香港城市大學
City University of Hong Kong

**SYL**

# Course Syllabus

## offered by Department of Chemistry
## with effect from Semester A 2020/21

This form is for the completion by the *Course Leader*. The information provided on this form is the official record of the course. It will be used for the City University's database, various City University publications (including websites) and documentation for students and others as required.

Please refer to the Explanatory Notes on the various items of information required.

***Prepared / Last Updated by:***


| | | | |
|---|---|---|---|
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**City University of Hong Kong**
**Course Syllabus**

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## Part I Course Overview

| | |
|---|---|
| **Course Title:** | Forensic Chemistry |
| **Course Code**: | CHEM4051 |
| **Course Duration:** | 1 semester |
| **Credit Units**: | 3 credits |
| **Level**: | B4 |
| **Proposed Area:** *(for GE courses only)* | ☐ Arts and Humanities<br>☐ Study of Societies, Social and Business Organisations<br>☐ Science and Technology |
| **Medium of Instruction:** | English |
| **Medium of Assessment:** | English |
| **Prerequisites**: *(Course Code and Title)* | CHEM2004/BCH2004 Principles of Analytical Chemistry<br>or<br>BCH1100 Chemistry / CHEM1300 Principles of General Chemistry (For students intending to take a Minor in Forensic Studies only) |
| **Precursors**: *(Course Code and Title)* | Nil |
| **Equivalent Courses**: *(Course Code and Title)* | BCH4051 Forensic Chemistry |
| **Exclusive Courses**: *(Course Code and Title)* | Nil |

## Part II Course Details

### 1. Abstract

*(A 150-word description about the course)*

This course helps students develop knowledge of the various analytical chemical, biochemical and chemometric principles and techniques that are applied to aid the enforcement of the law and the analysis of evidence found at crime scenes or on/in the bodies of crime suspects/victims.

Forensic chemistry is a field of applied chemistry and this course ties in with the emphasis of the Chemistry programme of CHEM on the applications of chemical knowledge and techniques to the industry and community as a whole.

### 2. Course Intended Learning Outcomes (CILOs)

*(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)*

| No. | CILOs[#] | Weighting* (if applicable) | Discovery-enriched curriculum related learning outcomes (please tick where appropriate) | | |
|---|---|---|---|---|---|
| | | | *A1* | *A2* | *A3* |
| 1. | Describe the concepts of forensic pathology, forensic odontology and forensic anthropology in personal identification and reconstruction. | | ✓ | | |
| 2. | Describe the operation of firearms and perform simple comparison of markings on bullets and other projectiles, cartridge and shell cases and analyze gunshot residues using various physical and chemical techniques. | | ✓ | | |
| 3. | Apply relevant chemical, biochemical and bio-analytical principles to examine and discover to reveal criminalistic and forensic toxicological evidences including glass, soil, fibers and hairs, blood and other body fluids, arson accelerants, explosive residues, residues of chemical warfare, drugs and the various toxic substances in human tissues and organs. Critically evaluate the applicability of various forensic techniques to different scenarios. | | | ✓ | ✓ |
| 4. | Critically evaluate the various forensic techniques in terms of identification, individualization and reconstruction and recommend or advise on the most appropriate selection for an investigation. | | | ✓ | ✓ |
| | ** If weighting is assigned to CILOs, they should add up to 100%.* | 100% | | | |

*[#] Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.*

*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 self-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.*

## 3. Teaching and Learning Activities (TLAs)

*(TLAs designed to facilitate students' achievement of the CILOs.)*

| TLA | Brief Description | CILO No. | | | | Hours/week (if applicable) |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | |
| Case studies and guest seminars | Students will learn to describe the concepts of forensic pathology, forensic odontology and forensic anthropology in personal identification and reconstruction primarily by case studies. Complementary guest seminars will further engage students in discussion of real-life forensic examination. | ✓ | | ✓ | ✓ | |
| Group activities and field visits | In large and small group activities and field visits to examine the operation of common firearms and to obtain hands-on experience in analyzing gun-shot residues. | | ✓ | ✓ | | |
| Laboratory practicals | Through a number of laboratory practicals, students will learn how to apply the various chemical, biochemical and bio-analytical techniques to discover and analyse criminal evidence. | | | ✓ | ✓ | |
| Group critical evaluation tasks and debates | In large and small group critical evaluation tasks and debates students will discuss the principles, limitations, relevance and applicability of the various forensic techniques and approaches in terms of achieving the three basic goals of forensic science, which are identification, individualization and reconstruction. | | | ✓ | ✓ | |

