

## MASTER OF SCIENCES FORENSIC SCIENCE

### ***INTRODUCTION***

The Department of Chemistry and the Department of Biological Sciences (College of Science) offer a M.Sc. program in **Forensic Science**. Full-time & Part-time students are admitted to this program. English is the language of instruction and research. The aim of this program is to develop analytical and interpersonal skills along with expertise in the specific fields of forensic science. This training will best prepare the graduates in pursuing and succeeding in a career of their choice within the field of forensic science without the need for further training. The program offers two fields of study; Biological Forensic Studies, and Chemical Forensic Studies.

### ***PROGRAM REQUIREMENTS***

The program requirements are:

#### **33 TOTAL COURSE CREDITS**

#### **18 COMPULSORY COURSE**

|          |   |     |
|----------|---|-----|
| 0250-510 | Criminal Procedures and Testimony           | (3) |
| 0409-512 | Forensic Sciences Skills                    | (2) |
| 0409-514 | Trends and Case Studies in Forensic Science | (2) |
| 0409-593 | Project                                     | (3) |
| 0420-513 | Forensic Instrumentation                    | (3) |
| 0510-501 | Biostatistics and Computer in Medicine      | (2) |
| 0560-565 | Forensic Pathology                          | (3) |

#### **6 COMPULSORY I. FORENSIC BIOLOGY (3 credits each)**

|          |                       |
|----------|-----------------------|
| 0497-522 | Forensic Biochemistry |
| 0497-555 | Molecular Forensics   |

#### **9 ELECTIVE COURSES \* (3 credits each)**

|          |  |
|----------|--|
| 0409-516 | Advanced Forensic Microscopy                   |
| 0420-517 | Food Analysis                                  |
| 0493-524 | Forensic Entomology                            |
| 0409-526 | Forensic Microbiology and Biohazards           |
| 1100-570 | Forensic Pharmacokinetics and Pharmacodynamics |

**9 COMPULSORY II. FORENSIC CHEMISTRY (3 credits each)**

|          |                                     |
|----------|-------------------------------------|
| 0420-533 | Forensic Analysis of Glass and Soil |
| 0420-534 | Drug Chemistry                      |
| 0420-535 | Arson, Textile and Paint Analysis   |

**6 ELECTIVE COURSES\* (3 credits each)**

|          |  |
|----------|--|
| 0409-516 | Advanced Forensic Microscopy                 |
| 0420-517 | Food Analysis                                |
| 0420-537 | Surface Analysis for Forensic Investigation  |
| 0420-539 | Environmental Crimes                         |
| 1100-570 | Forensic Pharmokinetics and Pharmacodynamics |

- Graduate students enrolled in the Forensic Biology may also select only one course from the Forensic Chemistry course list. The graduate students will be allowed to take 3 credit hours of 400-level courses from the Minor Forensic Science Program. Students can take these courses only with the approval of the supervisor.

**COURSE DESCRIPTION****0250-510: CRIMINAL PROCEDURES AND TESTIMONY  
CR: 3**

This course aims to examine the relationship between expertise and justice. Judicial authorities are often faced with technical issues that require expertise in specialized disciplines and sciences to assist them in understanding the evidence presented in order to draw objective and rational conclusions. This is concerning whether an event is criminal action or whether a particular person committed the crime. The course will review legal aspects of scientific and technical skills as well as expertise testimony that are often presented in criminal procedures. The approach for this course will be to review legal basis and aspects on the use of scientific and technical evidence and expertise in judicial and criminal procedures to assist in drawing the final verdict with emphasis on the importance of communicating scientific concepts to a lay person. This course will be offered by the Faculty of Law. The course will also cover basic ethical issues related to evidence handling. In addition the course will also explore ethical issues regarding evidence handling, reporting and testimony.

