Gyanmanjari
Innovative University

Subject: Forensic Chemistry and Toxicology - MSCFS12507

Type of course: Major

Prerequisite: The fundamental principles of general and organic chemistry, including molecular structures and chemical reactions.

Rationale: The Forensic Chemistry and Toxicology syllabus equips students with the skills to analyze substances in criminal investigations, covering key areas of chemistry, biology, and toxicology, while emphasizing analytical techniques, ethics, and legal considerations.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					
CI	T	P	C	Theory Marks		Practical Marks		CA	Total Marks
				ESE	MSE	V	P	ALA	
4	0	0	4	60	30	10	00	50	150

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; SEE - Semester End Evaluation; MSE- Mid Semester Examination; LWA - Lab Work Assessment; V – Viva voce; CCE-Continuous and Comprehensive Evaluation; ALA- Active Learning Activities.

Course Content:

Unit No	Course Content	Hrs	% Weightage
1	**Forensic Chemistry** Introduction, Colour & Spot test, microcrystal tests, inorganic and organic analysis. Analysis of Beverages: alcoholic and nonalcoholic beverages, country made liquor, illicit liquors, detection and estimation of ethanol. Breathe alcohol analyzer. Analysis of trace evidence – cosmetics dyes, pigments, clues of trap cases. Drug of Abuse: classification of drugs, drugs of abuse in sports.	15	25

	Narcotic drugs and psychotropic substances such as cocaine, cannabis, barbiturates, benzodiazepines, amphetamine, opium, designers drugs, NDPS act.		
2	**Analysis of Petroleum Products** Analysis of petrol, kerosene, diesel, lubricants by BIS methods and ASTM methods. Detection of adulterants of Gasoline, Diesel and Engine oils - including parameters like-Flash point, distillation range, density, kinematic -viscosity, smoke point, aniline point. Commodity Act & Petroleum Act. Arson Investigation: chemistry of fire, fire pattern, Extraction of fire accelerants from fire debris - Analysis of fire accelerants by UV visible spectrophotometry, TLC, Head Space GC. Analysis of oils and fats, analysis of gold in cheated cases.	15	25
3	**Forensic Toxicology** Introduction and scope of Forensic Toxicology, classification of poisons, legal aspects of poisoning, types of poisoning. Antidotes, factors modifying action of poisons, LD-50, ED50, sign and symptoms of common poisons. Collection, preservation of postmortem material for poison analysis; Extraction and isolation methods of poisons from postmortem material.	15	25
4	**General studies and Analysis of vegetable poisons** Abrus, Dhatura, Marking nuts, Nux-vomica, Oleander and Aconite. Snake venoms and insect poisons, Irrespirable gases, food poisoning. Insecticides and Metallic Poisons: Types of agriculture posions, organo-phosphorous compound, organocholorinated compound, carbamats, pyrethroids, aluminium phosphite and zinc phosphite. Arsenic, mercury, phosphorous: poisoning charecteristics and analysis.	15	25

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Written Report on Drug Classification** Students will write a report on the classification of drugs of abuse, detailing their chemical properties, effects, and the impact of narcotic drugs and psychotropic substances. The report should include discussion on drugs like cocaine, cannabis, and amphetamines, as well as the NDPS Act and upload it on GMIU web Portal.	10
2	**Analysis Report on Oil, Fats, and Gold in Forensic Cases** Students will be tasked with writing an analysis report on the forensic techniques	10

	used to examine oils, fats, and gold in criminal cases. This will include discussions on how these substances are identified and quantified in investigations involving fraud or chemical contamination and then upload it on GMIU web Portal.	
3	**Practical Scenario on Identifying Poisoning Symptoms** Faculty will provide a practical scenario involving a suspected poisoning case, students will identify and write out the potential symptoms, classify the poison involved, and explain the physiological processes that lead to those symptoms and then upload your observations on GMIU web Portal.	10
4	**Practical Assignment on Detection of Metallic Poisons** Students will be tasked with analyzing a hypothetical case involving mercury, arsenic, or phosphorus poisoning. They will write a detailed procedure on how to extract and detect these metals from biological materials such as blood or tissue samples, focusing on laboratory techniques like atomic absorption spectroscopy or colorimetric methods and then upload it on GMIU web Portal.	10
5	**Discussion on Prevention and Treatment of Insecticide Poisoning** Students will write an essay discussing the prevention, symptoms, and treatment options for poisoning caused by common agricultural insecticides (e.g., pyrethroids, carbamates). They will also address the role of forensic toxicologists in analyzing and identifying such poisons in criminal investigations and then upload the essay on GMIU web Portal.	10
	Total	50

Suggested Specification table with Marks (Theory):75

Distribution of Theory Marks (Revised Bloom's Taxonomy)					
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	25%	30%	30%	10%	5%	00

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course the students should be able to:	
CO1	Examine trace evidence such as cosmetics, dyes, and pigments in forensic investigations.
CO2	Investigate arson cases by analyzing fire accelerants using methods like UV-visible spectrophotometry, TLC, and Head Space GC.
CO3	Employ extraction and isolation techniques for detecting poisons from postmortem material in forensic investigations.
CO4	Understand food poisoning causes and apply forensic techniques for identifying related toxic agents.

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

[1] Forensic Toxicology: Principles and Applications" by **Alan J. H. Wright and David K. L. Chinn.
[2] Introduction to Forensic Chemistry" by James R. Boyd.
[3] Forensic Toxicology: Drug Testing and Analysis" by Richard M. Schlueter.
[4] Forensic Toxicology: A Practical Approach" by Douglas D. H. P. D'Ascoli.
[5] Forensic Toxicology Handbook" edited by James E. M. O'Neill.