## 4. Assessment Tasks/Activities (ATs)

*(ATs are designed to assess how well the students achieve the CILOs.)*

| Assessment Tasks/Activities | CILO No. | | | | Weighting* | Remarks |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | | |
| Continuous Assessment: 30% | | | | | | |
| Short Quizzes | ✓ | | ✓ | | 10% | |
| Laboratory practicals | | | ✓ | ✓ | 5% | |
| Tutorial Assignments | | ✓ | ✓ | | 5% | |
| Group Presentations | | | | ✓ | 5% | |
| Visit Reports | | ✓ | ✓ | | 5% | |
| Examination: 70% (duration: 3 hours) | | | | | | |
| ** The weightings should add up to 100%.* | | | | | 100% | |

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."***

## 5. Assessment Rubrics

*(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)*

| Assessment Task | Criterion | Excellent (A+, A, A-) | Good (B+, B, B-) | Fair (C+, C, C-) | Marginal (D) | Failure (F) |
|---|---|---|---|---|---|---|
| 1. Short Quizzes | Demonstration of understanding the principles and practice of various topics of forensic chemistry. | Able to demonstrate excellent understanding of the principles and practice of various topics of forensic chemistry. | Able to describe and explain the principles of various topics of forensic chemistry. | Able to describe and explain some key principles of selected topics of forensic chemistry. | Able to briefly describe isolated principles of selected topics of forensic chemistry. | Fail to accurately describe and explain relevant principles of any topics of forensic chemistry. |
| 2. Laboratory practicals | Demonstration of understanding the principles and practice of the selected topics of forensic analysis. | Able to demonstrate excellent understanding of the principles and practice of various topics of forensic analysis. | Able to describe and explain the principles of various topics of forensic analysis. | Able to describe and explain some key principles of selected topics of forensic analysis. | Able to briefly describe isolated principles of selected topics of forensic analysis. | Fail to accurately describe and explain relevant principles of any topics of forensic analysis. |
| 3. Tutorial Assignments | Demonstration of understanding the principles and practice of the selected topics of forensic chemistry. | Able to demonstrate excellent understanding of the principles and practice of the selected topics of forensic chemistry. | Able to describe and explain the principles of the selected topics of forensic chemistry. | Able to describe and explain some key principles of the selected topics of forensic chemistry. | Able to briefly describe isolated principles of the selected topics of forensic chemistry. | Fail to accurately describe and explain relevant principles of any topics of forensic chemistry. |
| 4. Group Presentations | Demonstration of understanding the principles and practice of the selected topics of forensic chemistry, and the ability to present those principles and practice in concise, orderly and professional manners. | Able to deliver fluent, well organized and well prepared presentations to demonstrate excellent understanding of the principles and practice of the selected topics of forensic chemistry. | Able to deliver fluent presentations, with evidence of proper preparation, to describe and explain the principles of the selected topics of forensic chemistry. | Able to deliver presentations, with evidence of proper preparation, to describe and explain some key principles of the selected topics of forensic chemistry. | Able to deliver comprehensible presentations to briefly describe isolated principles of the selected topics of forensic chemistry. | Fail to present relevant principles of any topics of forensic chemistry in coherent and comprehensible manners. |
| 5. Visit Reports | Demonstration of understanding of the operation of various firearms, and the forensic chemistry principles and practice in the examination of trace evidences produced by firearm discharge and terrorist attacks. | Able to demonstrate excellent understanding of the operation of various firearms, and the forensic chemistry principles and practice in the examination of trace evidences produced by firearm discharge and terrorist attacks. | Able to describe and explain the operation of various firearms, and the forensic chemistry principles and practice in the examination of trace evidences produced by firearm discharge and terrorist attacks. | Able to describe and explain some key principles in the: (a) operation of various firearms, and (b) the examination of trace evidences produced by firearm discharge and terrorist attacks. | Able to briefly describe isolated principles in the: (a) operation of various firearms, and (b) the examination of trace evidences produced by firearm discharge and terrorist attacks. | Fail to accurately describe and explain principles in the: (a) operation of various firearms, and (b) the examination of trace evidences produced by firearm discharge and terrorist attacks. |
| 6. Examination | Demonstration of understanding the principles and practice of various topics of forensic chemistry. | Able to demonstrate excellent understanding of the principles and practice of various topics of forensic chemistry. | Able to describe and explain the principles of various topics of forensic chemistry. | Able to describe and explain some key principles of selected topics of forensic chemistry. | Able to briefly describe isolated principles of selected topics of forensic chemistry. | Fail to accurately describe and explain relevant principles of any topics of forensic chemistry. |

**Part III Other Information** (more details can be provided separately in the teaching plan)

## 1. Keyword Syllabus

*(An indication of the key topics of the course.)*

Forensic toxicology
Drugs of abuse; Dangerous drugs & controlled drugs; Forensic analysis of pharmaceutical materials; Forensic analysis of nonmedicinal agents; Analytical & chemometric methodologies used in forensic toxicology.

