

## Minutes of 6<sup>th</sup> Board of Studies Meeting

**Program: B.Sc. Forensic Science (4 years) and B.Sc-M.Sc. Forensic Science (5 Years)**

Date: 18.06.2022

Venue: CUTM, Andhra Pradesh

### **Agenda:**

1. Discussion on Course Curriculum for the program B.Sc. Forensic Science
2. Introduction of Course Curriculum for the program B.Sc-M.Sc Forensic Science.
3. Students has to attain 222 credits by the end of 5 Years (10 semesters) for B.Sc-M.Sc Forensic Science.

### **Feedback received from stakeholders (Industry/Alumni/Parent/Student/Faculty);**

Feedback received from Expert

Feedback received from Faculty

### **Discussion and Resolutions taken (Syllabus/Evaluation systems etc.);**

The BOS meeting for the session 2022-2023 was held at CUTM, Andhra Pradesh campus on 18.06.2022

- **For B.Sc. programme:** B.Sc. CBCS courses are modified for 3 years ( 1<sup>st</sup> to 6<sup>th</sup> semester) to 4 Years (1 to 8 Semesters) Course. All core papers and elective papers are as per below attachment. Total credits are 160.
- **For B.Sc-M.Sc. programme:** B.Sc-M.Sc Forensic Science CBCS courses are discussed for 1<sup>st</sup> to 10<sup>th</sup> semesters. All core papers, elective papers were adapted from CUTM, BBSR campus and approved and
- B.Sc-M.Sc Forensic Science course is introduced from the current academic year 2022-23.

### **Key Remarks:**

- Type of curriculum: B. Sc. CBCS, B. Sc-M.SC Curriculum
- Syllabus designed and finalized for B.Sc, B.Sc-M.Sc Forensic Science
- 25% of syllabus modified in complete program for existing B.Sc. Forensic Science batch.
- New syllabus designed for B.Sc-M.Sc. Forensic Science 2022-23 batch
- **Type of curriculum:**
  - B.Sc. Forensic Science: CBCS
  - B.Sc-M.Sc Forensic Science: CBCS

## List of new courses added

- B.Sc. Forensic Science (4 Years)

Centurion University of Technology and Management, Vizianagaram, Andhra Pradesh & Bhubaneswar, Odisha								
Program Structure								
Bachelor of Forensic Science (B.Sc.) – 04 Year								
Semester	Total Subject	Course Code	Name of the Subject	Category	Credit	Total Credit	Contact Hour / Week	Total Contact Hour / Week
I	4	CUTM	Fundamentals of Forensic Science	Core	4-2-0 (06)	18	8	22
		CUTM	Introduction to Crime Scene	Core	4-2-0 (06)		8	
		CUTM	DSE	DSE	3-0-1 (04)		4	
		CUTM1693	Proficiency in English	AECC	1-1-0 (02)		2	
II	4	CUTM	Forensic Related Laws	Core	3-0-2 (05)	18	5	21
		CUTM	Forensic Psychology	Core	3-1-1 (05)		6	
		CUTM	GSE	GSE	4-2-0 (06)		8	
		CUTM1674	Environmental Science	AECC	0-0-2 (02)		2	
III	5	CUTM	Fingerprint Science & Other Impressions	Core	3-2-0 (05)	22	7	28
		CUTM	Instrumental Methods of Analysis	Core	3-2-0 (05)		7	
		CUTM	GSE	GSE	4-2-0 (06)		8	
		CUTM	DSE	DSE	3-0-1 (04)		4	
IV	5	CUTM	Human Values & Professional Ethics	SEC	1-0-1 (02)	23	2	31
		CUTM	Forensic Chemistry	Core	3-2-0 (05)		7	
		CUTM	Forensic Document Examination	Core	3-2-0 (05)		7	
		CUTM	Forensic Botany, Serology & DNA Fingerprinting	Core	3-2-0 (05)		7	
		CUTM	GSE	GSE	4-2-0 (06)		8	
V	6	CUTM	Personality Development & Soft Skills	SEC	1-0-1 (02)	25	2	33
		CUTM	Forensic Ballistics	Core	3-2-0 (05)		7	
		CUTM	Forensic Physics	Core	3-2-0 (05)		7	
		CUTM	Forensic Toxicology	Core	3-2-0 (05)		7	
		CUTM	GSE	GSE	4-2-0 (06)		8	
		CUTM	DSE	DSE	3-0-1 (04)		4	
VI	3	CUTM	Forensic Medicine	Core	3-2-0 (05)	14	7	18
		CUTM	Digital and Cyber Forensics	Core	3-2-0 (05)		7	
		CUTM	DSE	DSE	3-0-1 (04)		4	
VII	1	CUTM	Internship	Internship	20	20	20	20
VIII	2	CUTM	Project	Project	20	20	20	22
		CUTM	Research Methodology & Scientific Writing	VACC	0		2	
<b>Total</b>		<b>Credit - T-75, P-34, I-20 &amp; Pj-31</b>				<b>Total Credit - 160</b>	<b>Total Contact Hour - 195</b>	
<b>Total Subjects: - Core-14, GSE-04, DSE-04, AECC-02, SEC-02, VACC-01 and Internship-01</b>								
<b>Credit Distribution: - Core-72, GSE-24, DSE-16, AECC-04, SEC-04, VACC-00, Internship-20 &amp; Project-20</b>								
<b>Note: Students will study new subjects from first semester onwards</b>								

## 1. Newly Introduced syllabus for B.Sc-M.Sc Forensic Science (Total Credits: 160)

Semester I							
Sr. No.	Subject Code	Subject Name	L	T	P	C	TCH
1	CUTM2450	Introduction to Forensic Science	3	0	0	3	3
2	CUTM2451	Crime Scene Management & Criminal	3	0	0	3	3
3	CUTM2452	Crime and Society	3	0	0	3	3
4	CUTM2453	General Physics-I	3	0	0	3	3
5	CUTM2454	General Chemistry-I	3	0	0	3	3
6	CUTM2455	General Biology-I	3	0	0	3	3
7		Skill Based Elective - I	2	0	0	2	2
8	CUTM2456	Practical I	0	0	8	4	8
<b>Total Credit &amp; Total</b>						<b>24</b>	<b>28</b>

Semester II							
Sr. No.	Subject Code	Subject Name	L	T	P	C	TCH
1	CUTM2457	Criminal and Evidence Law	3	0	0	3	3
2	CUTM2458	Fingerprint Science	3	0	0	3	3
3	CUTM2459	Questioned Document	3	0	0	3	3
4	CUTM2460	General Physics-II	3	0	0	3	3
5	CUTM2461	General Chemistry-II	3	0	0	3	3
6	CUTM2462	General Biology-II	3	0	0	3	3
7		Skill Based Elective - II	2	0	0	2	2
8	CUTM2463	Practical II	0	0	8	4	8
<b>Total Credit &amp; Total</b>						<b>24</b>	<b>28</b>

Semester III							
Sr. No.	Subject Code	Subject Name	L	T	P	C	TCH
1.	CUTM2464	Forensic Psychology	3	0	0	3	3
2.	CUTM2465	Forensic Chemistry-I	3	0	0	3	3
3.	CUTM2466	Forensic Physics-1	3	0	0	3	3
4.	CUTM2467	Basics of Computer &	3	0	0	3	3
5.		Core Elective - I (From Elective Group A)	2	0	0	2	2
6.		Skill Based Elective - III	2	0	0	2	2
7.	CUTM2468	Practical III	0	0	8	4	8

### List of Core Elective – Group A (For Semester 3, 4 and 5)

Sl. No. 1 to 4 can be selected in ODD SEMESTER while Sl. No. 5 to 6 can be selected in EVEN SEMESTER

Sr. No.	Group A	Subject Code	Subject Name	L	T	P	Credits
1	Group A	CUTM247	Anti-dope Forensics	2	0	0	2
2	Group A		Incident Response and Management	2	0	0	2
3	Group A		Multimedia Forensics	2	0	0	2
4	Group A		Forensic Statistics	2	0	0	2
5	Group A		Accident Investigations	2	0	0	2
6	Group A		Immunology and Immunological Techniques	2	0	0	2

### List of Core Elective – Group B (For Semester 6 and 7)

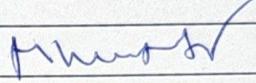
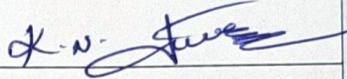
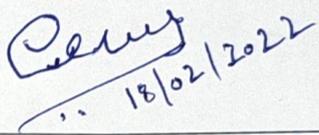
Sl. No. 1 to 3 can be selected in EVEN SEMESTER while Sl. No. 4 to 6 can be selected in ODD SEMESTER

Sl. No.	Group B	Code	Course Title	L	T	P	Credits
1	Group B		Clinical Toxicology	2	0	0	2
2	Group B		Forensic DNA Analysis	2	0	0	2
3	Group B		Forensic Engineering	2	0	0	2
4	Group B		Applied Cryptography	2	0	0	2
5	Group B		Data Science & Artificial	2	0	0	2
6	Group B		Forensic Photography	2	0	0	2

### List of Skill Based Elective – (From Semester 1 to 4)

Sl. No.	Code	Course Title	L	T	P	Credits
1	CUTM2469	Communication Skills	2	0	0	2
2	CUTM2470	English	2	0	0	2
3	CUTM2471	Yoga and its benefits-I	2	0	0	2
4	CUTM2472	Yoga and its benefits-II	2	0	0	2

List of Members present in 7<sup>th</sup> BoS meeting

Sl. No	Name of the Member	Designation	Role of Members	Signature
1	Prof. P K Mohanty	Vice Chancellor, CUTM AP	INTERNAL	
2	Dr P Pallavi	Registrar, CUTM AP	INTERNAL	
3	Dr. M L N Acharyulu	Dea, SoPAHS	INTERNAL	
4	Dr. Naga Jogayya K	HoD, School of Forensic Science, CUTM AP	INTERNAL	
5	Advot. K. Chinna Reddy	Ex. Chief Staff of Welfare Institute, Kharagpur, West Bengal. Advocate, Vizianagaram District Court.	External	 18/02/2022
6	Ms. V Pravallika	Assistant professor, Dept. of Forensic Science	INTERNAL	

# COURSE STRUCTURE AND SYLLABI

## B.Sc. - M.Sc. Forensic Science Integrated (5 years) Program

2023-24 Batch



**Centurion**  
**UNIVERSITY**

*Shaping Lives...*  
*Empowering Communities...*

**SCHOOL OF FORENSIC SCIENCES**  
**CENTURION UNIVERSITY OF TECHNOLOGY & MANAGEMENT**  
**ANDHRA PRADESH-535003, India**

Web Site: - [www.cutmap.ac.in](http://www.cutmap.ac.in)

**CENTURION UNIVERSITY OF TECHNOLOGY AND MANAGEMENT,  
ANDHRA PRADESH**

**CERTIFICATE**



**Centurion**  
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*Shaping Lives...  
Empowering Communities...*

**This is to certify that the syllabus of the Programme B.Sc. - M.Sc. Forensic Science Integrated (5 years) of the School of Forensic Sciences is approved in the \_\_\_\_\_ Academic Council Meeting held on \_\_\_\_\_.**

**Dean  
School of Forensic Sciences  
CUTM, Andhra Pradesh**



**Centurion**  
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*Shaping Lives...  
Empowering Communities...*

## PREFACE

Forensic science plays a role in criminal and civil law. Forensic scientists help determine cause of death, identify perpetrators of crimes, identify bodily remains, track the electronic transfer of money, investigate internet fraud and identity theft, and reconstruct vehicular accidents. Laws regulate the safety and quality of our food and water, the potency of medications, motor vehicle emissions, and pesticides used on crops. It would be impossible to monitor compliance with laws if not for accurate laboratory testing. Forensic science is becoming increasingly broad in its application to law and criminal investigations. Crime laboratory analyses are only relevant if the specimens received are properly collected, transported and preserved. Crime scene evidence is often collected and transported by trained police officers.

### **SCOPE OF FORENSIC SCIENCE**

Most of the Forensic Science candidates are hired by government agencies such as Central Bureau of Investigation or Information Bureau. Many legal firms and private investigators also hire Forensic Experts to strengthen their investigations and cases. Teaching is also a lucrative option for Forensic Science experts. There is a lot of demand for highly qualified and trained Forensic Science experts in India.

We are offering *Bachelors of Science and Masters of Science in Forensic Science* with a specialization of Forensic Chemistry & Toxicology, Forensic Biotechnology, Fingerprints & Question Documents, Cyber Forensics and Forensic Physics & Ballistics. B.Sc-M.Sc Forensic Science is a 5 years course, students has to complete 316 credits within 10 semesters. In each semester, student has to attend for Internal Assessment and External Assessment for each component of subject (Theory, Practice and Project combinations).

**COURSE CERTIFICATE:** After Completion of the course, Student will get a degree as “*Bachelors of Science and Masters of Science in Forensic Science (Integrated)*”

### **EVALUATION CRITERIA OF INTERNAL & EXTERNAL ASSESSMENTS**

**i. End semester theory examinations:**

- a. Duration – 3 hrs
- b. Full Mark – 100. During result processing, it will be proportionately added. Student has to get 30% of marks to be passed.

**ii. Internal assessments:**

**Continuous Assessment** - Includes Individual/Group presentation-10 Marks

Assignments-10 Marks

Learning Records-10 Marks

**Mid-semester examinations**-20 Marks descriptive type of 1 hour duration

### **ANNEXURE-I**

	Theory			Practice		Project		Full Mark	Result
	Full Mark								
	50	100	150	50	50	50	50		
	CA	ESTH	CA+ESTH	IPR	EPR	IPRO	EPRO		
<b>Pass Criteria</b>	<b>30%</b>	<b>30%</b>	<b>40%</b>	<b>50%</b>	<b>50%</b>	<b>50%</b>	<b>50%</b>		
<b>Subject Type</b>									
Theory	15	30	45					150(∞100)	Fail
Theory+Practice	15	30	45	25	25			250(∞100)	Fail
TPP	15	30	45	25	25	25	25	350(∞100)	Fail
Theory+Project	15	30	45			25	25	250(∞100)	Fail
Theory	20	40	60					150(∞100)	Pass
Theory+Practice	35	29	64	25	25			250(∞100)	Fail
TPP	10	50	60	25	25	25	25	350(∞100)	Fail
Theory+Project	15	45	60			25	25	250(∞100)	Pass
Practice				25	25			100(∞100)	Pass
Project						25	25	100(∞100)	Pass
Workshop								100	Pass

\*CA- Continuous Assessment

\*ESTH-End Semester Theory

\*IPR- Internal Practice

\*EPR- External Practice

\*IPRO- Internal Project

\*EPRO-External Project

## **OVERVIEW**

In majority of serious crime cases, hi-tech measures are being adopted by perpetrators of crime. The counter measures have to be more sophisticated to surpass them. This calls for strengthening the foundations of forensic science at national level. It is with this aim that we wish to initiate a B.Sc. – M.Sc. Forensic Science Integrated (5 years) program in Forensic Science.

