> (1) PowerPoint slides	Dr. Tinnakorn Tiensing
11	(8) Introduction to spectro-analytical chemistry (Beer's law)	2	0	<u>Teaching activities</u> (1) Lecture (2) Discussion  <u>Teaching media</u> (1) PowerPoint slides	Dr. Tinnakorn Tiensing
12	(9) Molecular absorption-emission spectrophotometry	2	0	<u>Teaching activities</u> (1) Lecture (2) Discussion  <u>Teaching media</u> (1) PowerPoint slides	Dr. Tinnakorn Tiensing
13	(9) Molecular absorption-emission spectrophotometry, instrumentation and its application	2	0	<u>Teaching activities</u> (1) Lecture (2) Discussion (3) Problem solving	Dr. Tinnakorn Tiensing



Specific course  
Course Title: Fundamental Analytical Chemistry  
Course Code: SCCH 262

Degree  Bachelor  Master  Doctoral  
Faculty of Science  
Department of Chemistry

Week	Topics/Details	Number of hours		Teaching activities/ media	Instructors
		Classroom sessions	Practice sessions		
				<u>Teaching media</u> (1) PowerPoint slides	
14	(10) Introduction to electrochemistry technique	2	0	<u>Teaching activities</u> (1) Lecture (2) Discussion  <u>Teaching media</u> (1) PowerPoint slides	Dr. Tinnakorn Tiensing
15	(10) Introduction to electrochemistry technique: Potentiometry	2	0	<u>Teaching activities</u> (1) Lecture (2) Discuss (3) Assignments  <u>Teaching media</u> (1) PowerPoint slides	Dr. Tinnakorn Tiensing
16	(11) Introduction to electrochemistry technique: Ion selective electrode and pH measurement	2	0	<u>Teaching activities</u> (1) Lecture (2) Problems solving  <u>Teaching media</u> (1) PowerPoint slides	Dr. Tinnakorn Tiensing
17	<b>Final examination</b>	-	-	Written exam	
	Total	<b>30</b>	<b>0</b>		

## 2. Evaluation of the CLOs

### 2.1 Measurement and Evaluation of learning achievement

#### a. Formative Assessment

The formative assessment methods for improving learning skill in which evaluation results are not included in the final score after completion the course are:

- Ask questions in the classroom
- Demonstrate examples for problem solving in the related topics of studying

#### b. Summative Assessment

##### (1) Tool and weight for measurement and evaluation





Specific course  
 Course Title: Fundamental Analytical Chemistry  
 Course Code: SCCH 262

Degree  Bachelor  Master  Doctoral  
 Faculty of Science  
 Department of Chemistry

CLO	Learning outcomes measurements					Weight (percent)
	Quiz	Evaluate from report / home work / assignment	Solving exercise	Midterm examination: Written exam	Final examination: Written exam	
CLO1 Describe principle in fundamental analytical chemistry in the following topics correctly; fundamental analytical chemistry and validation analytical method, reagents and sample preparation, error of the analysis and data evaluation using basic statistics, calculation concentration of the solution, calibration methods, volumetric and gravimetric analysis, fundamental of spectroanalytical chemistry (molecular absorption-emission spectrophotometry), potentiometry, ion-selective electrode and pH measurement	3		4	10	10	27
CLO2 Explain volumetric (titration methods) and gravimetric (precipitation methods) analysis, validation of analytical method, solution and sample preparation, error of the analysis correctly	2		3	10	5	20
CLO3 Demonstrate a use of concentration units for preparing reagent solutions and the analyte quantity in the sample appropriately	5	5	3	10	5	28
CLO4 Classify and clarify basic spectrophotometry, acid-base equilibrium and buffer concept and electrochemistry techniques correctly					10	10
CLO5 Integrate apply fundamental analytical chemistry knowledge gained to solve analytical and related field problems		5		5	5	15
Total	10	10	10	35	35	100

(2) Grading policy



Specific course  
Course Title: Fundamental Analytical Chemistry  
Course Code: SCCH 262

Degree  Bachelor  Master  Doctoral  
Faculty of Science  
Department of Chemistry

Criteria and conditions for measurement and evaluation are to be enforced in accordance with Mahidol University Regulation on Diploma and Undergraduate Study and recently Announcement, the Faculty of Science on Undergraduate Study, by using symbols showing results with assigned scores as shown in the table:

Score(percentage)	Symbols
80 – 100	A
70 – 79	B+
65 – 69	B
60 – 64	C+
55 – 59	C
50 – 54	D+
45 – 49	D
0 – 44	F

Symbol with D means pass in this course.

### **(3) Re-examination (if any)**

Follow the Announcement, the Faculty of Science on Undergraduate Study on Re-examination which can be done in the following conditions;

- Student received F or U
- Student taken that course fail less than 15 students, and
- That course would not open in the summer semester.

### **3. Student Academic Appeal**

Students may submit formal complaint or academic appeal directly to

**International Education and Administration Unit, Division of Salaya Campus**

Room SC1-116, SC1-Building, Faculty of Science (Salaya Campus), Mahidol University

999 Phuttamonthon 4 Road, A. Phuttamonthon, Nakhon Pathom 73170, Thailand

E-mail: scsim@mahidol.ac.th; Phone: +66 2 4419820 ext. 1199

If it considered that a case exists, the matter will be investigated in accordance with the procedures, and the complainant informed of the outcome.



