

# CHEM4085: TESTING AND CERTIFICATION SCIENCES

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## Effective Term

Semester A 2022/23

## Part I Course Overview

### Course Title

Testing and Certification Sciences

### Subject Code

CHEM - Chemistry

### Course Number

4085

### Academic Unit

Chemistry (CHEM)

### College/School

College of Science (SI)

### Course Duration

One Semester

### Credit Units

4

### Level

B1, B2, B3, B4 - Bachelor's Degree

### Medium of Instruction

English

### Medium of Assessment

English

### Prerequisites

CHEM2004/BCH2004 Principles of Analytical Chemistry

### Precursors

CHEM3027/BCH3027 Analytical Chemistry

### Equivalent Courses

BCH4085 Testing and Certification Sciences

### Exclusive Courses

Nil

## Part II Course Details

### Abstract

This course aims to provide students with essential knowledge in quality management and application to the laboratory testing and certification industry. Students will receive training on various contemporary laboratory quality and management practices. These include establishment of traceability, accuracy and reliability in measurement; estimation of uncertainty in measurement; quality control and quality assurance in testing and certification; laboratory and data auditing; accreditation and international standards in quality management for testing and certification (e.g. ISO9001, ISO/IEC17025, ILAC, HKOLAS).

### Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if DEC-A1 DEC-A2 DEC-A3 app.)			
1	Enumerate basic concepts of international standards in quality and safety management for laboratory testing and certification industry, including ISO9001, ISO/IEC17025, ILAC and HKOLAS.		x		
2	Elaborate and apply principles of managerial techniques and auditing skills of international quality and management systems to the testing and certification industry.			x	
3	Elaborate and apply appropriate calibration methods and measurement uncertainty estimation in different types of laboratory testing.			x	
4	Reflect on the commercial laboratory environment, accreditation requirements and practices in Hong Kong.				x

#### A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

#### A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

#### A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

### Teaching and Learning Activities (TLAs)

TLAs	Brief Description	CILO No.	Hours/week (if applicable)	
1	Large class activities	Formal lectures and tutorials enable students to acquire conceptual understanding of the various principles of laboratory quality management systems.	1, 2, 3	3 hours per week / 7 weeks

2	Guest talks	Special talks on specific topics of laboratory management by expert guest speakers enable students to understand specific aspects of various laboratory management standards and quality assurance practices.	1, 2, 3	2 hours per week / 6 weeks
3	Laboratory practicals	Team-based laboratory exercises provide students with opportunities to understand, perform and report various testing and calibration techniques, as well as, measurement uncertainty estimation.	2, 3	4 hours per week / 3 weeks
4	Site visits	Site visits to commercial laboratory operations enable students to understand basic requirements of various laboratory management systems, calibration practices and measurement uncertainty calculation.	1, 2, 3, 4	4 hour per week / 2 weeks

**Assessment Tasks / Activities (ATs)**

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Laboratory performance assessment and laboratory reports	2, 3	10	
2	Guest talks and company visit reports	1, 4	10	
3	Tutorial assignments	1, 2, 3	10	

**Continuous Assessment (%)**

30

**Examination (%)**

70

**Examination Duration (Hours)**

3

**Additional Information for ATs**

Starting from Semester A, 2015-16, students must satisfy the following minimum passing requirement for courses offered by CHEM:

“A minimum of 40% in both coursework and examination components.”

## Assessment Rubrics (AR)

### Assessment Task

#### 1. End-of-course written examination

##### Criterion

Demonstration of ability in the synthesis of the principles, processes, methodologies, problems and limitations related to various aspects of quality and laboratory management.

##### Excellent (A+, A, A-)

Students who complete all assessment tasks/activities and demonstrate excellent synthesis of the principles, processes, methodologies, problems and limitations related to various aspects of quality and laboratory management in detail.

##### Good (B+, B, B-)

Students who complete all assessment tasks/activities and can describe and explain principles, processes, methodologies, problems and limitations related to various aspects of quality and laboratory management with a high degree of accuracy and thoroughness.

##### Fair (C+, C, C-)

Students who complete all assessment tasks/activities and can describe and explain some key principles, processes and methodologies related to various aspects of quality and laboratory management.