## **PROGRAM OBJECTIVES**

Program objectives for B.Sc. M.Sc. Forensic Science Integrated Program includes:

1. To make the students conversant with the causes and consequences of crime.
2. To familiarize the students with various divisions of forensic science.
3. To get the students acquainted with the structure and functioning of the Criminal Justice System and Forensic Science Laboratories.
4. To develop in students, skill sets such as crime scene management and analysis of forensic science evidence.
5. To prepare the students to take up a career in the field of Criminal Justice and Forensic Science.

## **PROGRAM OUTCOMES (PO's)**

PO (Programme Outcomes): B.Sc. – M.Sc. Forensic Science Integrated

<b>POs</b>	<b>POs Outcomes</b>
<b>PO1</b>	Discipline specific knowledge: Demonstrate a deep understanding of the fundamental principles and concepts of forensic science, including fingerprints, Ballistics, Questioned Documents, Forensic biology, forensic chemistry & toxicology etc.
<b>PO2</b>	Laboratory Proficiency in Forensic Techniques: Develop hands-on competence in operating advanced forensic laboratory instruments, conducting analyses, and interpreting results accurately.
<b>PO3</b>	Interdisciplinary Integration: Demonstrate the ability to synthesize knowledge from various disciplines such as biology, chemistry, law, and psychology to address multifaceted forensic challenges.

<b>P04</b>	Individual and team work: Function affectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings in the field of forensic Science.
<b>P05</b>	Expertise in Crime Scene Examination: Achieve proficiency in the systematic collection, preservation, and documentation of physical evidence at crime scenes, adhering to established protocols.
<b>P06</b>	Ethics: Demonstrate ethical and professional conduct in all aspects of their work, including respect for privacy and confidentiality, adherence to scientific standards and protocols, and awareness of the social and legal implications of forensic evidence.
<b>P07</b>	Effective Communication: Comprehend concepts, frameworks and inventions through various learning methods and effectively communicate them to others through oral and written means.
<b>P08</b>	Legal and Psychological Understanding: Incorporate knowledge of the legal aspects of forensic science, including the rules of evidence and relevant case law, as well as an understanding of the basic principles of psychology to better analyze behavioral aspects in forensic cases.
<b>P09</b>	Forensic Sciences for society and criminal justice setup: Understand and analyze the impact of forensic solutions to the society and criminal justice setup.
<b>P010</b>	Research Skills: Acquire research skills to stay updated with advancements in forensic science and contribute to the field through independent research projects.
<b>P011</b>	Modern tool usage: Understand, select, and apply appropriate techniques, resources, and modern scientific techniques with understanding of its merits and limitations.
<b>P012</b>	Life- long learning: Recognize the need for lifelong learning in the broadest context of challenges and recent advances in the field of forensic science.

## **PROGRAM SPECIFIC OUTCOMES (PSO's)**

PSO-Program Specific Outcomes- B.Sc. -M.Sc. Forensic Science Integrated

**PSO1:** To develop the undergraduate level students with the specific knowledge of handling different types of evidences and their examinations.

**PSO2:** To develop the laboratory skills in examining different types of evidences found at the crime scene.

**PSO3:** To exhibit professional efficiency as scientist, academicians and researchers.



## **TEACHING SCHEME**

<b>Semester I</b>							
<b>Sr.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>TCH</b>
1	CUTM2450	Introduction to Forensic Science	3	0	0	3	3
2	CUTM2451	Crime Scene Management	3	0	0	3	3
3	CUTM2452	Crime and Society	3	0	0	3	3
4	CUTM2453	General Physics-I	3	0	0	3	3
5	CUTM2454	General Chemistry-I	3	0	0	3	3
6	CUTM2455	General Biology-I	3	0	0	3	3
7	CUTM2469	Skill Based Elective -I	2	0	0	2	2
8	CUTM2456	Practical I	0	0	8	4	8
<b>Total Credit &amp; Total Credit Hours</b>						<b>24</b>	<b>28</b>
<b>Semester II</b>							
<b>Sr.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>TCH</b>
1	CUTM2457	Criminal and Evidence Law	3	0	0	3	3
2	CUTM2458	Fingerprint Science	3	0	0	3	3
3	CUTM2459	Questioned Document	3	0	0	3	3
4	CUTM2460	General Physics-II	3	0	0	3	3
5	CUTM2461	General Chemistry-II	3	0	0	3	3
6	CUTM2462	General Biology-II	3	0	0	3	3
7	CUTM2470	Skill Based Elective - II	2	0	0	2	2
8	CUTM2463	Practical - II	0	0	8	4	8
<b>Total Credit &amp; Total Credit Hours</b>						<b>24</b>	<b>28</b>
<b>Semester III</b>							
<b>Sr. No</b>	<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>TCH</b>
1	CUTM2464	Forensic Psychology	3	0	0	3	3
2	CUTM2465	Forensic Chemistry-I	3	0	0	3	3
3	CUTM2466	Forensic Physics-1	3	0	0	3	3
4	CUTM2467	Basics of Computer & Biometrics	3	0	0	3	3
5	CUTM2473	Core Elective-I <b>(From Elective Group A)</b>	2	0	0	2	2
7	CUTM2471	Skill Based Elective - III	2	0	0	2	2
8	CUTM2468	Practical III	0	0	8	4	8
<b>Total Credit &amp; Total Credit Hours</b>						<b>20</b>	<b>24</b>



Semester IV							
Sr. No.	Course Code	Course Name	L	T	P	C	TCH
1	CUTM2899	Forensic Medicine	3	0	0	3	3
2	CUTM2900	Fundamentals of Forensic Toxicology	3	0	0	3	3
3	CUTM2901	Forensic Ballistics	3	0	0	3	3
4	CUTM2902	Forensic Biology and Wildlife Forensics	3	0	0	3	3
5	CUTM2909	Core Elective-II (From Elective GroupA)	2	0	0	2	2
6	CUTM2472	Skill based Elective -IV	2	0	0	2	2
7	CUTM2903	Practical IV	0	0	8	4	8
<b>Total Credit &amp; Total Credit Hours</b>						<b>20</b>	<b>24</b>
Semester V							
Sr. No.	Course Code	Course Name	L	T	P	C	TCH
1	CUTM2904	Forensic Anthropology	3	1	0	4	4
2	CUTM2905	Digital Forensics and Cyber Law	3	1	0	4	4
3	CUTM2906	Forensic Chemistry-II	3	1	0	4	4
4	CUTM2907	Instrumental Techniques-I	3	1	0	4	4
5	CUTM2910	Core Elective-III (From Elective GroupA)	2	0	0	2	2
6	CUTM2908	Practical-V	0	0	8	4	8
<b>Total Credit &amp; Total Credit Hours</b>						<b>22</b>	<b>26</b>
Semester VI							
Sr. No.	Course Code	Course Name	L	T	P	C	TCH
1	CUTM2914	Forensic Physics-II	3	1	0	4	4
2	CUTM2915	Information Security Audit	3	1	0	4	4
3	CUTM2916	Basics of Immunology and	3	1	0	4	4
4	CUTM2917	Instrumental Techniques-II	3	1	0	4	4
5	CUTM2943	Core Elective-IV (From Elective Group B)	2	0	0	2	2
6	CUTM2918	Practical-VI	0	0	8	4	8
<b>Total Credit&amp; Total Credit Hours</b>						<b>22</b>	<b>26</b>
SEMESTER-VII							
Specialization-I: Forensic Physics and Ballistics							
Sr. No.	Course Code	Course Name	L	T	P	C	TCH
1	CUTM2919	Lasers & Spectroscopy	3	1	0	4	4
2	CUTM2920	Advancement in Forensic Ballistics and Armour	3	1	0	4	4



3	CUTM2921	Audio and Video Analysis	3	1	0	4	4
4	CUTM2939	Research Methodology	3	1	0	4	4
5	CUTM2944	Core Elective-V <b>(From Elective Group B)</b>	2	0	0	2	2
6	CUTM2922	Practical-VII	0	0	8	4	8
<b>Total Credit &amp; Total Credit Hours</b>						<b>22</b>	<b>26</b>
<b>Specialization-II: Fingerprints and Questioned Documents</b>							
<b>Sr. No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>TCH</b>
1	CUTM2923	Advanced Fingerprint Technologies	3	1	0	4	4
2	CUTM2924	Advances in Forensic Document Examination	3	1	0	4	4
3	CUTM2925	Forensic Accounting and Auditing	3	1	0	4	4
4	CUTM2939	Research Methodology	3	1	0	4	4
5	CUTM2944	Core Elective-V <b>(From Elective Group B)</b>	2	0	0	2	2
6	CUTM2926	Practical-VII	0	0	8	4	8
<b>Total Credit &amp; Total Credit Hours</b>						<b>22</b>	<b>26</b>
<b>Specialization-III: Forensic Chemistry and Toxicology</b>							
<b>Sr. No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>TCH</b>
1	CUTM2927	Forensic Pharmacy and Pharmacology of Controlled Drugs	3	1	0	4	4
2	CUTM2928	Advanced Forensic Toxicology	3	1	0	4	4
3	CUTM2929	Modern and Applied Analytical Forensic Chemistry	3	1	0	4	4
4	CUTM2939	Research Methodology	3	1	0	4	4
5	CUTM2944	Core Elective-V <b>(From Elective Group B)</b>	2	0	0	2	2
6	CUTM2930	Practical-VII	0	0	8	4	8
<b>Total Credit &amp; Total Credit Hours</b>						<b>22</b>	<b>26</b>
<b>Specialization-IV: Forensic Biology and Biotechnology</b>							
<b>Sr. No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>TCH</b>
1	CUTM2931	Fundamentals of Biological Chemistry	3	1	0	4	4
2	CUTM2932	Molecular Biology and rDNA Technology	3	1	0	4	4
3	CUTM2933	Forensics Genomics and DNA Profiling	3	1	0	4	4
4	CUTM2939	Research Methodology	3	1	0	4	4
5	CUTM2944	Core Elective-V <b>(From Elective Group B)</b>	2	0	0	2	2
6	CUTM2934	Practical-VII	0	0	8	4	8
<b>Total Credit &amp; Total Credit Hours</b>						<b>22</b>	<b>26</b>



Specialization-V: Cyber Forensic							
Sr. No.	Course Code	Course Name	L	T	P	C	TCH
1	CUTM2935	Advanced Digital Forensics	3	1	0	4	4
2	CUTM2936	Mobile and Network Forensics	3	1	0	4	4
3	CUTM2937	Vulnerability Assessment and Penetration Testing	3	1	0	4	4
4	CUTM2939	Research Methodology	3	1	0	4	4
5	CUTM2944	Core Elective-V (From Elective Group B)	2	0	0	2	2
6	CUTM2938	Practical-VII	0	0	8	4	8
<b>Total Credit &amp; Total Credit Hours</b>						<b>22</b>	<b>26</b>
Semester-VIII							
Sr.No.	Course Code	Course Name	L	T	P	C	TCH
1	CUTM2946	Internship at Forensic Science Laboratory	0	0	48	24	48
<b>Total Credit &amp; Total Credit Hours</b>						<b>24</b>	<b>48</b>
Semester-IX							
Sr.No.	Course Code	Course Name	L	T	P	C	TCH
1	CUTM2947	Ethics in Science Education and Research	2	0	0	2	4
2	CUTM2948	Open Seminar and Comprehensive Viva-I	0	0	6	3	6
3	CUTM2949	M.Sc. Project-To Be continued in Semester X	0	0	24	12	24
<b>Total Credit &amp; Total Credit Hours</b>						<b>17</b>	<b>34</b>
Semester-X							
Sr.No.	Course Code	Course Name	L	T	P	C	TCH
1	CUTM2950	Open Seminar and Comprehensive Viva -II	0	0	6	3	4
2	CUTM2951	M.Sc. Project	0	0	48	24	48
<b>Total Credit &amp; Total Credit Hours</b>						<b>27</b>	<b>52</b>



ELECTIVES							
List of Core Elective-Group A (For Semester III, IV and V)							
Sr. No.	Course Code	Course Name	L	T	P	C	Group
1	CUTM2473	Anti-dope Forensics	2	0	0	2	A
2	CUTM2909	Incident Response and Management	2	0	0	2	A
3	CUTM2910	Multimedia Forensics	2	0	0	2	A
4	CUTM2911	Forensic Statistics	2	0	0	2	A
5	CUTM2912	Accident Investigations	2	0	0	2	A
6	CUTM2913	Immunology and Immunological Techniques	2	0	0	2	A
List of Core Elective-Group B (For Semester VI and VII)							
Sr. No.	Course Code	Course Name	L	T	P	C	Group
1	CUTM2940	Clinical Toxicology	2	0	0	2	B
2	CUTM2941	Forensic DNA Analysis	2	0	0	2	B
3	CUTM2942	Forensic Engineering	2	0	0	2	B
4	CUTM2943	Applied Cryptography	2	0	0	2	B
5	CUTM2944	Data Science & Artificial Intelligence	2	0	0	2	B
6	CUTM2945	Forensic Photography	2	0	0	2	B
<b>Note</b>	<b>Core Elective Sl. No. 1 to 3 can be selected in ODD SEMESTER while Sl. No. 4 and 5 can be selected in EVEN SEMESTER</b>						
List of Skill Based Elective- (From Semester I to IV)							
Sl. No.	Code	Course Title	L	T	P	C	
1	CUTM2469	Communication Skills	2	0	0	2	
2	CUTM2470	English	2	0	0	2	
3	CUTM2471	Yoga and its benefits -I	2	0	0	2	
4	CUTM2472	Yoga and its benefits- II	2	0	0	2	
<b>Total Credits: 222</b>							
<b>L: Lecture T: Tutorial P: Practical TCH: Total Credit Hours</b>							
1C= 1 Hour of Lecture/ Tutorial and 1C= 2Hours of Practical/ Project.							