Specific course  
Course Title: Fundamental Analytical Chemistry  
Course Code: SCCH 262

Degree  Bachelor  Master  Doctoral  
Faculty of Science  
Department of Chemistry

---

## Section 6 Teaching Resources

### 1. Required Texts and Main Documents

- 1) Jeffery, G.H.; Bassett, J.; Mendham, J.; Denney, R.C. Vogel's textbook of quantitative chemical analysis, Essex (UK): Pearson Education Limited, **2000** (or other years).
- 2) SKOOG, D.A.; WEST D.M and HOLLER F.J, Fundamentals of analytical chemistry, 9<sup>th</sup> ed., **2014**.
- 3) Skoog, D. A.; West, D. M. and Holler. J. Fundamental of Analytical Chemistry (7th ed.), Suanders College Publishing, **1997**.
- 4) Daniel C. Harris. Quantitative Chemical Analysis, 8<sup>th</sup> ed., **2010**.
- 5) Kellner, R.; Mermet, J. M.; Otto, M.; Valcarcel, M; Widmer, J. M. Analytical Chemistry: A Modern Approach to Analytical Science, 2<sup>nd</sup> Edition, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, **2004**.
- 6) Menham, J.; Denney, R. C. and Thomas, M. Vogel's textbook of Quantitative Chemical Analysis. PRENTICE HALL, Pearson education Limited, Essex, **2000**.
- 7) Miller, J. C. and Miller, J. N. Statistics for Analytical Chemistry (2<sup>nd</sup> Edition) Ellis Horwood Limited, Sussex, **1998**.
- 8) Wang, J. Electroanalytical Chemistry, John Wiley & Son Inc., New York, **2006**.
- 9)

### 2. Suggested Materials

- 1) All teaching documents
- 2) Books in Analytical Chemistry
- 3) Websites; <http://www.rsc.org/>

3. Other Resources (if any) none



Specific course  
Course Title: Fundamental Analytical Chemistry  
Course Code: SCCH 262

Degree  Bachelor  Master  Doctoral  
Faculty of Science  
Department of Chemistry

---

## Section 7 Evaluation and Improvement of Course Implementation

### 1. Strategy for Course Effectiveness Evaluation by Students

On-line evaluation form (i.e., instructor/lecturer and overall of the course) can be done by student which is easily assessed by the internet. Contents of the evaluation consist of topics, management, grading evaluation, satisfaction of the course and method usage and teaching method of the course.

### 2. Strategy for Teaching Evaluation

Skill, knowledge, teaching strategy and learning media in that course can be evaluated by student and also co-course instructor.

### 3. Teaching Improvement

Teaching Improvement methods can be done by meeting/seminar all lecturers in the course for improving teaching and learning methods that will be applied in the next academic year from all sources of information such as;

- grading results
- evaluation of the subject; teaching method / student learning
- recording from lecturer on performance and behavior student class

### 4. Verification Standard of Learning Outcome for the Course

The verification processes will be conducted by instructors based on student score, grading system and course evaluation results in that course for revision and verification standard LOs for the course.

### 5. Revision Process and Improvement Plan for Course Effectiveness

At the end of academic year, course instructor will summaries and do the report for teaching and subject evaluation results and information in the form of TQF.5 to the program administrative committee for future vision and improvement plan.



Specific course  
 Course Title: Fundamental Analytical Chemistry  
 Course Code: SCCH 262

Degree  Bachelor  Master  Doctoral  
 Faculty of Science  
 Department of Chemistry

## Appendix

### Concordance between Specific Course and Program

**Table 1** Relations between the course and the PLOs

Course name	PLOs					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
Fundamental Analytical Chemistry						
Course code SCCH 262						

**Remarks:** Show the level of the course management with the symbols I, R, P, and M. This must correspond to the curriculum mapping written in the TQF2.

**Table 2** Relations between CLOs and PLOs

Course code SCCH 262	PLOs					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1 Describe principle in fundamental analytical chemistry in the following topics correctly; fundamental analytical chemistry and validation analytical method, reagents and sample preparation, error of the analysis and data evaluation using basic statistics, calculation concentration of the solution, calibration methods, volumetric and gravimetric analysis, fundamental of spectroanalytical chemistry (molecular absorption-emission spectrophotometry), potentiometry, ion-selective electrode and pH measurement						
CLO2 Explain volumetric (titration methods) and gravimetric (precipitation methods) analysis, validation of analytical method, solution and sample preparation, error of the analysis correctly						
CLO3 Demonstrate a use of concentration units for preparing reagent solutions and the analyte quantity in the sample appropriately						
CLO4 Classify and clarify basic spectrophotometry, acid-base equilibrium and buffer						



Specific course  
Course Title: Fundamental Analytical Chemistry  
Course Code: SCCH 262

Degree  Bachelor  Master  Doctoral  
Faculty of Science  
Department of Chemistry

Course code SCCH 262	PLOs					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
concept and electrochemistry techniques correctly						
CLO5 Integrate apply fundamental analytical chemistry knowledge gained to solve analytical and related field problems						

**Remarks:**

- Each CLO should clearly correspond to the PLO at the SubPLO level to show a clear connection.
- Describe the PLOs and SubPlos only referred to in the course in “[Table 3](#) PLOs that the course is responsible for”.

**Table 3** Description of Program Learning Outcomes (PLO) and sub PLOs of your responsible course

PLOs	Sub PLOs
PLO1	1.1
	1.2
PLO2	2.1
	2.2
PLO3	3.1
	3.2