

CHEM4051: FORENSIC CHEMISTRY

Effective Term

Semester A 2024/25

Part I Course Overview

Course Title

Forensic Chemistry

Subject Code

CHEM - Chemistry

Course Number

4051

Academic Unit

Chemistry (CHEM)

College/School

College of Science (SI)

Course Duration

One Semester

Credit Units

3

Level

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

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

CHEM2004/BCH2004 Principles of Analytical Chemistry

or

BCH1100 Chemistry / CHEM1300 Principles of General Chemistry (For students intending to take a Minor in Forensic Studies only)

Precursors

Nil

Equivalent Courses

BCH4051 Forensic Chemistry

Exclusive Courses

Nil

Part II Course Details

Abstract

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.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the concepts of forensic pathology, forensic odontology and forensic anthropology in personal identification and reconstruction.		x		
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.		x		
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.			x	x
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.			x	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.

Learning and Teaching Activities (LTAs)

LTAs		Brief Description	CILO No.	Hours/week (if applicable)
1	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.	1, 3, 4	
2	Group activities and field visits	In large and small group activities and field visits, students will examine the operation of common firearms and to obtain hands-on experience in analyzing gun-shot residues.	2, 3	
3	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.	3, 4	
4	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.	3, 4	

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Short Quizzes	1, 3	10	
2	Laboratory practicals	3, 4	5	
3	Tutorial Assignments	2, 3	5	

4	Group Presentations	4	5	
5	Visit Reports	2, 3	5	

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**

Short Quizzes

Criterion

Demonstration of understanding the principles and practice of various topics of forensic chemistry.

Excellent (A+, A, A-)

Able to demonstrate excellent understanding of the principles and practice of various topics of forensic chemistry.

Good (B+, B, B-)

Able to describe and explain the principles of various topics of forensic chemistry.

Fair (C+, C, C-)

Able to describe and explain some key principles of selected topics of forensic chemistry.

Marginal (D)

Able to briefly describe isolated principles of selected topics of forensic chemistry.

Failure (F)

Fail to accurately describe and explain relevant principles of any topics of forensic chemistry.

Assessment Task

Laboratory practicals

Criterion

Demonstration of understanding the principles and practice of the selected topics of forensic analysis.

Excellent (A+, A, A-)

Able to demonstrate excellent understanding of the principles and practice of various topics of forensic analysis.

Good (B+, B, B-)

Able to describe and explain the principles of various topics of forensic analysis.

Fair (C+, C, C-)

Able to describe and explain some key principles of selected topics of forensic analysis.

Marginal (D)

Able to briefly describe isolated principles of selected topics of forensic analysis.

Failure (F)

Fail to accurately describe and explain relevant principles of any topics of forensic chemistry.

Assessment Task

Tutorial Assignments

Criterion

Demonstration of understanding the principles and practice of the selected topics of forensic chemistry.

Excellent (A+, A, A-)

Able to demonstrate excellent understanding of the principles and practice of the selected topics of forensic chemistry.

Good (B+, B, B-)

Able to describe and explain the principles of the selected topics of forensic chemistry.

Fair (C+, C, C-)

Able to describe and explain some key principles of the selected topics of forensic chemistry.

Marginal (D)

Able to briefly describe isolated principles of the selected topics of forensic chemistry.

Failure (F)

Fail to accurately describe and explain relevant principles of any topics of forensic chemistry.

Assessment Task

Group Presentations

Criterion

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.

Excellent (A+, A, A-)

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.

Good (B+, B, B-)

Able to deliver fluent presentations, with evidence of proper preparation, to describe and explain the principles of the selected topics of forensic chemistry.

Fair (C+, C, C-)

Able to deliver presentations, with evidence of proper preparation, to describe and explain some key principles of the selected topics of forensic chemistry.

Marginal (D)

Able to deliver comprehensible presentations to briefly describe isolated principles of the selected topics of forensic chemistry.

Failure (F)

Fail to present relevant principles of any topics of forensic chemistry in coherent and comprehensible manners.

Assessment Task

Visit Reports

Criterion

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.

Excellent (A+, A, A-)

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.

Good (B+, B, B-)

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.

Fair (C+, C, C-)

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.

Marginal (D)

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.

Failure (F)

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.

Assessment Task

Examination

Criterion

Demonstration of understanding the principles and practice of various topics of forensic chemistry.

Excellent (A+, A, A-)

Able to demonstrate excellent understanding of the principles and practice of various topics of forensic chemistry.

Good (B+, B, B-)

Able to describe and explain the principles of various topics of forensic chemistry.

Fair (C+, C, C-)

Able to describe and explain some key principles of selected topics of forensic chemistry.

Marginal (D)

Able to briefly describe isolated principles of selected topics of forensic chemistry.

Failure (F)

Fail to accurately describe and explain relevant principles of any topics of forensic chemistry.

Part III Other Information

Keyword Syllabus

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.

Reading List

Compulsory Readings

Title	
1	Nil

Additional Readings

Title	
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.