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# COURSE OBJECTIVES AND COURSE OUTCOMES



## SEMESTER I

Code	Subject Name	Course Objectives	Course Outcomes
CUTM2450	Introduction to Forensic Science	<ol style="list-style-type: none"> <li>1. To know about the development and understand the basic principles of Forensic science.</li> <li>2. To understand about the organizational setup of Forensic Science, various academic institutions and government agencies involved in criminal investigations.</li> <li>3. To analyze the functional aspects of forensicscience.</li> </ol>	<ul style="list-style-type: none"> <li>• Able to explain the development of ForensicScience in India.</li> </ul>
			<ul style="list-style-type: none"> <li>• To demonstrate the scope, need and application of various disciplines of forensic science in the human society.</li> </ul>
			<ul style="list-style-type: none"> <li>• To apply the fundamental principles of forensic science in criminal investigations.</li> </ul>
			<ul style="list-style-type: none"> <li>• Able to identify the working of the forensic establishments in India and abroad.</li> </ul>
			<ul style="list-style-type: none"> <li>• To illustrate the organizational setup in a forensic science laboratory and its functional aspects.</li> </ul>
CUTM2451	Crime Scene Management and Criminal Profiling	<ol style="list-style-type: none"> <li>1. To understand about the crime and its type, techniques behind management of different crime scenes including photography.</li> <li>2. To evaluate the importance of evidences and its correct collection, handling and preservation techniques.</li> <li>3. To analyse about the criminal and victim profiling.</li> </ol>	<ul style="list-style-type: none"> <li>• To apply the skills to reconstruct crime scenes, and make logical deductions based on physical evidence, eyewitness accounts, and forensic documents</li> </ul>
			<ul style="list-style-type: none"> <li>• To develop proficiency in documenting and reporting crime scenes through written reports, sketches, and photographs, ensuring clarity and accuracy in conveying information.</li> </ul>
			<ul style="list-style-type: none"> <li>• To apply the art of collecting, packaging, preserving and handling different types of physical and trace evidence at crime scenes.</li> </ul>
			<ul style="list-style-type: none"> <li>• To Examine various tools and techniquesfor analysis of different types of crime scene evidence.</li> </ul>
			<ul style="list-style-type: none"> <li>• To identify the significance of criminal profiling and victim profiling in crime scene investigation</li> </ul>
CUTM2452	Crime and Society	<ol style="list-style-type: none"> <li>1. To understand the importance of criminology and elements of criminal justice system.</li> <li>2. To understand the causes of criminal behavior and its consequences in society.</li> <li>3. To understand the significance of criminal profiling to mitigate crime.</li> </ol>	<ul style="list-style-type: none"> <li>• To explain the importance of criminology and causes of criminal behaviour.</li> </ul>
			<ul style="list-style-type: none"> <li>• To analyse the significance of criminal profiling in alleviating crimes.</li> </ul>
			<ul style="list-style-type: none"> <li>• To demonstrate an understanding of the elements of the criminal justice system and the consequences of crime in society.</li> </ul>
			<ul style="list-style-type: none"> <li>• To explore and understand the various types of crimes, their causes, and how they impact society</li> </ul>
			<ul style="list-style-type: none"> <li>• To study different criminological theories that explain why individuals engage in criminal behaviour.</li> </ul>
CUTM2453	General Physics- I	1. To learn about the variouslaws of motion.	<ul style="list-style-type: none"> <li>• To describe the Laws of motion</li> </ul>
			<ul style="list-style-type: none"> <li>• To illustrate the concepts of thermodynamics.</li> </ul>

		<p>2. To make students understand about the waves and its properties.</p> <p>3. To build concept about the various aspects of radioactivity and atomic structure.</p>	<ul style="list-style-type: none"> <li>To explain the concepts involving properties of waves and optics.</li> <li>To identify the concepts of elasticity</li> <li>To examine the concept of radioactivity and atomic structure</li> </ul>
CUTM2454	General Chemistry- I	<p>1. To learn about different bonding theories and periodic trends.</p> <p>2. To learn about Structure of ionic solids.</p> <p>3. To learn about basics of physical and organic chemistry.</p>	<ul style="list-style-type: none"> <li>To explain the different bonding theories and structure of ionic solids</li> <li>To attain basic understanding of concepts relating to organic chemistry.</li> <li>To describe the concepts relating to physical chemistry.</li> <li>To identify the concepts of thermodynamics</li> <li>To learn about atomic structure</li> </ul>
CUTM2455	General Biology- I	<p>1. To teach about cell structure and their functions</p> <p>2. To impart knowledge of microbial world</p> <p>3. To teach about core-concepts of various aspects of genetics</p>	<ul style="list-style-type: none"> <li>To describe the cellular organisation and functions of different organelles</li> <li>To gain knowledge about the microbes and their general characteristics.</li> <li>To attain a basic understanding of genetics.</li> <li>To identify and study different stages of cell division</li> <li>To identify the basis of chromosomal inheritance</li> </ul>
CUTM2456	Practical I	<p>1. To make students gain hands on training in different courses.</p> <p>2. To learn about the techniques used in different fields.</p> <p>3. To learn about the basic concepts of physics, biology and chemistry for their application in forensic science.</p>	<ul style="list-style-type: none"> <li>To remember the history, development and organizational setup of different central and state organizations in India along with the cases related to sections of IPC, CrPC and IEA.</li> <li>To apply skills in processing and reconstructing a crime scene, preparing report and establishing chain of custody.</li> <li>To demonstrate aspects of velocity, acceleration, thermal conductivity.</li> <li>To determine anions and cations by chemical tests.</li> <li>To identify stages of cell division under microscope</li> </ul>

## SEMESTER II

Code	Subject Name	Course Objectives	Course Outcomes
CUTM2457	Criminal and Evidence Law	<p>1. To develop concepts about law and legal procedures, courts, IPC, CrPC &amp; IEA.</p> <p>2. To learn about police, police organizations at national &amp; international levels.</p> <p>3. To learn about the NDPS Act, Explosives Act, Environment Protection Act, etc.</p>	<ul style="list-style-type: none"> <li>To explain the concepts involving elements of Indian Penal Code, Criminal Procedure Code and Indian Evidence Act related to forensic science.</li> <li>To elucidate on the police organizational structure and their function under the central and the state government.</li> <li>To understand the acts governing socio- economic crimes and environmental crimes.</li> <li>To examine the rules of evidence, including the admissibility of various types of evidence, such as testimonial, documentary, and physical evidence.</li> </ul>

			<ul style="list-style-type: none"> <li>To develop the ability to analyze and apply legal principles to real-world criminal cases and scenarios.</li> </ul>
CUTM2458	Fingerprint Science	<p>1. To learn about fingerprint science, its development and various aspects.</p> <p>2. To learn about various classification systems of fingerprints.</p> <p>3. To learn about development and analysis of fingerprint by various physical and chemical methods.</p>	<ul style="list-style-type: none"> <li>To demonstrate an understanding of the history and development of fingerprint science, recognizing its significance in forensic science.</li> </ul>
			<ul style="list-style-type: none"> <li>To identify various ridge patterns and characteristics in fingerprints, which are fundamental in forensic fingerprint analysis.</li> </ul>
			<ul style="list-style-type: none"> <li>To classify fingerprints using various systems, including the Henry classification system, numerical values, and symbols.</li> </ul>
			<ul style="list-style-type: none"> <li>To develop, analyse, and present various types of fingerprint impressions, using both physical and chemical methods.</li> </ul>
			<ul style="list-style-type: none"> <li>To handle the basic Automated Fingerprint Identification Systems (AFIS)</li> </ul>
CUTM2459	Questioned Documents	<p>1. To understand the principles and tools employed in examining questioned documents, including the identification of document age through scientific methods.</p> <p>2. To acquire expertise in analysing handwritings, printed documents, and conducting systematic comparisons to establish authenticity or detect forgery.</p> <p>3. To develop proficiency in identifying and analysing various alterations in documents, from erasures to additions, to uncover potential fraud or manipulation.</p>	<ul style="list-style-type: none"> <li>To articulate a comprehensive definition of questioned documents and categorize them into different types</li> </ul>
			<ul style="list-style-type: none"> <li>To use forensic tools such as Ultraviolet, Visible, Infrared, and Fluorescence Spectroscopy, demonstrating hands-on competence in laboratory techniques</li> </ul>
			<ul style="list-style-type: none"> <li>To analyse documents to determine their age and relative age using appropriate forensic techniques</li> </ul>
			<ul style="list-style-type: none"> <li>To acquire advanced skills in comparing handwriting, determining stroke sequences, and recognizing natural variations and fundamental divergences, aligning with legal and psychological understanding</li> </ul>
			<ul style="list-style-type: none"> <li>To apply forensic techniques to examine and authenticate a range of documents, including alterations, charred documents, counterfeit currency, passports, visas, and mechanical impressions</li> </ul>
CUTM2460	General Physics- II	<p>1. To learn about atom and their characteristics</p> <p>2. To learn the fundamentals of lasers and holography</p> <p>3. To learn the basics of electricity and magnetism</p>	<ul style="list-style-type: none"> <li>To demonstrate about different atomic structures involved in atomic physics</li> </ul>
			<ul style="list-style-type: none"> <li>To enhance their skills in different applications of laser</li> </ul>
			<ul style="list-style-type: none"> <li>To gain knowledge about electric field and magnetic field.</li> </ul>
			<ul style="list-style-type: none"> <li>To apply the concepts of nuclear physics and radioactivity</li> </ul>
			<ul style="list-style-type: none"> <li>To apply the laws and equations of electromagnetic induction.</li> </ul>
CUTM2461	General Chemistry - II	<p>1. To learn about various analytical techniques.</p> <p>2. To learn about basic electrochemistry.</p> <p>3. To learn about basic nuclear and radiation chemistry.</p>	<ul style="list-style-type: none"> <li>To enhance their skills in different reagent preparation</li> </ul>
			<ul style="list-style-type: none"> <li>To demonstrate the laws and theories of electrochemistry</li> </ul>
			<ul style="list-style-type: none"> <li>To apply knowledge about nuclear forces and nuclear fission reaction</li> </ul>

			<ul style="list-style-type: none"> <li>To apply basic knowledge and understanding of important scientific principles for analytical chemistry</li> <li>To apply elementary ideas of radiation chemistry.</li> </ul>
CUTM2462	General Biology- II	<ol style="list-style-type: none"> <li>To impart knowledge of human anatomy and physiology</li> <li>To teach concepts of evolution and ecology</li> <li>To impart knowledge of plant anatomy and physiology</li> </ol>	<ul style="list-style-type: none"> <li>To identify basic concepts of animal anatomy.</li> <li>To demonstrate the basic physiological processes in animals</li> <li>To develop knowledge about the history of biological evolution and components of ecology.</li> <li>To explain the basic components of plant anatomy</li> <li>To analyse the physiology of plants and structure of diatoms.</li> </ul>
CUTM2463	Practical II	<ol style="list-style-type: none"> <li>Hands on training in different courses.</li> <li>Techniques used in different fields of forensic science</li> <li>To learn about the basic concepts of physics, biology and chemistry for their application in forensic science.</li> </ol>	<ul style="list-style-type: none"> <li>To elucidate on the cases that falls under the purview of criminal and evidence law.</li> <li>To acquire skills for analyzing fingerprint patterns, classification and their detection.</li> <li>To examine forgeries, frauds and counterfeiting in documents</li> <li>To explain aspects of resistance, current, and magnetic field.</li> <li>To apply concepts for preparing molar solutions of acid-bases and also demonstrate the different biological techniques involved.</li> </ul>

### SEMESTER III

Code	Subject Name	Course Objectives	Course Outcomes
CUTM2464	Forensic Psychology	<ol style="list-style-type: none"> <li>To understand the practical role played by contemporary forensic psychologists in society</li> <li>To demonstrate a knowledge of forensic psychology as a discipline and research methods used within forensic psychology</li> <li>To demonstrate awareness of the fundamental application of psychology, as a science, to understand key forensic issues</li> </ol>	<ul style="list-style-type: none"> <li>To explain the fundamental principles and concepts of psychology as applied to forensic settings.</li> <li>To apply techniques of detection of deception and the use of investigative tools like the Polygraph and BEOS, contributing to their laboratory proficiency in the field.</li> <li>To apply their knowledge of forensic psychology to address legal and ethical issues, such as mental competency assessments, eyewitness testimony, and criminal profiling.</li> <li>To identify persons attention and perception</li> <li>To analyze the impact of psychology on criminal behaviour, crime, and psychopathology, contributing to their understanding of the broader implications of forensic solutions in society and the criminal justice system.</li> </ul>
CUTM2465	Forensic Chemistry- I	<ol style="list-style-type: none"> <li>To help students learn the basics of forensic chemistry and quality management.</li> <li>To study and understand Narcotics and</li> </ol>	<ul style="list-style-type: none"> <li>To identify the significance of quality management.</li> <li>To handle Narcotic drugs and Psychotropic substances along with their analysis and also about the significance of bomb scene management.</li> </ul>

		<p>psychotropic substances.</p> <p>3. To learn about explosives, arson and petroleum products.</p>	<ul style="list-style-type: none"> <li>• To demonstrate the methods of analysing trace petroleum products in crime scene, arson evidence and explosives.</li> <li>• To emphasize the importance of maintaining strict quality control and adhering to legal standards in forensic chemistry analysis.</li> <li>• To prepare students for the possibility of providing expert testimony in court as forensic chemists and the ethical responsibilities associated with it.</li> </ul>
CUTM2466	Forensic Physics- I	<p>1. To understand the properties of the materials, glass and soil nature.</p> <p>2. To evaluate different types of paints and their compositions.</p> <p>3. To analyse the importance of soil as evidence.</p>	<ul style="list-style-type: none"> <li>• To remember the methods for examination and analysis of glass evidence.</li> <li>• To identify the composition of paint and its forensic examination.</li> <li>• To use soil as a geomarker evidence with its forensic analysis.</li> <li>• To explain physical properties such as refractive index, density, and composition for different evidences.</li> <li>• To analyse different case studies involving glass, paints and soil as evidence</li> </ul>
CUTM2467	Basics of Computer & Biometrics	<p>1. Explore logical, relational, and shift operations on binary numbers.</p> <p>2. Understand the fundamentals of firewall, IDS, and IPS in securing computer systems.</p> <p>3. Learn the purpose of IP and MAC addresses in network communication.</p>	<ul style="list-style-type: none"> <li>• To explain about the number systems, basics of operating systems involved and computer related crimes.</li> <li>• To acquire skills in computer networking and elucidate crime cases related to networking and the internet.</li> <li>• To gain an introductory understanding of computer security principles, including malware, firewalls, and best practices for safe computing.</li> <li>• To describe the basics of biometry and illustrate the classification of biometric processes.</li> <li>• To handle biometric systems that are integrated with computer-based access control and authentication systems.</li> </ul>
CUTM2468	Practical III	<p>1. To make students gain hands on training in different courses.</p> <p>2. To learn about the techniques used in different fields of forensic science.</p> <p>3. To learn about the basic concepts of physics, biology and chemistry for their application in forensic science.</p>	<ul style="list-style-type: none"> <li>• To develop a deep and integrated understanding of the psychology of criminal behaviour, combining knowledge of psychology, law, and forensic science to analyze the complex factors contributing to criminal conduct.</li> <li>• To acquire skills in analysis of NDPS drugs, explosives, petroleum products by TLC.</li> <li>• To demonstrate the methods in analysing properties of glass, paint and soil.</li> <li>• They will also be able to gain knowledge on basics of computer applications.</li> <li>• To be competent in handling of instruments such as refractometer, microscope etc.</li> </ul>

## SEMESTER IV

Code	Subject Name	Course Objectives	Course Outcomes
	Forensic Medicine	1. To know the duties of the first responding officer who receives a call on	<ul style="list-style-type: none"> <li>• To explain the fundamental aspects and scope of forensic medicine, identify the procedures involved in approaching a crime scene of death.</li> </ul>

