# Course Contents

## MS Forensic Chemistry

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First Semester

Subject Title / Credit Hours: Introduction to Forensic Science Credit hrs. 3
Course Code: FCHEM-7105 Class: MS Forensic Chemistry
Year: 2013 Semester: I

Forensic Science:

Legal Aspects of Forensic Science:

Subject Title / Credit Hours: Crime Scene Investigation Credit hrs. 3
Course Code: FCHEM-7106 Class: MS Forensic Chemistry
Year: 2011 Semester: I

A Brief History of Forensic Investigation,
Protecting the Evidence: Specialized crime scene procedures, Utilizing correct weapons collection procedures, Collecting traffic crash evidence, Recovering buried bodies and surface skeletons, Applying specialized processing techniques,
Interpreting a Crime Scene and Setting Crime Scene Perimeters
Identifying Physical Evidence: Blood splatter studies, Firearms and Tool Mark, Fingerprinting analysis, Latent Fingerprint Development, Trace Evidence Examination
Reconstruction of a Crime Scene
Types of Evidence
Preparing crime scene related documents: Documenting with personal notes, Writing reports in accepted police format, Diagramming crime scene using computers, Dictating reports, Generating reports using computer software.
Other investigative personnel/agencies: Analyzing all known data to implement plan of action, Implementing the plan of action by coordinating with other investigative personnel/agencies. Receiving evidence for analysis in lab, documenting chain of custody, and evidence security.
Dealing with Witnesses and Family Members
Exercises: Actual cases, accompanied by crime scene photographs for a factual view of techniques, procedures and strategies utilized by crime investigators.
Drug chemist and drug analysis, The work-flow of the drug analysis, classification/ Identification of drugs of abuse, Drug Classes and Controlled Substances Act, Drug Dependence and Addiction, Drugs as Evidence- The Five P’s, The chemistry, origin and identification of important CNS Depressants, Alcohol, Opioids, Cannabinoids, Hallucinogens, CNS Stimulants, CNS Volatile Substances, Predator Drugs, Human Performance Drugs

Analytical Techniques in Forensic Chemistry

Separation Techniques

Elemental Analysis
Introduction, methods and interpretation of Atomic Spectrometry, inductively coupled plasma mass spectrometry, X-ray Fluorescence spectroscopy and their applications in glass, gunshot residue, toxicology and paint.

Molecular Spectroscopy

Mass Spectrometry
Introduction, methods and interpretation of Molecular Mass Spectrometry, Ion Mobility Spectrometry and their applications in explosives and drugs.

Thermal Analysis
Second Semester

Subject Title / Credit Hours Chemistry of Arsons, Explosives and Firearms Credit hrs. 3
Course Code: FCHEM-7204    Class: MS Forensic Chemistry
Year: 2011    Semester: II

The Chemistry of Combustion and Arsons: The Combustion continuum, Four aspects of Combustion, Combustion Deflagration and Detonation, Deflagration and Fires, Arson and fire investigation,
Explosives: Explosives Power, Low and high Explosives and their uses, Field Screening Methods, Laboratory Methods
Firearms and Propellants: Gun shot Residues, Elemental, Inorganic and Organic Analysis

Subject Title / Credit Hours DNA and Serology Credit hrs. 3
Course Code: FCHEM-7205    Class: MS Forensic Chemistry
Year: 2011    Semester: II

DNA Fingerprinting:
The basics of population genetics Allele frequency differences, Inbreeding coefficients, Most common genetic marker systems used in the forensic community: use of VNTR, SNP, and STR markers, DNA analysis methodologies, including the CODIS database, Techniques include extraction protocols, amplification of DNA, methods for labeling DNA, and ultimately construction of a genetic profile. Mitochondrial DNA, Parentage testing, Y-chromosome, and Amelogenin, Most commonly used gender identification locus, Dealing with mixtures and incomplete profiles.

Serology:
Screening Evidence for Biological Stains in Forensic Casework, Theory and methodology used in the examination and identification of body fluid stains, Determination of species origin and sources of false positive and negative, Collection and Storage of Biological Evidence, Chemical and Microscopic Analysis of Biological Stains including blood, semen and saliva, Structure and identification of hair, ABO Grouping and Secretor Status, Biological Markers of Forensic Significance.
Statistics and Quality Control in Forensics
Credit hrs. 3

Course Code: FCHEM-7207
Class: MS Forensic Chemistry
Year: 2012
Semester: II

Statistics in Forensics

Quality Control in Forensics
Introduction to QA/QC, Key Elements of a QA/QC programs in forensic science. Laboratory accreditation, staff accreditation, standard operating procedures, study protocol. Evidence Quality (Chain of Custody, Instrument reliability, Peer review on the evidence Analysis, Quality of results).

Forensic Analysis Lab
Credit hrs. 3

Course Code: FCHEM-7208
Class: MS Forensic Chemistry
Year: 2011
Semester: II

Physical Evidence Lab
Procedures in Fingerprint analysis, latent fingerprint development etc. Microscopic analysis of trace evidence, Spot test and analysis of Arsons and Explosives

Drug Analysis Lab
Presumptive Tests, TLC, GCMS and HPLC of Drugs including Caffeine, Alcohol, Heroin, Morphine, Cocaine, Cannabinoids, Barbiturates, Benzodiazepines

DNA Analysis
Methods of extraction of DNA, DNA Amplification and STR Analysis etc.

Synthesis of nanomaterials with Bottom Up and Top Down approaches. Methods of chemical synthesis: anodization, hydrothermal, convention heating, deposition-precipiation methods and influence of reaction parameters.

Characterization of nanomaterials by X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Brunauer, Emmett and Teller (BET) adsorption method, Thermogravimetric Analysis (TGA), Atomic Absorption Spectroscopy (AAS), Ultraviolet-Visible Spectroscopy (UV-Vis) and Fourier Transform Infrared (FTIR) spectroscopy.

Applications of nanomaterials: Destruction of chemical warfare agents, Decontamination and degradation of hazards materials, Latent fingerprint enhancement, Trace explosive, PCR efficiency, Trace evidence.

Use of Micro X-ray Fluorescence (µXRF), Powder X-ray diffraction (XRD), Atomic force microscope (AFM) and Fourier Transform Infrared (FTIR) in Residue visualization, Questioned documents, Forensic pathology, Bloodstain and Traces.
Third and Fourth Semester

Subject Title / Credit Hours  Internship  Credit hrs. 1
Course Code: FCHEM-7302  Class: MS Forensic Chemistry
Year: 2011  Semester: III & IV

The students shall complete 4-week internship in an organization/Agency related to forensic science. For this purpose the students shall be divided into several groups pertaining to different aspects of the forensic chemistry and shall work in a relevant organization/agency. This course carries a weight of one credit hour. After 4-week internship, a report shall be submitted in proper format. The manuscript shall be evaluated by the external and internal examiners.

Subject Title / Credit Hours  Journal Club  Credit hrs. Nil
Course Code: FCHEM-7301  Class: MS Forensic Chemistry
Year: 2011  Semester: III&IV

Each student shall deliver a seminar on a publication in a reputed international journal of Forensic Science. For qualifying this course every student must attend at least 9 sessions. Each student shall submit a summary of each presentation including the title, name of the author/s and the journal, and get it signed by the teacher in-charge.