##### Marginal (D)

Students who complete all assessment tasks/activities and can briefly describe isolated principles, processes and methodologies related to various aspects of quality and laboratory management.

##### Failure (F)

Students who fail to complete all assessment tasks/activities and/or cannot accurately describe and explain relevant principles, processes, methodologies, problems and limitations related to various aspects of quality and laboratory management.

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### Assessment Task

#### 2. Laboratory performance assessment and laboratory reports

##### Criterion

Demonstration of ability to validate new analytical techniques with originality in thought, argument or application, with effective oral and written communication.

##### Excellent (A+, A, A-)

Students who demonstrate excellent ability to validate new analytical techniques with originality in thought, argument or application in quality and laboratory management, with professional oral and written communication.

##### Good (B+, B, B-)

Students who show ability in integration of concepts, analytical techniques and applications in quality and laboratory management with clear oral and written communication.

##### Fair (C+, C, C-)

Students who show ability in practicing analysis techniques in quality and laboratory management, with adequate oral and written communication.

##### Marginal (D)

Students who show limited degree of practical skills in quality and laboratory management.

**Failure (F)**

Students who fail to demonstrate their practical skills in quality and laboratory management.

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**Assessment Task**

3. Guest talk and company visit reports

**Criterion**

Demonstration of capability in analysing the implementation of integrated management systems for testing laboratories, with clarity of explanations, logical and advanced justifications, and creative/personal interpretations and view-points.

**Excellent (A+, A, A-)**

Students who are capable of providing a comprehensive analysis of the implementation of integrated management systems for testing laboratories, with clarity of explanations, logical and advanced justifications, and creative/personal interpretations and view-points.

**Good (B+, B, B-)**

Students who are capable of providing a detailed, critical analysis of the implementation of integrated management systems for testing laboratories.

**Fair (C+, C, C-)**

Students who can provide simple but accurate explanations and basic justifications for the implementation of integrated management systems for testing laboratories.

**Marginal (D)**

Students who demonstrate limited ability in the analysis of the implementation of integrated management systems for testing laboratories, with a lack of integrated understanding of applications of relevant concepts and principles as a whole.

**Failure (F)**

Students who cannot provide appropriate analysis and satisfactory justifications to the implementation of integrated management systems for testing laboratories.

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**Assessment Task**

4. Tutorial assignments

**Criterion**

Demonstration of ability in solving problems related to various aspects of quality and laboratory management.

**Excellent (A+, A, A-)**

Students who demonstrate excellent ability in solving problems related to various aspects of quality and laboratory management.

**Good (B+, B, B-)**

Students who are capable of solving problems related to certain aspects of quality and laboratory management.

**Fair (C+, C, C-)**

Students who show limited ability in solving problems related to certain aspects of quality and laboratory management.

**Marginal (D)**

Students who show barely adequate ability in solving problems related to limited aspects of quality and laboratory management.

**Failure (F)**

Students who fail to demonstrate their ability to solve problems related to quality and laboratory management.

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**Part III Other Information****Keyword Syllabus**

- Commercial laboratory management practice
- ISO9001 & ISO/IEC 17025
- Environmental management in laboratory (ISO14001)
- Safety management in laboratory (OHSAS18001)
- Management/ technical requirements for accreditation
- Calibration practice
- ISO Guide to expression of uncertainty in measurement
- EURACHEM/CITAC Guide of quantifying uncertainty in analytical measurement
- Traceability concept
- Quality assurance in testing
- Standard operation procedure (SOP) for difference testing methods and sampling technique
- Internal auditor requirements
- Laboratory assessor requirements

**Reading List****Compulsory Readings**

Title	
1	HKAS 002, HOKLAS 003, HOKLAS 015, HKAS Supplementary Criteria No. 5, and HOKLAS Supplementary Criteria No. 2 & 33.

**Additional Readings**

Title	
1	Piotr Konieczka, Jacek Namiesnik. Quality Assurance and Quality Control in the Analytical Chemical laboratory: A Practical Approach. 2nd Edition, CRC Press, Boca Raton, 2018