CUTM2899		<p>homicide or suicide case.</p> <p>2. To understand the steps involved in processing the death scene.</p> <p>3. To understand the importance of autopsy and forensic odontology</p>	<ul style="list-style-type: none"> <li>• To analyze the medico-legal aspects of death, considering cause, manner and mode of death and legal implications.</li> <li>• To evaluate the role and significance of forensic odontology, different methods in estimating the age from teeth, legal implications of bite marks in forensic investigations.</li> <li>• To examine the types and classification of injuries, distinguishing between ante-mortem and post-mortem injuries, drowning death</li> <li>• To create an effective process for processing and preserving evidence and systematic approach to indexing death investigations</li> </ul>
CUTM2900	Fundamentals of Forensic Toxicology	<p>1. To help students learn basic principles of toxicology.</p> <p>2. To study and understand concepts of mechanism of toxicity.</p> <p>3. To learn the concepts of toxicological examination.</p>	<ul style="list-style-type: none"> <li>• To demonstrate a comprehensive understanding of the history, scope, and significance of forensic toxicology, including the medico-legal aspects of poisoning, relevant laws, and the roles of nodal agencies and stakeholders.</li> <li>• To explain the protocols and procedures for the collection and preservation of biological and non-biological samples in accordance with national and international guidelines.</li> <li>• To produce comprehensive autopsy reports and laboratory reports and to evaluate and communicate findings effectively in legal contexts.</li> <li>• To be proficient in applying various extraction methods for poisons from different sample types.</li> <li>• To acquire the skills to conduct toxicological analyses using chemical tests and instrumental methods.</li> </ul>
CUTM2901	Forensic Ballistics	<p>1. To learn about the methods of identification of firearms.</p> <p>2. To know the basics of internal, external and terminal ballistics.</p> <p>3. To understand the concepts of ammunitions and gunshot residue</p>	<ul style="list-style-type: none"> <li>• To explain classification of firearms and their firing mechanisms.</li> <li>• To assemble various types of ammunitions.</li> <li>• To remember the basic terminologies for the understanding of internal, external and terminal ballistics.</li> <li>• To analyse the class and individual characteristics for firearm identification</li> <li>• To analyse Gun Shot Residues.</li> </ul>
CUTM2902	Forensic Biology and Wildlife Forensics	<p>1. To learn the significance of different biological evidences.</p> <p>2. To learn the forensic importance of hair evidence.</p> <p>3. To learn about various aspects of wildlife forensics.</p>	<ul style="list-style-type: none"> <li>• To demonstrate the collection, preservation, packing, forwarding and documentation of biological evidences.</li> <li>• To analyse and interpret forensic significance of wood samples, pollen samples, hair evidence, fibres and microbial organisms.</li> <li>• To demonstrate the aspects of forensic limnology and examine diatoms from different matrices.</li> <li>• To determine the importance of entomology in estimating post-mortem interval and its significance as forensic evidence.</li> <li>• To explain the functionality of different wildlife agencies and analyse various wildlife parts and products.</li> </ul>

CUTM2903	Practical IV	1. To make students gain hands on training in the field of forensic medicine and toxicology.	• To design questionnaire for the first responder, checklist for the forensic scientists, a canvass form giving description of an unidentified victim.
		2. To make students gain hands on training in the field of forensic ballistics.	• To perform extraction and analysis of heavy metals, volatile and non-volatile poisons, plant poisons and drugs
		3. To teach students about various techniques involved in forensic biology and wildlife forensics.	• To identify firing mechanisms of different types of firearms and to identify gunshot residue.
			• To perform correlation of velocity of bullet with the impact it produces, the striking angle of the bullet, the nature of injuries with distance
			• To perform examination on hair, wood, fibres, diatoms, pollens

## SEMESTER V

Code	Subject Name	Course Objectives	Course Outcomes
CUTM2904	Forensic Anthropology	1. To learn about basics of anthropology. 2. To learn the basics of odontology and its application in forensics. 3. To learn about disaster victim identification	• To define the basic concepts of forensic anthropology, including skeletal anatomy and human osteology.
			• To apply different techniques for analysis of skeletal remains and estimate age, sex, stature from bones.
			• To interpret age, sex, race from teeth and evaluate its forensic significance.
			• To identify and examine skeletal remains from accidents, crimes, mass disaster cases to determine individual and population characteristics.
			• To apply forensic anthropological techniques to real-world cases and communicate the findings.
CUTM2905	Digital Forensics and Cyber Law	1. To Understand the different types of crimes in the cyberspace. 2. To Get familiar with the principles of Digital Forensics. 3. To Get an overview of the different sections of IT Act and laws related to the admissibility of digital evidences.	• To understand basic concepts of internal communication of computer.
			• To understand the parts of computers and their role as an evidence.
			• To understand the standard models for the layered approach OSI and TCP/IP.
			• To make students understand about how multimedia evidences are collected and analysed for forensic investigation.
			• To learn about the legal admissibility of multimedia evidences
CUTM2906	Forensic Chemistry- II	1. To learn about Forensic Analysis of Alcoholic Beverages. 2. To know about Examination of chemical evidences in Bribe Trap Cases and forensic Examination and dating of Inks, Plastics and Adhesives 3. To acquire knowledge of common food adulterants	• To understand the techniques used in the analysis of alcoholic beverages, country-made liquors and medicinal preparations containing alcohol.
			• To understand the use of chemicals in bribe trap cases and the forensic analysis techniques employed in identifying substances used in bribery.
			• To understand and demonstrate skills in dating and ageing of inks, identify and differentiate various types of polymers and conduct forensic

		and their analysis and analysis of Narcotic Drugs and Psychotropic Substances.	<p>examinations of ink, plastics and adhesives using various techniques.</p> <ul style="list-style-type: none"> <li>To identify common food adulterants and understand their forensic analysis. To perform physical and chemical analysis of lipids, oils, fats, butter and butter fats.</li> <li>To learn techniques for collection, sampling and testing of drug evidence. To demonstrate skills to perform presumptive and screening tests, including microcrystalline tests for narcotic drugs and psychotropic substances.</li> </ul>
CUTM2907	Instrumental Techniques -I	<ol style="list-style-type: none"> <li>To know about various microscopes, their parts, working and pH buffer systems.</li> <li>To learn about basic analytical techniques and electrophoretic techniques.</li> <li>To learn about separation and extraction techniques.</li> </ol>	<ul style="list-style-type: none"> <li>To handle different microscopes and understand its applications,</li> <li>To apply basic analytical techniques involved in forensic evidence analysis</li> <li>To execute different electrophoresis techniques proficiently</li> <li>To discuss the interactions of substances with electromagnetic radiations</li> <li>To demonstrate concepts of separation, identification and extraction of compounds</li> </ul>
CUTM2908	Practical V	<ol style="list-style-type: none"> <li>To make students gain hands on training in carrying out anthropological examination of human skeletal remains.</li> <li>To make students gain hands on training in different instrumental techniques involved in forensic chemistry</li> <li>To teach students about methods involved in digital forensic and cybercrime investigation.</li> </ol>	<ul style="list-style-type: none"> <li>To demonstrate the ability to determine age from skull and teeth, sex from both skull and pelvis, and identify bones with accurate measurements.</li> <li>To apply digital forensics techniques by acquiring and preserving volatile data, calculating file hashes, recovering deleted files, and imaging data storage media.</li> <li>To apply qualitative tests for ethyl alcohol and methyl alcohol, identify drugs of abuse, perform TLC, conduct UV and TLC tests for bribe trap, and analyse microcrystalline tests for drugs of abuse.</li> <li>To prepare comprehensive reports on clandestine drug investigations, narcotic drug investigations, and forensic anthropological analyses.</li> <li>To apply knowledge by studying the parts of a compound microscope, preparing buffers, conducting pH metric titrations, extracting plant-based drugs using Soxhlet, and performing instrument calibration.</li> </ul>

## SEMESTER VI

Code	Subject Name	Course Objectives	Course Outcomes
CUTM2914	Forensic Physics- II	<ol style="list-style-type: none"> <li>To study various impression marks and their nature in forensic science</li> <li>To learn about Fibre as evidence.</li> <li>To know the techniques for restoration of erased marks</li> </ol>	<ul style="list-style-type: none"> <li>To evaluate the importance of tool marks and tyre marks</li> <li>To understand the classification and analysis of fibres as evidence</li> <li>To apply the knowledge for restoration of erased marks</li> </ul>

			<ul style="list-style-type: none"> <li>To create understanding of lip prints and bite marks</li> <li>To understand the importance of footprints, shoe prints and ear prints for personal identification</li> </ul>
CUTM2915	Information Security Audit and Compliance	<ol style="list-style-type: none"> <li>Understand the various concepts of information security, risks, threats and vulnerabilities.</li> <li>Understand the various policy standards, baselines, and classification of information assets.</li> <li>Get familiar with the concepts of risk management and other security technologies like firewalls, VPNs, Honeypots, IPS and IDS.</li> <li>Comprehend the techniques for implementing information security and its subsequent management.</li> </ol>	<ul style="list-style-type: none"> <li>To understand various information security system</li> <li>To learn &amp; identify vulnerabilities and threats in an information system.</li> <li>To learn, Analyze and apply different risk control strategies: defend, transfer, mitigate, accept, and terminate.</li> <li>Understand the principles and strategies of Crisis Management in the context of information security.</li> <li>Understand the importance of ongoing monitoring for maintaining a secure information environment.</li> </ul>
CUTM2916	Basics of Immunology and Forensic Serology	<ol style="list-style-type: none"> <li>To learn about the significance of biological fluids and serological evidences in crime investigations.</li> <li>To teach the usefulness of genetic markers in forensic investigations.</li> <li>To learn about the forensic importance of bloodstain patterns.</li> </ol>	<ul style="list-style-type: none"> <li>To understand the basic concepts of immunology.</li> <li>To demonstrate the different blood grouping system and its significance in forensic investigation.</li> <li>To detect secretors and non-secretors and HLA antigen from biological evidences.</li> <li>To analyse blood stain patterns found in a crime scene.</li> <li>To identify and analyse blood and body fluids using biochemical tests and instrumental methods.</li> </ul>
CUTM2917	Instrumental Techniques- II	<ol style="list-style-type: none"> <li>To learn about various spectroscopic techniques</li> <li>To learn about various chromatographic and hyphenated techniques</li> <li>To learn about various elemental techniques.</li> </ol>	<ul style="list-style-type: none"> <li>To demonstrate the theory and instrumentation of different spectroscopic techniques</li> <li>To apply the concepts of spectroscopy in analysis of forensic evidences</li> <li>To understand the basic principles of different chromatographic techniques</li> <li>To analyse forensic evidences using chromatographic techniques</li> <li>To learn and practice various elemental techniques such as AAS, ICP-OES, etc.</li> </ul>
CUTM2918	Practical- VI	<ol style="list-style-type: none"> <li>To learn about different types of the impressions and their analysis.</li> <li>To learn about various types of evidences found at the scene of crime.</li> <li>To learn about various instrumental techniques involved in the analysis of different types of evidences</li> </ol>	<ul style="list-style-type: none"> <li>To identify and analyse different types of tool marks found at the scene of crime</li> <li>To learn about different types of impressions and their characteristic analysis.</li> <li>To understand the principles and strategies of incidence response in the context of information security.</li> <li>To understand the basic instrumental techniques used in the analysis of different biological evidences</li> <li>To understand the basic instrumental techniques used in the analysis of different pharmaceutical drugs.</li> </ul>

# SEMESTER VII (Specialization)



## Forensic Physics and Ballistics

Code	Subject Name	Course Objectives	Course Outcomes
CUTM2919	Lasers & Spectroscopy	<ol style="list-style-type: none"> <li>1. To learn about Light sources and basic components of optical spectrometer</li> <li>2. To learn about Light detectors and Gratings</li> <li>3. To study Vacuum pumps and gauges</li> </ol>	<ul style="list-style-type: none"> <li>• To understand the principal involved in spectroscopic techniques</li> </ul>
			<ul style="list-style-type: none"> <li>• to understand the laser of various wavelengths</li> </ul>
			<ul style="list-style-type: none"> <li>• to remember working of types of vacuum techniques and optical fibres</li> </ul>
			<ul style="list-style-type: none"> <li>• to understand the functioning of various spectrographic techniques involved in the analysis</li> </ul>
CUTM2920	Advancement in Forensic Ballistics and Armour Material	<ol style="list-style-type: none"> <li>1. To learn about the forensic aspects of firearms.</li> <li>2. To study the core concepts of internal, external and terminal ballistics.</li> <li>3. To learn the application of different instrumental techniques used for ballistics</li> </ol>	<ul style="list-style-type: none"> <li>• To understand classification of firearms and their firing mechanisms.</li> </ul>
			<ul style="list-style-type: none"> <li>• To understand the basic assembly of ammunitions.</li> </ul>
			<ul style="list-style-type: none"> <li>• To analyse the core concepts of internal, external and terminal ballistics for their application in case analysis.</li> </ul>
			<ul style="list-style-type: none"> <li>• To remember the working of various instrumental techniques like BDAS, IBIS, Boroscope, etc.</li> </ul>
CUTM2921	Audio and Video Analysis	<ol style="list-style-type: none"> <li>1. To introduce the concept of Voice identification and speaker recognition</li> <li>2. To be able to authenticate audio samples</li> <li>3. To learn Video and image analysis along with CCTV analysis</li> </ol>	<ul style="list-style-type: none"> <li>• To understand the handling of audio recording evidences and speaker profiling</li> </ul>
			<ul style="list-style-type: none"> <li>• To learn the components and approaches of speaker recognition including extraction, matching, comparison, etc.</li> </ul>
			<ul style="list-style-type: none"> <li>• To learn about the recognition of different types of tampering in audio and video files.</li> </ul>
			<ul style="list-style-type: none"> <li>• To analyse the importance of Image, Videos and CCTVs for the case investigation</li> </ul>
CUTM2939	Research Methodology	<ol style="list-style-type: none"> <li>1. Literature review and the development of a research plan</li> <li>2. Data collection, interpretation and errors</li> <li>3. Important components for writing the research paper and thesis along with basics of Ethical issues, Intellectual property rights, Copy right</li> </ol>	<ul style="list-style-type: none"> <li>• Understand the basic of research</li> </ul>
			<ul style="list-style-type: none"> <li>• Conceptualize the data analysis methods</li> </ul>
			<ul style="list-style-type: none"> <li>• Application of the different statistical tools</li> </ul>
			<ul style="list-style-type: none"> <li>• Imply the concepts in scientific reports and thesis writing</li> </ul>
			<ul style="list-style-type: none"> <li>• Signify the ethics in publication and IPR</li> </ul>

CUTM2922	Practical - VII	1. To learn about Light sources and basic components of optical spectrometer 2. To learn the application of different instrumental techniques used for ballistics 3. To learn about Important components for writing the research paper.	• to understand the laser and spectroscopic instrumental techniques
			• to understand the working of firearms and ammunition
			• To evaluate the standard protocols for the analysis GSR and the firearm
			• To learn the components and analysis of Audio and video analysis
			• to understand the use of Research methodology in research aspects

## Fingerprints & Questioned Documents

Code	Subject Name	Course Objectives	Course Outcomes
CUTM 2923	Advanced Fingerprint Technologies	1. Basics of fingerprint development techniques 2. Significance of ridgeology and poroscopy 3. To understand the working of AFIS	• To gain understanding of advanced fingerprint development techniques, including the development of fingerprints from porous and non-porous surfaces, as well as from nanoparticles.
			• To apply ridgeology and poroscopy concepts for individual identification.
			• To effectively utilize edgeoscopy in the identification process
			• To demonstrate a comprehensive understanding of automated fingerprint identification and imaging systems
			• To solve practical problems and challenges in forensic scenarios, demonstrating a high level of cognitive skills.
CUTM 2924	Advances in Forensic Documents Examination	1. The basics of forensic document examination 2. Examination of alterations in documents 3. Forensic examination of different types of documents	• To understand the roles of a Forensic Document Examiner, the scope of document examination, and the fundamental tools required for forensic document analysis.
			• To analyze and compare handwriting, showcasing analytical skills in document examination.
			• To analyze forgeries, determine the age of documents, and report on cases, integrating a range of forensic document examination techniques.
			• To be proficient in examining Photostat copies, e- documents, digital signatures, counterfeit currency, passports, legal deeds, and more.
			• To analyze and evaluate different types of computer printouts, aligning their understanding of technology with the forensic examination of printed documents.
CUTM 2925	Forensic Accounting and	1. Forensic Accounting and frauds	• To comprehend the theory of fraud perpetrators and the role of Forensic Accounting in litigation support.