**0409-512: FORENSIC SCIENCES SKILLS  
CR: 2**

This is a general theoretical course that aims to introduce students and train them in basic skills used in Forensic science and Crime scene Analysis. The course will be divided into two main parts, the first dealing with tools in Forensic Biology and the other with tools in Forensic Chemistry including mainly Forensic Microscopy and Chromatography. In addition, the course will provide an insight into the importance of computers and specialized software programs in the areas of both Forensic Biology and Chemistry. The course will also cover and practice quality assurance and report writing procedures and professional ethics emphasizing the importance of efficient communication skills of scientific concepts and testimony will be discussed and practiced. The lectures of this course will be equally shared between the Department of Biological Sciences and the Department of Chemistry. as well as guest lecturers from the department of Forensic Sciences, Ministry of Interior.

**0409-514: TRENDS AND CASE STUDIES IN FORENSIC SCIENCE**  
**CR: 3**

This course will review and discuss current trends and innovative techniques in Forensic Science. The course will also involve student presentations on recent publications (seminar series) and group discussion of news-breaking case reports both local and international and studies involving the use of Forensic Science techniques as well as ethical issues and concerns arising from such cases. (Review of recent peer-reviewed research publications).

**0409-516: ADVANCED FORENSIC MICROSCOPY**  
**CR: 3 PR: 0409-513**

The course is a combined theory and practical course designed to provide an in-depth understanding of the theory and practice of microscopy as it applies to forensic trace evidence. Basic and advanced types of microscopes will be covered including light microscopy, polarized light microscopy, dark field and phase contrast microscopy, fluorescent microscopy, scanning electron microscopy, spectroscopic methods that can be interfaced with the microscope (such x-ray microanalysis) and photomicrography. Students will have the opportunity to analyze different types of trace evidence in the laboratory using a variety of microscopes.

**0409-526: FORENSIC MICROBIOLOGY AND BIOHAZARDS**  
**CR: 3**

This course will introduce methods and techniques used in biothreat detection and identification as well as medical intervention. Many topics will be covered including microbial forensic analysis of trace and unculturable specimens, biological agents, collection and preservation of specimens, decontamination and removal of microbial forensic samples. A practical approach will also be used to demonstrate forensic analysis of bacterial pathogens, procedures for working in biosafety level 3 and 4 environments. The course will also include discussion of case studies such as microbial forensics investigation of the anthrax-letter attacks, viral forensics and food-born outbreaks. Response to biological threats and legal aspects of biosecurity will also be discussed.

**0420-513: FORENSIC INSTRUMENTATION**  
**CR: 3 PR: 0409-512**

Survey of forensic toxicology, with emphasis on analytical and interpretive aspects; analytical methods including, mass spectrometry, LC/MS. GC/MS, FTIR, XRD, XRF spectrometry and RAMAN nontraditional matrices, interpreting the significance of results. An in-depth treatment of classes of commonly encountered drugs of abuse and the analytical methods used in their screening, identification and quantitation will be reviewed. The lectures of this course will be equally shared between the Department of Biological Sciences and the Department of Chemistry.

**0420-517: FOOD ANALYSIS**  
**CR: 3 PR: 0420-513**

This course will examine the principles of chemical methods in food analysis such as oil and fat analysis. The course will also demonstrate the recent developments in the detection and analysis of inorganic poisons in food samples. It will also cover basic techniques in the analysis of food components. This course will be offered by the Biochemistry Program.

**0420-533: FORENSIC ANALYSIS OF GLASS AND SOIL**  
**CR: 3**

This course will examine glass and soils, refractive index measurements, polarized light observations of minerals and X-ray diffraction, XRF analysis of minerals.

**0420-534: DRUG CHEMISTRY**  
**CR: 3 PR: 0409-512**

This course will describe the chemical factors that influence toxicity and toxicity evaluation methods. Chemical and toxicological characteristics of commonly abused drugs and the mechanisms of their action will be reviewed and discussed. Dose response of drugs using micro-chemical and instrumental methods (GC/MS, LC/MS, FTIR), will be explained.

**0420-535: ARSON, TEXTILE AND PAINT ANALYSIS**  
**CR: 3 PR: 0420-513**

This course will examine arson accelerants, textile fibers polymers, plastics and paints and explosives. The course will also cover applications of HPLC to

forensic chemistry analysis. Analysis of spectroscopy and GC/MS will also be covered.

