Department of Forensic Science

Revised Syllabus of II Year Diploma Program (UG)

Title of Program: Investigative tools and techniques in Forensic Chemistry and Toxicology

Syllabus Structure (UG)

Year	Semester	Course No.	Course Code	Contact Hours	Credits (1Credit=15 H)	Total Marks
2	III	CT III	DFSCT 303	30	2	75
		CL III	DFSC L303	60	2	75
	IV	CT IV	DFSCT 404	30	2	75
		CL IV	DFSCL404	60	2	75
	Annual	CP II	DFSCP202	30	1	50
	Industrial and or Incubation and or Research and or Field Training			30	1	-
		Total		**240**	**10**	**350**

D: Diploma, *: Departmental Code (C: Chemistry, MI: Microbiology, CSE: Computer Science (Entire), FSC: Forensic Science etc)

C: Course, T: Theory, L: Lab (Practical), P: Project

Total No. of Courses: 6 (Theory: 02, Practical: 02, Project: 01)

Theory and Practical: Semester, Project: Annual

Semester III

CT-III: DFSCT 303: Title: Investigative tools and techniques in Forensic Chemistry and Toxicology I (Contact Hrs: 30 Credits: 2)

Learning Objectives:

Students will be able to:

1. Understand the skills, abilities, and qualities of Forensic Chemistry and Toxicology and the various investigative tools and techniques used in Forensic Chemistry and Toxicology.
2. Understand history and developmental changes in Forensic Chemistry and Toxicology.
3. Understand the various types of extraction and detection techniques in forensic chemistry

Unit I: Extraction and separation techniques **(15)**

Solvent extraction, Distillation-- Steam Distillation, Fractional Distillation, Distillation Under Vacuum sweep Co-distillation, Micro-diffusion: Dialysis, Sublimation: Digestion or Chemical Treatment, Microwave Digestion, Absorption, Modern Methods of Extraction: Head Space Technique, Dynamic Headspace, Purge and Trap Technique.

Unit II: Solid Phase Extraction (SPE) **(15)**

Solid Phase Micro Extraction (SPME), Micellar Extraction, Biological Matrices The extraction of metals in biological matrices may be carried out by the following methods-Dry Ashing Method, Wet Digestion or Acid Digestion Method, Fresenius and Babo Method, Selective Chemical Treatment.

Learning Outcomes:

After completion of the unit, Student is able to :

1. Develop skills for handling instruments.
2. Knowledge about analytical techniques used for the analysis of toxicological evidences
3. Students will able to isolate and separate the mixture of poisons, fertilizers, metallic poison in poisoning cases

Reference Books:

1. DFS manual
2. Qualitative and quantitative analysis by Vogel

CL-III: DFSCL303: **Title:** **(Contact Hrs: 60 Credits: 02)**

Learning Objectives:

Students will be able to:

1. Learn about Extraction methods.
2. Learn about Distillation techniques.
3. Learn about digestion method for extraction of poison.
4. Learn about digestion method for extraction of poison.

List of Practical's (15)

1. To extract the given sample by liquid-liquid extraction method.
2. To extract active principle of Yellow oleander by liquid- liquid extraction.
3. To perform the dry ashing method for extraction of toxins.
4. To extract Volatile Poisons by neutral and acid distillation.
5. To extract Volatile Poisons by alkaline distillation.
6. To perform the wet digestion method for extraction of poison.

7. To prepare the chromatographic plate by using silica gel G.
8. To separate the given component by TLC.
9. To separate metal ions by thin layer chromatography.
10. To detect the plant poison (Ricinus communis) by TLC.
11. To detect the plant poison (Abrus Precatorious) by TLC.
12. To detect the plant poison (Atropa Belladona) by TLC.
13. To detect the O.P (Malathion, Parathion) by TLC.
14. To detect the O.P (Dichlorovas) by TLC
15. To detect O.C (Methoxychlor, DDT) by TLC.

Learning Outcomes:

After completion of the unit, Student is able to:

1. Perform the types of extraction for detection of elements.
2. Detect types of Poisons by using different extraction methods, TLC techniques.

Reference Books:

1. DFS manual
2. Qualitative and quantitative analysis by Vogel

Semester IV

CT-IV: DFSCT 404: Title: Investigative tools and techniques in Forensic Chemistry and Toxicology II (Contact Hrs: 30 Credits: 2)

Learning Objectives:

Students will be able to:

1. Understand the importance of analysis of Toxicological evidences.
2. Learn different techniques of analysis of toxicological evidences.