	Auditing	<p>2. Money Laundering and Fraud deterrence</p> <p>3. Investigation of frauds and Legal Framework for Forensic Accounting</p>	<ul style="list-style-type: none"> <li>• To analyze types of financial statement frauds, occupational frauds, and abuses, including asset misappropriation, cheque tampering, false refunds, and credit/debit card fraud.</li> <li>• To analyze and interpret financial and electronic data, aligning with practical forensic accounting procedures.</li> <li>• To assess the legal aspects of cyber-crimes, ethical considerations for forensic accountants, and intellectual property rights.</li> <li>• To evaluate laws related to fraud, individual rights during examination, criminal prosecutions for fraud, and the civil justice system.</li> </ul>
CUTM 2939	Research Methodology	<p>1. Literature review and the development of a research plan</p> <p>2. Data collection, interpretation and errors</p> <p>3. Important components for writing the research paper and thesis along with basics of Ethical issues, Intellectual property rights, Copy right</p>	<ul style="list-style-type: none"> <li>• Understand the basic of research</li> <li>• Conceptualize the data analysis methods</li> <li>• Application of the different statistical tools</li> <li>• Imply the concepts in scientific reports and thesis writing</li> <li>• Signify the ethics in publication and IPR</li> </ul>
CUTM 2926	Practical - VII	<p>At the end of course, students will be gaining the hands on training in the following courses</p>	<ul style="list-style-type: none"> <li>• To apply modern fingerprint science techniques, including microscopic analysis, gender-based comparison, and latent fingerprint development methods, while understanding AFIS, Palatoprints, Cheiloscopy, and molecular fingerprints.</li> <li>• To demonstrate expertise in forensic document examination, identifying handwriting characteristics, forged signatures, disguised writing, and alterations in documents, while examining security features in various documents.</li> <li>• To apply forensic accounting and auditing techniques, including ink examination by TLC, GCMS, LCMS, determining paper aging, and examining various documents like currency notes, passports, and rubber seal impressions.</li> <li>• To analyze data effectively using statistical measures showcasing analytical skills.</li> <li>• To develop a holistic understanding of fingerprint science, forensic document examination, forensic accounting, and research methodology, demonstrating advanced cognitive skills in evaluation and synthesis.</li> </ul>

## Forensic Chemistry & Toxicology

Code	Subject Name	Course Objectives	Course Outcomes
CUTM 2927	Forensic Pharmacy and Pharmacology of Controlled Drugs	<ol style="list-style-type: none"> <li>To help students learn basics of pharmacology.</li> <li>To help students learn concepts forensic pharmacology.</li> <li>To study and understand action of various drugs.</li> </ol>	<ul style="list-style-type: none"> <li>To understand about the branches and scope of pharmacology, pharmacopeia's, nature and source of drugs, concept of prodrugs and soft drugs.</li> <li>To understand the concepts of adverse drug reactions, drug-induced side effects, pharmacokinetics, pharmacodynamics, bioavailability and bioaccumulation.</li> <li>To explore the pharmacology of neurotransmitters (GABA, Glutamate, Dopamine etc.) and apply this knowledge to specific drugs like general anaesthetics, sedatives, hypnotics, hallucinogens, antipyretics etc.</li> <li>To demonstrate the ability to detect prohibited drugs such as anabolic steroids, peptide hormones, growth factors etc.</li> <li>To analyse case studies to understand the practical applications of pharmacological principles in real-life scenarios.</li> </ul>
CUTM 2928	Advanced Forensic Toxicology	<ol style="list-style-type: none"> <li>To help students learn basic principles of toxicology.</li> <li>To help students learn about xenobiotic and toxic effects.</li> <li>To study and understand concepts of mechanism of toxicity.</li> </ol>	<ul style="list-style-type: none"> <li>To understand about the branches of toxicology, toxicants and its types, basics concepts of toxicology and national and international regulatory bodies</li> <li>To understand bioaccumulation, bio concentration and detoxification of xenobiotic in the body, translocation of toxicants, toxico-dynamics and toxico-kinetics, dose response relationships and antidotal therapy</li> <li>To gain knowledge of different heavy metals, alcohol, plant poisons, insects and animal poisons and their effects</li> <li>To understand the mechanism of toxicity</li> <li>To analyse case studies to understand the practical applications of toxicological principles in real-life scenarios.</li> </ul>
CUTM 2929	Modern and Applied Analytical Forensic Chemistry	<ol style="list-style-type: none"> <li>To help students learn advanced aspects of forensic drug chemistry.</li> <li>To help students learn the concepts of petro-forensics and international guidelines about fireforensics.</li> <li>To study and understand various chromatographic and spectroscopic techniques.</li> </ol>	<ul style="list-style-type: none"> <li>To gain knowledge of controlled substances, narcotic drugs and psychotropic substances and forensic analysis including presumptive and confirmatory tests for drugs.</li> <li>To understand the fire dynamics, fire chemistry and thermodynamics and to demonstrate skills required for analysis of petroleum products</li> <li>To gain knowledge about explosives and its types, causes of explosion and analysis of residue materials in post-blast investigation.</li> <li>To gain knowledge about chemical warfare agents and their analysis.</li> <li>To analyse case studies to understand the practical applications of forensic chemistry in real-life scenarios.</li> </ul>

CUTM 2939	Research Methodology	<ol style="list-style-type: none"> <li>Literature review and the development of a research plan</li> <li>Data collection, interpretation and errors</li> <li>Important components for writing the research paper and thesis along-with basics of Ethical issues, Intellectual property rights, Copy right</li> </ol>	<ul style="list-style-type: none"> <li>Understand the basic of research</li> </ul>
			<ul style="list-style-type: none"> <li>Conceptualize the data analysis methods</li> <li>Application of the different statistical tools</li> <li>Imply the concepts in scientific reports and thesis writing</li> </ul>
CUTM 2930	Practical - VII	At the end of course, students will be gaining the hands on training in the following courses	<ul style="list-style-type: none"> <li>To gain skills in qualitative and quantitative analysis of drugs</li> </ul>
			<ul style="list-style-type: none"> <li>To identify and perform analysis of heavy metals, plant poisons, Organophosphorus, Carbamates and Pyrethroids</li> </ul>
			<ul style="list-style-type: none"> <li>To identify and perform analysis of heavy metals, plant poisons, Organophosphorus, Carbamates and Pyrethroids</li> </ul>
			<ul style="list-style-type: none"> <li>To perform analysis of alcoholic beverages and derivates</li> <li>To perform analysis of high explosives, fire residues, dye in petrol and kerosene and NDPS Drugs</li> </ul>

## Forensic Biology and Biotechnology

Code	Subject Name	Course Objectives	Course Outcomes
CUTM2931	Fundamentals of Biological Chemistry	<ol style="list-style-type: none"> <li>To learn the fundamentals of biomolecules</li> <li>To learn the chemistry of Carbohydrates, Proteins and Lipids</li> <li>To learn the basics of Enzymes and Enzyme kinetics</li> </ol>	<ul style="list-style-type: none"> <li>To understand the core chemical foundations of biology and bioenergetics.</li> </ul>
			<ul style="list-style-type: none"> <li>To interpret the chemistry, classification and biological importance of carbohydrates.</li> </ul>
			<ul style="list-style-type: none"> <li>To interpret the chemistry, classification and biological importance of lipids.</li> </ul>
			<ul style="list-style-type: none"> <li>To interpreted the chemistry, classification and biological importance of proteins.</li> </ul>
			<ul style="list-style-type: none"> <li>To demonstrate the properties, kinetics, inhibition and regulation of enzyme action.</li> </ul>
CUTM2932	Molecular Biology and rDNA technology	<ol style="list-style-type: none"> <li>To teach the basics of Molecular Biology</li> <li>To teach about Genetic Engineering</li> <li>To learn about the Fundamentals of rDNA technology</li> </ol>	<ul style="list-style-type: none"> <li>To demonstrate the basics of genome organization and molecular biology.</li> </ul>
			<ul style="list-style-type: none"> <li>To execute different advanced techniques involved in isolation, quantitation and sequencing of DNA samples.</li> </ul>
			<ul style="list-style-type: none"> <li>To understand the concept of central dogma.</li> </ul>
			<ul style="list-style-type: none"> <li>To discuss the fundamentals of rDNA technology.</li> </ul>
			<ul style="list-style-type: none"> <li>To apply knowledge about choosing of different vectors and host organism.</li> </ul>
CUTM2933	Forensics Genomics and DNA Profiling	<ol style="list-style-type: none"> <li>To learn about STR profiling</li> <li>To learn about the application of lineage markers in DNA</li> </ol>	<ul style="list-style-type: none"> <li>To demonstrate the techniques involved in STR Profiling.</li> </ul>
			<ul style="list-style-type: none"> <li>To analyse mitochondrial DNA, Y-STR and X-STR.</li> </ul>

		<p>Forensics</p> <p>3. To learn the fundamentals of bioinformatics and its application in Forensics</p>	<ul style="list-style-type: none"> <li>• To evaluate the application of lineage markers and advanced methods of analysis in DNA Forensics.</li> <li>• To understand the significance of different databases and type of information to be retrieved.</li> <li>• To interpret the fundamentals of bioinformatics and its application in forensics.</li> </ul>
CUTM2939	Research Methodology	<p>1. Literature review and the development of a research plan</p> <p>2. Data collection, interpretation and errors</p> <p>3. Important components for writing the research paper and thesis along with basics of Ethical issues, Intellectual property rights, Copyright</p>	<ul style="list-style-type: none"> <li>• Understand the basic of research</li> <li>• Conceptualize the data analysis methods</li> <li>• Application of the different statistical tools</li> <li>• Imply the concepts in scientific reports and thesis writing</li> <li>• Signify the ethics in publication and IPR</li> </ul>
CUTM2934	Practical - VII	<p>1. To learn about the skills involved in analysis of biomolecules.</p> <p>2. To learn the methods involved in molecular biology, forensic genomics and DNA Profiling.</p> <p>4. To learn statistical concepts related to research methodology.</p>	<ul style="list-style-type: none"> <li>• To analyse different biomolecules and gain in-hand experience.</li> <li>• To gain skills in performing DNA extraction, amplification and sequencing from biological samples.</li> <li>• To perform profiling using different lineage markers used in forensic science.</li> <li>• To retrieve data from different database and analyse them using different tools and software.</li> <li>• To evaluate data sets using statistical approaches.</li> </ul>

## Cyber Forensics

Code	Subject Name	Course Objectives	Course Outcomes
CUTM2935	Advanced Digital Forensics	<ol style="list-style-type: none"> <li>1. Understand the various stages of digital forensics investigation</li> <li>2. Get familiar with the various artefacts and their sources, found in Windows Operating System.</li> <li>3. Get a basic understanding of the various artefacts and evidences found in Linux and MAC forensics.</li> </ol>	<ul style="list-style-type: none"> <li>• To understand Cyber-crime Investigation and Digital Forensics</li> </ul>
			<ul style="list-style-type: none"> <li>• To understand the concepts of digital evidence seizure and collection</li> </ul>
			<ul style="list-style-type: none"> <li>• To learn about Forensic Analysis of Windows System Artefacts</li> </ul>
			<ul style="list-style-type: none"> <li>• to acquire knowledge about different types of malicious software's</li> </ul>
			<ul style="list-style-type: none"> <li>• To understand Forensic Analysis of Linux and MAC System Artifacts</li> </ul>
CUTM2936	Mobile and Network Forensics	<ol style="list-style-type: none"> <li>1. Get familiar with the different mobile and network-based technologies.</li> <li>2. Identify the various artifacts of evidentiary value found in mobile phone devices.</li> <li>3. Appreciate the different data acquisition techniques used in mobile device forensics.</li> </ol>	<ul style="list-style-type: none"> <li>• To understand the various evidences to be collected from different networking devices and their analysis.</li> </ul>
			<ul style="list-style-type: none"> <li>• To learn to Identify the different tools and techniques used for forensic analysis of mobile phones and computer networks.</li> </ul>
			<ul style="list-style-type: none"> <li>• To Gain knowledge about the challenges in forensic investigation of mobile phones and computer networks.</li> </ul>
			<ul style="list-style-type: none"> <li>• To learn the basics Security Information and Event Management System</li> </ul>
			<ul style="list-style-type: none"> <li>• To learn about Forensic Analysis of Windows System Artifacts</li> </ul>
CUTM2937	Vulnerability Assessment and Penetration Testing	<ol style="list-style-type: none"> <li>1. Understand the need for security assessments and vulnerability management governance.</li> <li>2. Get familiar with the various tools and techniques used for penetration testing and vulnerability assessment.</li> <li>3. Identify the modus operandi of different attacks and security assessment pre-requisites.</li> <li>4. Study the importance of penetration testing and vulnerability assessment in the cyberspace.</li> </ol>	<ul style="list-style-type: none"> <li>• To learn the basic principles and techniques of how attackers can enter computer systems</li> </ul>
			<ul style="list-style-type: none"> <li>• To acquired knowledge into practice by performing ethical penetration tests and hide the intrusion.</li> </ul>
			<ul style="list-style-type: none"> <li>• To understand performance analyses of data breaches and audits of information technology security, evaluate the strengths and weaknesses of various information technology solutions in terms of data security.</li> </ul>
			<ul style="list-style-type: none"> <li>• To learn performance of pen-tests for educational purposes.</li> </ul>
			<ul style="list-style-type: none"> <li>• evaluate the societal role of hacking from a social, ethical and economic standpoint</li> </ul>
CUTM2939	Research Methodology	<ol style="list-style-type: none"> <li>1. Literature review and the development of a research plan</li> <li>2. Data collection, interpretation and errors</li> <li>3. Important components for writing the research paper and thesis along with basics of Ethical issues, Intellectual property rights, Copy right</li> </ol>	<ul style="list-style-type: none"> <li>• Understand the basic of research</li> </ul>
			<ul style="list-style-type: none"> <li>• Conceptualize the data analysis methods</li> </ul>
			<ul style="list-style-type: none"> <li>• Application of the different statistical tools</li> </ul>
			<ul style="list-style-type: none"> <li>• Imply the concepts in scientific reports and thesis writing</li> </ul>
			<ul style="list-style-type: none"> <li>• Signify the ethics in publication and IPR</li> </ul>
CUTM2938	Practical - VII	<ol style="list-style-type: none"> <li>1. To learn about various stages of digital forensics investigation processes</li> <li>2. To learn about various</li> </ol>	<ul style="list-style-type: none"> <li>• To understand the core concepts of Advanced Digital Forensics</li> </ul>
			<ul style="list-style-type: none"> <li>• To understand the core concept of Mobile and Network Forensics</li> </ul>

		processes involved in Data Acquisition and vulnerabilities 3. To learn about research methodology	<ul style="list-style-type: none"> <li>To learn about Vulnerability Assessment and Penetration Testing</li> <li>To understand the core concepts of digital evidence handling and analysis</li> <li>To acquire knowledge regarding Research Methodology</li> </ul>
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## SEMESTER VIII