Analysis of blood, bloodstains and other biological fluids and stains
Analytical techniques for the identification of blood, semen, saliva, urine, feces, vomitus, vaginal secretions; Determination of bloodstains; Interpretation of bloodstain patterns; Genetic markers in blood.

Examination of physical forensic evidence
Examination and identification of fingerprints, footwear impressions, tool marks, tire tracks & tire impressions.

Microanalysis and examination of trace evidence
Microscopic examination and microanalysis of glass, synthetic fibres, hairs & furs, paint and soil particles; Chemical and instrumental analysis of trace evidence.

Examination of firearms, bullets and explosives
Working principles of modern firearms; Ballistics; Gunshot residues; Chemical natures of common explosives; Chemical analysis of explosives.

Investigation of arson cases
Chemistry and behaviour of fire & explosion; Fire accelerants and their chemical analysis.

Forensic DNA analysis
DNA fingerprinting; Sampling, isolation, extraction and analysis of genetic materials for forensic examinations; Parentage testing.

Forensic medicine, odontology & anthropology
Forensic pathology; personal identification by forensic dentistry; personal identification and reconstruction based on bodily / skeletal remains.

Examination of questioned documents
Interpretation of handwriting; analysis of papers, inks and other materials used to produce documents; counterfeit banknotes; forged documents; anti-counterfeit and anti-forgery technologies.

## 2. Reading List

### 2.1 Compulsory Readings

*(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)*

N.A.

### 2.2 Additional Readings

*(Additional references for students to learn to expand their knowledge about the subject.)*

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|---|---|
| 1. | Forensic Science – An Introduction to Scientific and Investigative Techniques, 4th Ed., Stuart H. James and Jon J. Norby, Taylor and Francis, 2014. |
| 2. | Forensic Science, 3rd Ed., Andrew R. W. Jackson, Julie M. Jackson, Pearson Education Inc., Essex, UK, 2011. |
| 3. | FORENSICnetBase: ~150 entire books covering many different forensic sub-fields, available online. City University is the only university in Hong Kong with this excellent facility that is continually updated as new books are added to the scheme. |

**Annex**
**(for GE courses only)**

Please specify the Gateway Education Programme Intended Learning Outcomes (PILOs) that the course is aligned to and relate them to the CILOs stated in Part II, Section 2 of this form:

| **GE PILO** | **Please indicate which CILO(s) is/are related to this PILO, if any** ***(can be more than one CILOs in each PILO)*** |
|---|---|
| PILO 1: Demonstrate the capacity for self-directed learning | |
| PILO 2: Explain the basic methodologies and techniques of inquiry of the arts and humanities, social sciences, business, and science and technology | |
| PILO 3: Demonstrate critical thinking skills | |
| PILO 4: Interpret information and numerical data | |
| PILO 5: Produce structured, well-organised and fluent text | |
| PILO 6: Demonstrate effective oral communication skills | |
| PILO 7: Demonstrate an ability to work effectively in a team | |
| PILO 8: Recognise important characteristics of their own culture(s) and at least one other culture, and their impact on global issues | |
| PILO 9: Value ethical and socially responsible actions | |
| PILO 10: Demonstrate the attitude and/or ability to accomplish discovery and/or innovation | |

*GE course leaders should cover the mandatory PILOs for the GE area (Area 1: Arts and Humanities; Area 2: Study of Societies, Social and Business Organisations; Area 3: Science and Technology) for which they have classified their course; for quality assurance purposes, they are advised to carefully consider if it is beneficial to claim any coverage of additional PILOs. General advice would be to restrict PILOs to only the essential ones. (Please refer to the curricular mapping of GE programme: http://www.cityu.edu.hk/edge/ge/faculty/curricular_mapping.htm.)*

A. Please select an assessment task for collecting evidence of student achievement for quality assurance purposes. Please retain at least one sample of student achievement across a period of three years.

| **Selected Assessment Task** |
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