Unit I: Chromatography technique (15)

Chromatography: Introduction to Chromatography , Definition of Chromatography, Types of chromatography, Theoretical principle underlying chromatographic techniques, theories of chromatography, Development of Chromatogram, Qualitative and quantitative Analysis by chromatography. Paper chromatography (Introduction, Principle, Migration parameters, Types of paper chromatography, Experimental details for Qualitative analysis, Experimental details for Quantitative analysis, Forensic application and importance) TLC (Introduction, Superiority of TLC over other chromatographic techniques, Experimental technique, Application of TLC, Limitation of TLC ,Forensic application and importance) HPLC (Introduction, Principle, Instrumentation, Apparatus and material, Column efficiency and selectivity, Comparison of gas chromatography and HPLC, HPLC adsorption chromatography , HPLC partition chromatography, Forensic application and importance) GC (Introduction, Principle, Instrumentation, Evaluation, Retention volume, Resolution, Branches of Gas chromatography, Application, Forensic application and importance)

Unit II: Spectroscopic technique **(15)**

Ultraviolet spectroscopy (Introduction, Origin and theory of Ultraviolet spectra, Types, of transition of Inorganic molecule, Types of transition of organic molecule, The shape of UV absorption, curve, Transition , probability, Chromophore and related terms, Effect of Conjugation, Solvent effect, Choice of Solvent, Woodward Fischer rule, Instrumentation, Application)

Mass spectrometry (Introduction, Theory, Components of mass Spectrometer, Recording of mass spectrogram, Resolution of mass spectrometer, Types of ions produced in mass Spectrometer, General rule for interpretation of mass Spectra, Example of Mass spectra, Quantitative analysis ,Application.)

Emission spectroscopy (Introduction, Theory, Instrumentation, Spectrographs, Application of Spectrographs, Application of Emission Spectroscopy, Advantages and disadvantages.)

Learning Outcomes:

After completion of the unit, Student is able to:

1. Learn about Chromatographic techniques and study its applications.
2. Learn about Spectroscopic techniques, its types & its applications.

Reference Books:

1. Instrumental analysis: Skoog
2. Instrumental analysis: Anand and chatwal
3. Instrumental analysis: Pavia
4. Elementary organic spectroscopy: Y.R Sharma.

CL-IV: DFSCL404: **Title (Practical):** **(Contact Hrs: 60 Credits: 02)**

Learning Objectives:

Students will be able to:

1. Understand & study the detection techniques of Poisons.
2. Learn & study about Separation techniques of Chromatography.
3. Learn & understand HPLC techniques & its applications.
4. Study the UV visible Spectrophotometer & its Applications.

List of Practical's (15)

1. To detect O.C (Dieldrin , Chloradane) by TLC.
2. To detect Carbamate (carbofuran)by TLC.
3. To detect Carbamate (carbaryl) by TLC.
4. To measure absorbance of given solution at different concentration by using UV visible
5. Spectrophotometer.

6. To detect the plant poison (Ricinus communis) by Paper Chromatography.
7. To detect the plant poison (Abrus Precatorious) by Paper Chromatography
8. To detect the plant poison (Atropa Belladona) by Paper Chromatographhy.
9. To perform the thin layer chromatography to separate the plant poison.
10. To extract and detect the abrin from Abrus precatorsious by Uv spectroscopy.
11. To detect the plant poison Yellow oleander by UV-visible spectrophotometer.
12. To separate metal ions by paper chromatography.
13. To study UV- visible spectrophotometer.
14. To study paper chromatography.
15. To study HPLC.
16. To study Gas Chromatography

Learning Outcomes:

After completion of the unit, Student is able to :

1. To learn & understand TLC techniques & its use.
2. To learn & understand about UV, HPLC, Gas Chromatography instrumentation & its applications in Forensic Science laboratory.

Reference Books:

1. Instrumental analysis: Skoog
2. Instrumental analysis: Anand and chatwal
3. Instrumental analysis: Pavia
4. Elementary organic spectroscopy: Y.R Sharma.

CP-II: DFSCP202: Project
(Contact Hrs. 60, Credits: 2)

Industrial and or Incubation and or Research and or Field Training
(Contact Hrs. 60, Credits: 2)

BOS Sub-Committee		Expert Committee
1. Miss Payal Dahotre	**Chairman**	1. Name of Academic Expert : Mr. Abhilash Sukhdive
2. Mr. Gaurav Varade	**Member**	2. Name of Industrial Expert : Mr. Arun Kevad