Code	Subject Name	Course Objectives	Course Outcomes
CUTM2946	Internship at Forensic Science Laboratory	Student Interns will be exposed to 1. Hands-on analysis and experimentation 2. Reporting, 3. finding research prospects	<ul style="list-style-type: none"> <li>To demonstrate the practical application of forensic techniques in real-world scenarios.</li> <li>To apply laboratory skills in the analysis and processing of forensic evidence.</li> <li>To understand the importance of maintaining accurate and detailed documentation.</li> <li>To collaborate with professionals from various forensic disciplines to understand the interdisciplinary nature of forensic investigations.</li> <li>To understand the importance of continuous learning and staying updated on advancements in forensic technologies and methodologies.</li> </ul>

## SEMESTER IX

Code	Subject Name	Course Objectives	Course Outcomes
CUTM2947	Ethics in Science Education and Research	1. To learn Ethics with respect to science and research 2. To postulate maintenance for Ethical Standards in Higher Education 3. To know about the Publication ethics	<ul style="list-style-type: none"> <li>To analyse the Academic Research ethics, issues and concerns related to it.</li> <li>To understand the concept of Intellectual Property Rights</li> <li>To create skills for collaborative research, credit sharing, student-supervisor relationships.</li> <li>To remember the scientific misconducts: Falsification, fabrication, plagiarism</li> <li>To remember the best practices and standards for publication</li> </ul>
CUTM2948	Open Seminar and Comprehensive Viva-I	1. To develop effective presentation skills and articulate complex research or academic topics clearly and succinctly. 2. To demonstrate efficiency in their chosen research area, responding adeptly to	<ul style="list-style-type: none"> <li>To present a coherent and well-structured oral presentation on a chosen research or academic topic</li> <li>To exhibit in-depth knowledge and critical understanding of the theoretical foundations and practical applications related to their chosen research area.</li> </ul>

		<p>questions from the examination panel and showcasing a deep understanding of theoretical and practical aspects.</p> <p>3. To refine their academic communication abilities, incorporating constructive feedback to enhance both content delivery and critical engagement.</p>	<ul style="list-style-type: none"> <li>• To work on constructive feedback from peers and faculty, enabling them to refine their presentation skill, enhance content clarity, and improve overall communication effectiveness.</li> <li>• To demonstrate the ability to think critically and analytically about their research topic.</li> <li>• To develop effective time management skills and efficiently address questions during the comprehensive viva.</li> </ul>
CUTM2949	M.Sc. Project (To Be continued in 10 <sup>th</sup> Sem)	<p>1. To demonstrate advanced knowledge and understanding of a specific research area within their field of study.</p> <p>2. To apply research methodologies and analytical skills to collect, analyse, and interpret data, effectively addressing the research questions</p> <p>3. To develop effective communication and presentation skills.</p>	<ul style="list-style-type: none"> <li>• To demonstrate a comprehensive understanding of the chosen research area, including relevant theories, methodologies, and key concepts.</li> <li>• To apply critical thinking and analytical skills to collect, analyse, and interpret data, effectively addressing the research questions.</li> <li>• To synthesize information from the literature, data analysis, and their own insights to produce a coherent and well-structured research document.</li> <li>• To demonstrate problem-solving skills by addressing challenges encountered during the research process.</li> <li>• To enhance their communication skills, effectively conveying complex ideas and research findings.</li> </ul>

## SEMESTER X

Code	Subject Name	Course Objectives	Course Outcomes
CUTM2950	Open Seminar and Comprehensive Viva-II	<ol style="list-style-type: none"> <li>1. To develop effective presentation skills and articulate complex research or academic topics clearly and succinctly.</li> <li>2. To demonstrate efficiency in their chosen research area, responding adeptly to questions from the examination panel and showcasing a deep understanding of theoretical and practical aspects.</li> <li>3. To refine their academic communication abilities, incorporating constructive feedback to enhance both content delivery and critical engagement.</li> </ol>	<ul style="list-style-type: none"> <li>• To present a coherent and well-structured oral presentation on a chosen research or academic topic</li> </ul>
			<ul style="list-style-type: none"> <li>• To exhibit in-depth knowledge and critical understanding of the theoretical foundations and practical applications related to their chosen research area.</li> </ul>
			<ul style="list-style-type: none"> <li>• To work on constructive feedback from peers and faculty, enabling them to refine their presentation skill, enhance content clarity, and improve overall communication effectiveness.</li> </ul>
			<ul style="list-style-type: none"> <li>• To demonstrate the ability to think critically and analytically about their research topic.</li> </ul>
			<ul style="list-style-type: none"> <li>• To develop effective time management skills and efficiently address questions during the comprehensive viva.</li> </ul>
CUTM2951	M.Sc. Project	<ol style="list-style-type: none"> <li>1. To demonstrate advanced knowledge and understanding of a specific research area within their field of study.</li> <li>2. To apply research methodologies and analytical skills to collect, analyze, and interpret data, effectively addressing the research questions.</li> <li>3. To develop effective communication and presentation skills.</li> </ol>	<ul style="list-style-type: none"> <li>• To demonstrate a comprehensive understanding of the chosen research area, including relevant theories, methodologies, and key concepts.</li> </ul>
			<ul style="list-style-type: none"> <li>• To apply critical thinking and analytical skills to collect, analyze, and interpret data, effectively addressing the research questions.</li> </ul>
			<ul style="list-style-type: none"> <li>• To synthesize information from the literature, data analysis, and their own insights to produce a coherent and well-structured research document.</li> </ul>
			<ul style="list-style-type: none"> <li>• To demonstrate problem-solving skills by addressing challenges encountered during the research process.</li> </ul>
			<ul style="list-style-type: none"> <li>• To enhance their communication skills, effectively conveying complex ideas and research findings.</li> </ul>

## CORE ELECTIVES

Code	Subject Name	Course Objectives	Course Outcomes
CUTM2473	Anti-dope Forensics	1. To learn about anti- dope forensics & drugs of abuse in sports 2. To learn about pharmacodynamics and pharmacokinetics of dope drugs 3. To learn about dope testing in humans & animals	<ul style="list-style-type: none"> <li>To gain knowledge about different drugs used in case of doping</li> </ul>
			<ul style="list-style-type: none"> <li>To understand the importance of pharmacokinetics and pharmacodynamics of doping drugs</li> </ul>
			<ul style="list-style-type: none"> <li>To gain skills on testing different drugs from body fluids and understanding guidelines for dope testing</li> </ul>
			<ul style="list-style-type: none"> <li>To emphasize the importance of maintaining professionalism, confidentiality, and impartiality in anti-doping work.</li> </ul>
			<ul style="list-style-type: none"> <li>To encourage students to engage in research and innovation within the field of anti-doping, including the development of new detection methods and strategies</li> </ul>
CUTM2909	Incident Response and Management	1. To learn key concepts of information security 2. To learn about incident response 3. To learn about the steps involved in Incident handling	<ul style="list-style-type: none"> <li>To gain knowledge about the key concepts of Incident management</li> </ul>
			<ul style="list-style-type: none"> <li>To enhance their skills in handling an incident response scene</li> </ul>
			<ul style="list-style-type: none"> <li>To demonstrate the importance of incident response plan</li> </ul>
			<ul style="list-style-type: none"> <li>To understand various methods and tools for detecting security incidents, including intrusion detection systems (IDS) and security information and event management (SIEM) systems.</li> </ul>
			<ul style="list-style-type: none"> <li>To explore methods for preserving digital evidence in a forensically sound manner, understand the importance of maintaining a proper chain of custody for evidence integrity.</li> </ul>
CUTM2910	Multimedia Forensics	1. To introduce multimedia forensics and multimedia files 2. To develop understanding on Source identification of multimedia evidences 3. To learn about Enhancement and authentication techniques for multimedia exhibits	<ul style="list-style-type: none"> <li>To gain knowledge about handling of multimedia evidences</li> </ul>
			<ul style="list-style-type: none"> <li>To enhance skills for audio, video, image examination</li> </ul>
			<ul style="list-style-type: none"> <li>To develop skills on handling, preservation and management of multimedia evidences.</li> </ul>
			<ul style="list-style-type: none"> <li>To understand about analog- digital conversions of multimedia content.</li> </ul>
			<ul style="list-style-type: none"> <li>To understand techniques for audio authentication and enhancement</li> </ul>
CUTM2911	Forensic Statistics	1. To teach the importance of statistics in Forensic Science 2. To teach the different types of distributions; Normal, Binomial and Poisson 3. To teach the concept of probability theory, Chi square test, Student's t- test etc.	<ul style="list-style-type: none"> <li>To gain knowledge about standard deviation, mean, median and mode and other statistical methodologies</li> </ul>
			<ul style="list-style-type: none"> <li>To solve probability problems, and analyze real-world scenarios where probability is applicable, especially in the context of forensic evidence.</li> </ul>
			<ul style="list-style-type: none"> <li>To comprehend the concepts of simple linear regression and correlation, and the computational methodology.</li> </ul>
			<ul style="list-style-type: none"> <li>To analyze and interpret the results using appropriate statistical methods.</li> </ul>
			<ul style="list-style-type: none"> <li>To gain knowledge and skills in hypothesis testing and to evaluate significance of results.</li> </ul>

CUTM2912	Accident Investigations	<ol style="list-style-type: none"> <li>1. To learn about vehicular accidents</li> <li>2. To learn about Pre-crash and Post-crash movement</li> <li>3. To learn about Tachograph data &amp; charts</li> </ol>	<ul style="list-style-type: none"> <li>• To gain knowledge about source of accident and its investigation procedure</li> </ul>
			<ul style="list-style-type: none"> <li>• To acquire skills to photograph evidences found at a crime scene</li> </ul>
			<ul style="list-style-type: none"> <li>• To identify the different types of injuries resulting from accident</li> </ul>
			<ul style="list-style-type: none"> <li>• To understand the aspects of accident analysis</li> </ul>
			<ul style="list-style-type: none"> <li>• To interpret tachograph charts and data for accident investigation</li> </ul>
CUTM2913	Immunology and Immunological Techniques	<ol style="list-style-type: none"> <li>1. To learn the basics of immunology</li> <li>2. To learn fundamentals of Antigen and Antibody</li> <li>3. To learn about the different immunotechniques.</li> </ol>	<ul style="list-style-type: none"> <li>• To gain knowledge about the immune system and organs involved</li> </ul>
			<ul style="list-style-type: none"> <li>• To understand the structure and function of antigens and antibodies</li> </ul>
			<ul style="list-style-type: none"> <li>• To gain skills for performing different immune techniques</li> </ul>
			<ul style="list-style-type: none"> <li>• To acquire skills in carrying out immunological tests for forensic evidences</li> </ul>
			<ul style="list-style-type: none"> <li>• To demonstrate different strategies for vaccine development</li> </ul>
CUTM2940	Clinical Toxicology	<ol style="list-style-type: none"> <li>1. General principle of clinical toxicology</li> <li>2. Epidemiological toxicity &amp; drug toxicology</li> <li>3. Heavy metal &amp; Pesticide induced toxicity</li> </ol>	<ul style="list-style-type: none"> <li>• Comprehend the fundamental concepts of clinical toxicology</li> </ul>
			<ul style="list-style-type: none"> <li>• Evaluate, minimize and prevent the community health poisoning on Risk assessment and risk management</li> </ul>
			<ul style="list-style-type: none"> <li>• Annotate the drug toxicity w.r.t. carcinogenicity and neurobehavioral effects</li> </ul>
			<ul style="list-style-type: none"> <li>• Recognise and differentiate the clinical symptoms of various acute and chronic poisonings</li> </ul>
			<ul style="list-style-type: none"> <li>• Distinguish and manage the various clinical symptoms of different poisoning by heavy metals and pesticides.</li> </ul>
CUTM2941	Forensic DNA Analysis	<ol style="list-style-type: none"> <li>1. To teach the basics of DNA</li> <li>2. To learn about forensic DNA typing</li> <li>3. To teach about paternity testing</li> </ol>	<ul style="list-style-type: none"> <li>• Understand the significance of genomic and mitochondrial DNA as an important forensic evidence.</li> </ul>
			<ul style="list-style-type: none"> <li>• Execute proper protocols in collecting different biological evidences for DNA analysis.</li> </ul>
			<ul style="list-style-type: none"> <li>• demonstrate the basic principles involved in forensic DNA typing</li> </ul>
			<ul style="list-style-type: none"> <li>• Apply skills in performing various techniques used in DNA typing.</li> </ul>
			<ul style="list-style-type: none"> <li>• Understand the concepts of parentage testing, population genetics and create scientific reports based on the findings.</li> </ul>
CUTM2942	Forensic Engineering	<ol style="list-style-type: none"> <li>1. To learn the basics of forensic engineering</li> <li>2. To analyse various case studies to understand the engineering failures</li> <li>3. To understand the responsibilities and standards to be followed for forensic engineering inspections</li> </ol>	<ul style="list-style-type: none"> <li>• Understand the need for forensic engineering along with its types and root causes.</li> </ul>
			<ul style="list-style-type: none"> <li>• Analyse different cases related to construction failures.</li> </ul>
			<ul style="list-style-type: none"> <li>• Analyse different cases related to electrical, fires, and blast and mining failures.</li> </ul>
			<ul style="list-style-type: none"> <li>• Remember the role of forensic engineers for scene inspections.</li> </ul>
			<ul style="list-style-type: none"> <li>• Create recommendations for the improvements in engineering aspects</li> </ul>