**0420-537: SURFACE ANALYSIS FOR FORENSIC INVESTIGATION**  
**CR: 3 PR: 0420-513**

This course will examine the application of X-ray photoelectron spectroscopy, electron microscopy and energy dispersive spectroscopy in the analysis of evidence collected in crime investigations.

**0420-539: ENVIRONMENTAL CRIMES**  
**CR: 3 PR: 0420-513**

This course will examine the principles, standards and regulations that govern the treatment and disposal of wastes. The course will also review laws and regulations governing the violation of environment and for the protection of the environment.

**0493-524: FORENSIC ENTOMOLOGY**  
**CR: 3 PR: 0409-512**

This course will introduce students and train them on the various methods of how insects can be used in forensic analysis of crime scenes and determination of time of death. The course will concentrate on how insects and related arthropods are used to determine postmortem intervals and estimate time of death in murder and unexplained death investigations. This course will include lectures and practical exercises on the examination and collection of insects, handling and reference storing of insects, taxonomic identification of forensic insects and proper methods of postmortem interval determinations as well as processing a mock crime scene for entomological evidence.

**0497-522: FORENSIC BIOCHEMISTRY**  
**CR: 3 PR: 0420-513**

This course will introduce the principles of immunology, biochemistry, toxicology techniques and their application to forensic analyses. This course will cover the following topics: Analytical Biochemistry, Enzyme Structure and Function Humoral and Cellular Immunology, Functional properties of Antibodies, Activation and Regulation, Immune Response Disorders, Immunology and Serology Laboratory Methods and toxicology. The course will include practical and laboratory techniques commonly used for the examination and identification of body fluids, enzymes and immune assays.

**0497-555: MOLECULAR FORENSICS**  
**CR: 3**

This is a course that aims to introduce students and train them in DNA profiling techniques. The course will be divided into a theoretical part consisting of lectures and group discussion (molecular biology, DNA structure and organization, profiling theory and techniques) and practical part consisting of laboratory practicals (DNA extraction, Realtime PCR, Gene Fragment Analysis, Data Interpretation and analysis). The course will also cover recent topics in DNA profiling techniques, population genetics as well as applications in other organisms.

**0510-501: BIostatistics AND COMPUTER IN MEDICIN**  
**CR: 2**

Sampling data presentation and measures of central tendency and dispersion. Basic probability concepts: the binomial, normal and poison distributions. Sampling distributions mean and t-distribution. Tests of hypothesis: significance about single population mean; independent or dependent mean, single or two proportions. Determination of size of an investigation and Chi-square distribution. Correlation and regressions. Experimental design. Vital and health statistics. Statistical methods in Epidemiology. Types of computers, data representation in computers. Hardware and software of a digital computer. Operating system. Supporting software package (SPSSX). Use of computers in Medicine. Health information system: hospital computer sharing system, drug information system and computer-assisted clinical diagnosis.

**0560-565: FORENSIC PATHOLOGY**  
**CR: 3**

This course aims at familiarizing the candidates with basic knowledge on the major causes of natural and unnatural death, general understanding of the medico-legal systems of death investigation, and the major causes and types of injury. The course is also designed to explain the multidisciplinary nature of forensic investigations with emphasis on the basic organizational structures involved in the forensic practice both locally and internationally, as well as the role, duties and responsibilities of all members of the

forensic investigative team. Ethical issues arising in forensic science practice are also included.

**1100-570: FORENSIC PHARMOKINETICS AND PHARMODYNAMICS**

**CR: 3 PR: 0420-513**

This course will provide knowledge in analytical chemistry, pharmacokinetics and pharmacodynamics which is important for the forensic toxicologist to understand and interpret the analytical results. The course will provide the student with the essential information to allow

development of critical understanding of the role of a forensic toxicology leading to pharmacodynamics and pharmacokinetics of substances of abuse. Focuses will be placed on the detection and quantification of drugs and poisons in biological specimens and the interpretation of the results to the purposes of the law. This course will be offered by the Health Sciences Center.

**0409-593: RESEARCH PROJECT**

**CR: 3**