CUTM2943	Applied Cryptography	<ol style="list-style-type: none"> <li>1. The basics concepts of security and cryptography</li> <li>2. Computer-based symmetric and asymmetric cryptography algorithms</li> <li>3. Public-Key Infrastructure and Internet Security Protocols.</li> <li>4. User Authentication Mechanisms and Network Security.</li> </ol>	<ul style="list-style-type: none"> <li>• Understand fundamental algorithms for symmetric key and public key cryptography.</li> <li>• Understand the number theoretic foundations of modern cryptography and the principles behind their security.</li> <li>• To learn comprehensive understanding of cryptology, encryption techniques, key management, public-key infrastructure, and various applications, including the use of codes in different domains.</li> <li>• Gain a comprehensive understanding of database security, auditing, and data loss prevention practices.</li> <li>• Understand the security measures to protect databases, monitor database activities, and prevent data loss across various channels, including networks, devices, and applications</li> </ul>
CUTM2944	Data Science & Artificial	<ol style="list-style-type: none"> <li>1. To understand concept of Artificial Intelligence, Machine Learning and Deep Learning</li> <li>2. To learn various Machine Learning and Deep Learning techniques</li> <li>3. To create models to understand applications of AI</li> </ol>	<ul style="list-style-type: none"> <li>• Gain a comprehensive understanding of the foundational concepts in data science and AI, including machine learning, statistics, data analysis, and algorithms.</li> <li>• Acquire skills in data pre-processing, cleaning, wrangling, and handling various types of data</li> <li>• To Learn a variety of machine learning algorithms and techniques</li> <li>• To Understand neural networks</li> <li>• To Develop proficiency in data visualization tools and techniques to effectively communicate insights derived from data analysis</li> </ul>
CUTM2945	Forensic Photography	<ol style="list-style-type: none"> <li>1. To learn about types of camera, filters, lenses and specialized photography methods.</li> <li>2. To learn about the different types of forensic photography techniques.</li> <li>3. To learn different software's for processing of images.</li> </ol>	<ul style="list-style-type: none"> <li>• To illustrate the use of different lenses, filters, camera, and camera accessories used in evidence photography.</li> <li>• To apply special photographic techniques for capturing various forensically significant evidences.</li> <li>• To execute different types of forensic photographic techniques that can be used for crime scene and laboratory photography.</li> <li>• To analyse photographs of various file formats using software</li> <li>• To apply advanced technologies used in 3D documentation of crime scene, processing of images and their admissibility in the court as digital evidences.</li> </ul>

## SKILL ELECTIVES

Code	Name	Course Objectives	Course Outcomes
CUTM 2469	Communication Skills	1. To identify basic communication skills principles. 2. To teach the students about interview etiquettes. 3. To teach students develop conversational and technical writing skills.	<ul style="list-style-type: none"> <li>To improve their basic communication skills.</li> </ul>
			<ul style="list-style-type: none"> <li>To understand the importance of body language and gesture.</li> </ul>
			<ul style="list-style-type: none"> <li>To develop interpersonal communication skills.</li> </ul>
			<ul style="list-style-type: none"> <li>To improve their skills in written communication.</li> </ul>
			<ul style="list-style-type: none"> <li>To develop a confidence posture with verbal and non-verbal language.</li> </ul>
CUTM 2470	English	1. To improve English speaking 2. To learn to communicate official letters and circular 3. To improve vocabulary	<ul style="list-style-type: none"> <li>To understand the grammatical components of a language and the proficiency to employ them.</li> </ul>
			<ul style="list-style-type: none"> <li>To understand the basic concepts of comprehension.</li> </ul>
			<ul style="list-style-type: none"> <li>To enhance their vocabulary.</li> </ul>
			<ul style="list-style-type: none"> <li>To improve formal and official writing skills</li> </ul>
			<ul style="list-style-type: none"> <li>To execute skills in writing circular letters.</li> </ul>
CUTM2471	Yoga and its benefit- I	1. To perform various Pranayama 2. To understand the power of Meditation 3. To understand the impact of yoga on health	<ul style="list-style-type: none"> <li>To gain knowledge about the components of self and self-identity</li> </ul>
			<ul style="list-style-type: none"> <li>To understand the importance of pranayama and its impact on human body</li> </ul>
			<ul style="list-style-type: none"> <li>To perform different yoga postures</li> </ul>
			<ul style="list-style-type: none"> <li>To retain the history and evolution of yoga</li> </ul>
			<ul style="list-style-type: none"> <li>To understand the schools of yoga</li> </ul>
CUTM 2472	Yoga and its benefit- II	1. To learn about development of spiritual self 2. To learn about the concept of Spiritualism and Integral Humanity 3. To learn various Asana	<ul style="list-style-type: none"> <li>To gain knowledge about spiritual awareness and its integration in daily life</li> </ul>
			<ul style="list-style-type: none"> <li>To gain skill in performing different asana</li> </ul>
			<ul style="list-style-type: none"> <li>To apply the knowledge of yoga in the well-being of self and society</li> </ul>
			<ul style="list-style-type: none"> <li>To explain the concept of spiritualism and integral humanity</li> </ul>
			<ul style="list-style-type: none"> <li>To understand the concept of astangyog</li> </ul>



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# Syllabus

# Semester I

**CUTM2450: Introduction to Forensic Science**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200

\* Note: TA-2 will be in form of assignments or workshops.

**Learning Objectives**

1. To help students learn basic principles of Forensic science
2. To learn about the development of forensic science
3. To learn about the organizational setup of Forensic Science
4. To understand about the various academic institutions and government agencies involved in criminal investigations.
5. To help students develop a basic understating about Forensic Science

**MODULE -1 History and Basic principles of Forensic Science      Teaching Hours: 15 Hours**

History of Development of Forensic Science in India. Functions of forensic science. Historical aspects of forensic science. Definitions and concepts in forensic sciences. Scope of forensic science. Various contemporary disciplines of forensic sciences and their applications in different approaches with theoretical concepts. Need of forensic science. Basic principles of forensic science.

**MODULE-2 Functional aspects of Forensic Science      Teaching Hours: 15 Hours**

Contemporary development in the academic and practices in forensic sciences-advantage of scientific investigations- Tools and Techniques in Forensic Science- Branches of forensic science. Forensic science in international perspectives, including set up of INTERPOL, and FBI. Duties of forensic scientists. Code of conduct for forensic scientists. Qualifications of forensic scientists. Data depiction. Report writing.

**MODULE-3 Organizational setup in Forensic Science      Teaching Hours: 15 Hours**

Academic institutions involvement- Organizational set up of Forensic Science Laboratories in India Hierarchical set up of Central Forensic Science Laboratories, State Forensic Science Laboratories, Government Examiners of Questioned Documents, Fingerprint Bureaus, National Crime Records Bureau, Police & Detective Training Schools, NIA, CCNTS, Bureau of Police Research & Development, Directorate of Forensic Science and Mobile Crime Laboratories. Police Academies. National investigation agency and other agencies involved in the criminal investigations- agencies referred for the additional information and requisite examinations.

**References and Suggested Readings:**

1. B.B. Nanda and R.K. Tiwari, *Forensic Science in India: A Vision for the Twenty First Century*, Select Publishers, New Delhi (2001).
2. M.K. Bhasin and S. Nath, *Role of Forensic Science in the New Millennium*, University of Delhi, Delhi (2002).
3. S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2nd Edition, CRC Press, Boca Raton (2005).
4. W.G. Eckert and R.K. Wright in *Introduction to Forensic Sciences*, 2nd Edition, W.G. Eckert (ED.), CRC Press, Boca Raton (1997).
5. R. Saferstein, *Criminalistics*, 8th Edition, Prentice Hall, New Jersey (2004).
6. W.J. Tilstone, M.L. Hastrup and C. Hald, *Fisher's Techniques of Crime Scene Investigation*, CRC Press, Boca Raton (2013).

**CUTM2451: Crime Scene Management & Criminal Profiling**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200		

\* Note: TA-2 will be in form of assignments or workshops.

**Learning Objectives**

1. To make students understand about the crime and its types.
2. To learn about the techniques behind management of different crime scenes.
3. To understand about the importance of evidences and its correct collection & handling.
4. To learn about the concept of chain of custody & its importance.

**MODULE-I Crime Scene Evidence Teaching Hours: 15 Hours**

Introduction to the crime scene, Types of crime scene, Evaluation and processing of crime scene, securing the scene of crime, documenting the crime scene: Note making, sketching

Searching techniques of Crime scene, Processing of physical evidence-discovering, recognizing and examination of physical evidences

Collection, Safety measures for evidence collection, Preservation, Packaging, sealing, labelling and forwarding of physical evidences, maintaining the chain of custody, Probative value of physical evidences, Reconstruction of scene of crime

**Photography:** Photography (Cameras-SLR &DSLR, lenses, filters, films, exposing, development & printing, different kinds of developers and fixers. Specialized photography- UV, IR, close up. Photography using scientific equipment, role of the first arriving officer at the crime scene, Digital Imaging of Crime Scene, 3-D scanning technique, videography of crime scene

**MODULE-2 Physical Evidences Teaching Hours: 15 Hours**

Introduction to physical evidences, Types of physical evidences, Classification and Role of physical evidences in Criminal Investigations & Trails.

**Crime Detection Devices:** UV, IR, X-Rays, their nature and applications, Detective Dyes, Neutron Radiography, Speed Detection Devices, Tools: Basic Kits, Investigator's Kit, Tools used in Mobile laboratory. Digital Imaging of Crime Scene, 3-D scanning technique, Tele forensic Technology for crime scene investigation, Information, Manpower, and logistics management of crime scene ,

Technology innovation in crime scene management, Case studies & report writing of crime scene visits. National and International scenario of crime scene management

**MODULE-3      Criminal Profiling      Teaching Hours: 15 Hours**

History of Profiling, Behavioural Evidence Analysis, Criminal motivation, Crime scene investigation, Victim profiling, Psychological Autopsy, Sexual Offences, Geographical Profiling, Criminal behaviour on the internet, Case studies.

**References and Suggested Readings:**

1. J.Walls; Forensic Science-An Introduction to Scientific Crime Detection 2nd Ed.,Universal, 1st Indian Reprint (2002).
2. Richard Saferstein; Criminalistics-An Introduction to Forensic Science 5th Ed., Prentice Hall (1995).
3. Jay A.Siegel, Pekka J Saukko and Geoffrey C. Koouper; Encyclopedia of Forensic Science, Academic Press (2000).
4. E.R.Mengel; Forensic Physics in 2002 year book, McGraw hill Encyclopedia of Science & Technology.
5. Jenkins and White; Fundamentals of Optics; Mc Graw Hill; Fourth Ed, (I) James, S.H. And Nordby, J. J.; Forensic Science; An Introduction to Scientific And Investigative Techniques, CRCPress USA
6. M. Byrd, Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence, CRC Press, Boca Raton (2001).
7. T.J. Gardener and T.M. Anderson, Criminal Evidence, 4th Ed., Wadsworth, Belmont (2001).
8. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
9. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).

**CUTM2452: Crime & Society**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200		

\* Note: TA-2 will be in form of assignments or workshops.

Learning Objectives:

After studying this paper the students will know:

1. The importance of criminology.
2. The causes of criminal behavior.
3. The significance of criminal profiling to mitigate crime.
4. The consequences of crime in society.
5. The elements of criminal justice system.

**MODULE-I Crime Teaching Hours: 15 Hours**

Introduction to Crime, Essentials of Crime (Actus reus and mens rea), Causes and consequences of crime, Crimes against Property and Person. Types of crime- traditional crimes, modern crimes white collar crimes, Economic crimes, Political crime, Cyber-crime, Terrorism and Insurgency, Crime and Politics. Hate crimes, Transnational crimes; Offences in CrPC and IPC; Media, technology and crime; Juvenile Delinquency; Social change and crime; Psychological disorders and criminality; Situational crime prevention. Types of criminals- Adult offenders, children in conflict with law, recidivists, Violent offenders, occupational offenders; Criminal Profiling.

**MODULE-2 Fundamentals of Criminology & Victimology Teaching Hours: 15 Hours**

Criminology Definition, aim and scope. Schools of Criminology. Criminology and other social sciences; Criminological Theories: Pre-classical, Classical, Neo-classical, Positivist; Causation of crime - Psychological theories of crime, sociological theories of crime, Biological theories of crime; Feminist Criminology. Crime Prevention, Modus Operandi, Criminal profiling. Basic concepts of Victimology.

**MODULE-3 Criminal Justice System Teaching Hours: 15 Hours**

Broad components of criminal justice system. Structure of Criminal Justice System in India; Role of Legislature and Law making; Coordination among Criminal Justice System, Policing styles and

principles. Police's power of investigation. Compoundable and Non-compoundable offences; Investigation of Crimes; Complaint, F. I. R. Arrest, Search, Seizure, Police Custody, Role of prosecution, judiciary- Judicial Remand and Bail; Types of Evidence, Admissibility of Confession, Dying declaration, Filing of criminal charges. Community policing. Policing a heterogeneous society. Correctional measures and rehabilitation of offenders. Human rights and criminal justice system in India.

**References and suggested Readings:**

1. Ahuja, Ram. (2000). *Criminology*. Rawat Publication
2. Barnes, H. E. & Teeters, N. K. (1959). *New horizons in criminology*. (2<sup>nd</sup> ed.). New York, NY: Prentice-Hall.
3. Beccaria, Cesare. (1764). *On Crimes and Punishments*. Richard Davies, Cambridge University Press.
4. Bonnie, S. Fisher & Steven, P. La.,(2010). *Encyclopedia of Victimology and Crime Prevention*. SAGE Publications, Inc.
5. David, Kauzlarich and Hugh D. Barlow. (2009) *Introduction to criminology* (9<sup>th</sup> ed.) Rowman&Littlefield Publishers.
6. John, Martyn Chamberlain.(2015). *Criminological Theory in Context: An Introduction*. SAGE Publications Ltd . Southampton University
7. Paranjape, N.V. (2009). *Criminology and Penology*. Central Law Publications.
8. Reid, Sue Titus. (2006). *Crime and Criminology*. Mc. Graw Hill.
9. Sutherland, E. H. and Cressey, Donald. (1992 ), *Principles of Criminology*. (11<sup>th</sup>ed). Lanham, Md.: Alta Mira Press
10. Tappan, Paul. (1960). *Crime, Justice ,and Correction*. McGraw-Hill Book Company ,Inc. New york ,Toronto, London.
11. Viano, Emilio.(1987). *Crime and its Victims*. Hemisphere Publishing Corporation, New York
12. Kocsis, RN (2006) *Criminal Profiling- Principles and Practices*. Humana Press, New Jersey
13. Roger G. Dunham (Author), Geoffrey P. Alpert (Author), Kyle D. McLean (2015). *Critical Issues in Policing: Contemporary Readings*. Waveland Press
14. N. Prabha Unnithan (2013). *Crime and Justice in India*. Sage Publications
15. H.R. Bhardwaj (2019). *The Criminal Justice system in India*. Konark Publishers Pvt Ltd
16. Adam Sutton, Adrian Cherney, Rob White, Garner Clancey. (2021) *Crime Prevention 3ed- Principles, Perspectives and Practices*. Cambridge University Press
17. Manish Dwivedi (2011) *Juvenile Justice System in India*. Adhyayan Publishers & Distributors.
18. S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2<sup>nd</sup> Edition, CRC Press, Boca Raton (2005).
19. D.E. Zulawski and D.E. Wicklander, *Practical Aspects of Interview and Interrogation*, CRC Press, Boca Raton (2002).
20. R. Saferstein, *Criminalistics*, 8<sup>th</sup> Edition, Prentice Hall, New Jersey (2004).
21. J.L. Jackson and E. Barkley, *Offender Profiling: Theory, Research and Practice*, Wiley, Chichester (1997).
22. R. Gupta, *Sexual Harassment at Workplace*, LexisNexis, Gurgaon (2014).



**MODULE-3**

**Wave and Optics**

**Teaching Hours: 15 Hours**

**Wave:** Wave motion, Wave equation, longitudinal and transverse waves, Plane Progressive (Travelling) Waves, Nature and properties of electromagnetic waves, Speed of sound wave in different media and their properties, Velocity of Transverse Vibrations of Stretched Strings, Newton's hypothesis, Laplace correction in speed of sound.

**Optics:** Electromagnetic spectrum, Interference, Reflection, refraction polarization and diffraction of light. Young's double slit experiment, Refractive index and total internal reflection of light. Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers. Physical and Chromatic aberrations.

**Reference books:**

1. NCERT Physics Part 1 And part 2.
2. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
3. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
4. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
5. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
6. Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill.
7. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.
8. Optics, Ajoy Ghatak, 2008, Tata McGraw Hill.

**CUTM2454: General Chemistry-I**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200		

\* Note: TA-2 will be in form of assignments or workshops.

**Learning objectives:**

1. To learn about different bonding theories.
2. To learn about Structure of ionic solids.
3. To learn about periodic trends.
4. To learn about basics of organic chemistry.
5. To learn about basics of physical chemistry.

**MODULE-I                      Structure and Bonding                      Teaching Hours: 15 Hours**

**Atomic Structure:** Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrodinger wave equation; H atom; Radial and angular wave functions. Quantum numbers and their significance, Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number, Molecular orbital theory and shapes of s, p, d and f Orbitals.

**Chemical Bonding:** VB and MO approach of H<sub>2</sub> molecule; MO treatment of homonuclear and heteronuclear (CO & NO) diatomic molecules; Concept of HOMO and LUMO. VSEPR theory; Structure of simple molecules and ions of main group elements

**Ionic Solids:** Close packing, Radius ratio rule and crystal coordination number. Examples of MX and MX<sub>2</sub> type ionic solids (NaCl and TiO<sub>2</sub>)

**Metallic Bonding:** theories of bonding in metals; Free electron, VB and Band theories.

**Weak Interactions:** Hydrogen bonding and van der Waal's interactions

**Periodic trends and properties:** Size, Ionization Energy, Electron Affinity, Electronegativity, Lattice and Hydration Energies, Use of redox potential and reaction feasibility.

**MODULE-2                      Basics of Organic Chemistry                      Teaching Hours: 15 Hours**

Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties. Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Racemic mixture and resolution. Chemistry of

aliphatic, aromatic hydrocarbons and Cycloalkanes. Aromaticity and Huckel rule - A general concept. Molecular orbital picture of benzene.

**MODULE-3                      Basics of Physical Chemistry                      Teaching Hours: 15 Hours**

**Gaseous State:** Kinetic theory of gases, ideal gas laws based on kinetic theory. Collision in a gas-mean free path, collision diameter, collision number. Behaviour of real gases - the van der Waal's equation.

**Liquid State:** Surface tension of liquids - capillary action, experimental determination of surface tension, temperature effect on surface tension. Viscosity of liquids, experimental determination of viscosity coefficient, its variation with temperature.

**Thermodynamics:** Enthalpy, heat changes at constant volume and constant pressure, heat capacities (CV, CP) and their relationship for ideal gases. Thermodynamic quantities ( $w$ ,  $q$ ,  $\Delta U$ ,  $\Delta H$ ) for isothermal and adiabatic reversible expansion of ideal gases and their comparison. Change in internal energy ( $\Delta U$ ) and enthalpy ( $\Delta H$ ) of chemical reactions, relation between  $\Delta U$  and  $\Delta H$ , variation of heat of reaction with temperature (Kirchhoff's equation).

**Reference Books:**

1. Basic Inorganic Chemistry, F. A Cotton, G. Wilkinson, and Paul L. Gaus, 3rd Edition (1995), John Wiley & Sons, New York.
2. Concise Inorganic Chemistry, J. D. Lee, 5th Edition (1996), Chapman & Hall, London.
3. Physical Chemistry, P. Atkins and J. De Paul, 8th Edition (2006), International Student Edition, Oxford University Press.
4. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications 1962.
6. Vogel, A.I. A Textbook of Quantitative Inorganic Analysis, ELBS.
7. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
8. Physical Chemistry, P. C. Rakshit, 5th Edition (1988), 4th Reprint (1997), Sarat Book House, Calcutta.
9. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma, and M. S. Pathania, 37th Edition (1998), Shoban Lal Nagin Chand & Co., Jalandhar.
10. Physical Chemistry, K. J. Laidler and J. M. Meiser, 3rd Edition, Houghton Mifflin Comp., New York, International Edition (1999).

**CUTM2455: General Biology-I**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200		

\* Note: TA-2 will be in form of assignments or workshops.

**Learning Objectives:**

1. Understanding of Cell structure and function
2. Knowledge of Microbial world
3. Conceptualisation of various aspects of genetics

**MODULE-I Cellular Organisation Teaching Hours: 15 Hours**

Cell and cellular organelles, The cell theory, Prokaryotic and Eukaryotic cells, Eukaryotic sub-cellular components: Nucleus, chromosomes, plasma membrane, endoplasmic reticulum, lysosomes, peroxisomes, Golgi apparatus, mitochondria, chloroplast, cytoskeleton. Cell cycle and its control; Cell division-amitosis, mitosis and meiosis.

**MODULE-2 Introduction to Microbiology Teaching Hours: 15 Hours**

Bacteria: General characteristics, cell structure of bacteria and their components, Classification of bacteria (Outline), mode of nutrition, mycoplasma, archaeobacteria, cyanobacteria. Fungi: General characteristics and classification Viruses: General characteristics and classification.

**MODULE-3 Basic of Genetics Teaching Hours: 15 Hours**

Introduction to genetics, pre-Mendelian, Mendelian and non-Mendelian inheritance, genetic linkage, recombination and crossing over, chromosomal basis of inheritance, mutations and mutagenesis, genetic basis of sex determination, extra-nuclear inheritance, exchange of genetic material-Conjugation, Transformation and Transduction.

**References and Suggested Readings:**

1. Nelson DL, Cox MM (2017) Lehninger Principles of Biochemistry, 7th Edition. W. H. Freeman
2. Stryer L, Berg JM, Tymoczko JL, Gatto GJ. (2015) Biochemistry, 8th Edition. W. H. Freeman
3. Voet DV, Voet JG. (2011) Biochemistry, Wiley
4. Pelczar Mi J., Chan, E.C.S., Krieg, NR, (2009). Microbiology, McGraw-Hill publisher
5. Satyanarayana U, (2013), Biochemistry Elsevier
6. Snustad DP, Simmons MJ. (2015) Principles of Genetics, 7th Edition , Wiley.
7. Albertis B, Jhonson A, Lewis L, Morgan D, Raff M, Roberts K, Emeritus, Walter P (2014) Molecular Biology of the Cell. 6th Edition, Garland Science

**CUTM2469: Communication skill**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
2	0	0	2	2	25	00:45	50	01:30	100	03:00	-	-	200

\* Note: TA-2 will be in form of assignments or workshops.

**Learning Objectives:**

1. To learn about importance of communication
2. To learn about the techniques to face interview, do group discussions, etc.

**MODULE-I Importance and process of Communication Teaching Hours: 15 Hours**

Verbal and Non-verbal process of Communication, How to face an interview, Group Discussion, How plan and conduct the Interviewer, importance of body language and gesture in interview, eye contact and appearance during interview process.

**MODULE-2 Different skills and its importance Teaching Hours: 15 Hours**

Listening, Developing Reading Skills, Developing Conversational skills, Technical Writing skills.

**References and Suggested Readings:**

1. Sreevalsan, MC; Spoken English, Vikash Publishing House, New Delhi.
2. Communication Skills; Sanjay Kumar, Pushphate, Oxford.
3. Krishna Mohan, Meera Banarjee, Developing Communication Skills.
4. Frank O' Connor, Phonetics, Penguin.
5. Business Correspondence and Report Writing- Sharma and Krishna Mohan- Tata McGraw.

**CUTM2456: Practical-1**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams			University Exams (LPW)	
					TA-1 & TA-2		MSE		Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs					
0	0	8	4	8							100	6:00	100

\* Note: TA-2 will be in form of assignments or workshops.

**Learning Objectives:**

At the end of course, students will be gaining the hands on training in the following courses;

**MODULE-1 Introduction to Forensic Science**

1. To study the history of crime cases from forensic science perspective.
2. To write report on different type of crime cases.
3. To review how the Central Fingerprint Bureau, New Delhi, coordinates the working of State Fingerprint Bureaus.
4. To examine the list of projects undertaken by the Bureau of Police Research and Development and suggest the thrust areas of research in Police Science.
5. To compare the code of conduct prescribed by different establishments for forensic scientists.

**MODULE-2 Crime Scene Management**

1. To prepare a report on evaluation of crime scene.
2. To establish chain of custody and note taking at crime scene.
3. To reconstruct an indoor crime scene.
4. To reconstruct an outdoor crime scene.
5. Collection, Packaging and Preservation of the evidences.

**MODULE-3 Crime & Society**

1. To review crime cases where criminal profiling assisted the police to apprehend the accused.
2. To evaluate how rising standards of living affect crime rate.
3. To review the recommendations on modernization of police stations and evaluate how far these have been carried out in different police stations.
4. To prepare a report on interrogation cells and suggest improvements.

**MODULE-4 General Physics-I**

1. To determine force, velocity and acceleration of moving object.
2. To determine angle of minimum deviation for a given prism by plotting a graph between angle of incidence and angle of deviation
3. To find the refractive index of a liquid by using convex lens and plane mirror.
4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.
5. To study the variation of Thermo Electric EMF with temperature using the thermocouple using the kit.

**MODULE-5**

**General Chemistry-I**

1. Determination of anions by chemical tests
2. Determination of cations of group 0, 1, & 2 by chemical tests.
3. Determination of melting point of organic solids.
4. Determination of viscosity of sugar solution
5. Determination of effect of temperature on viscosity of solution.

**MODULE-6**

**General Biology-I**

1. Visualization of animal cells under microscope
2. Visualization of bacterial cells under microscope
3. Visualization of mitosis in plant cell
4. Isolation of bacteria from soil/water sample
5. Mendelian inheritance using seeds of different colour/sizes of any plant

# Semester II

**CUTM2457: Criminal and Evidence Law**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200		

\* Note: TA-2 will be in form of assignments or workshops.

**Learning Objectives:**

1. To develop concepts about law and legal procedures, courts, IPC, CrPC & IEA.
2. To learn about police, police organizations at national & international levels.
3. To learn about NDPS Act, Explosives Act, Environment Protection Act, etc.

**MODULE-1 Law Teaching Hours: 15 Hours**

Definition of Law, Court, Judge, Basic Terminology in Law, Introduction to Criminal Procedure Code, FIR, Difference between civil and Criminal Justice, Object of Punishment, Kinds of Punishment, Primary and Sanctioning Rights Primary and Secondary functions of Court of Law. Law to Combat Crime-Classification – civil, criminal cases. Essential elements of criminal law. Constitution and hierarchy of criminal courts.

Criminal Procedure Code. Cognizable and non-cognizable offences. Bailable and nonbailable offences. Sentences which the court of Chief Judicial Magistrate may pass.

Laws specific to Forensic Science: Indian Penal Code pertaining to offences against persons – Sections 121A, 299, 300, 302, 304A, 304B, 307, 309, 319, 320, 324, 326, 351, 354, 359, 362. Sections 375 & 377 and their amendments.

Indian Evidence Act – Evidence and rules of relevancy in brief. Expert witness. Cross examination and re-examination of witnesses. Sections 32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137, 138, 141. CrPC – Sections 291, 291A, 292 & 293 in the code of criminal procedure.

**MODULE-2 Police Science Teaching Hours: 15 Hours**

Definition and scope----Police organization under central government: general information about their structure and function BPR&D, CBI, IB, RAW, NCRB, NICFS, NPA, UT Police Force International Police Organization: INTERPOLE- history, structure general and special notices State Police organization: general organization of police at state and range level. Police organization at district level.

**MODULE-3      Acts Relating to Socio-economic and Environmental Crimes      Teaching  
Hours: 15 Hours**

Narcotic Drugs and Psychotropic Substances Act. Essential Commodity Act. Drugs and Cosmetics Act. Explosive Substances Act. Arms Act. Dowry Prohibition Act. Prevention of Food Adulteration Act. Prevention of Corruption Act. Wildlife Protection Act. I.T. Act. Environment Protection Act. Untouchability Offences Act

**References and Suggested Readings:**

1. D.A. Bronstein, Law for the Expert Witness, CRC Press, Boca Raton (1999).
2. Vipa P. Sarthi, Law of Evidence, 6th Edition, Eastern Book Co., Lucknow (2006).
3. A.S. Pillia, Criminal Law, 6th Edition, N.M. TripathiPvt Ltd., Mumbai (1983).
4. R.C. Nigam, Law of Crimes in India, Volume I, Asia Publishing House, New Delhi (1965).
5. (Chief Justice) M. Monir, Law of Evidence, 6th Edition, Universal Law Publishing Co. Pvt. Ltd., New Delhi (2002).

**CUTM2458: Fingerprint Science**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200		

\* Note: TA-2 will be in form of assignments or workshops.

**Learning Objectives:**

1. To learn about fingerprint science, its development and various aspects.
2. To learn about various classification systems of fingerprints.
3. To learn about development and analysis of fingerprint by various physical and chemical methods.

**MODULE-1 History and Basics of Fingerprints Teaching Hours: 15 Hours**

History of Fingerprint Science, main function of Fingerprint bureau, main function of Fingerprint bureau, Development of Fingerprint Science, Composition of sweat and secretion of sweat, Pattern types & Ridge characteristics, Ridge tracing, Ridge counting.

**MODULE-2 Classification Methods of Fingerprints Teaching Hours: 15 Hours**

Various systems for Fingerprint classification, Henry classification system, numerical value, symbol, primary classification, secondary classification, sub-secondary classification and final classification, NCIC classification, AFIS classification.

**MODULE-3 Development and Analysis of Fingerprint Teaching Hours: 15 Hours**

Development, Identification & Presentation of Fingerprint, Known prints & Rolled impressions, Direct or Inked prints, Development of Latent Prints & Lifting techniques, Physical & chemical Methods: Powder techniques & Various chemical techniques, Processing of Post developed prints. Fingerprint comparison & Identification, Introduction to AFIS.

**References and Suggested Readings:**

1. David R. Ashbaugh; Quantitative and Qualitative Friction Ridge Analysis, CRC Press

2. E. Roland Menzel; Fingerprint Detection, with Lasers, Second edition; Marcel, Dekker, Inc. USA.
3. James F. Cowger; Friction Ridge skin CRC Press London.
4. Mehta, M.K: Identification of Thumb Impression & Cross Examination of Finger Prints, N. M. Tripathi (P) Ltd, Bombay.
5. Moenssens: Finger Prints Techniques, Chitton Book Co. Philadelphia, New York.
6. Chatterjee S.K., Speculation in Finger print identification, Jantralekha, Printing Works, Kolkata.
7. Cowger, James F: Friction ridge skin: Comparison and Identification of Fingerprints; CRC Press, Boca Raton, New York.

**CUTM2459: Questioned Document**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200		

\* Note: TA-2 will be in form of assignments or workshops.

**Learning Objectives:**

1. To learn about questioned documents, various tools for its examination and age of document.
2. To learn about fundamentals of handwritings, printed documents, and their comparison.
3. To learn about various alterations used in documents.
4. To learn about charred documents and its examination.
5. To learn about Examination of Counterfeit Indian Currency Notes, Passports, Visas, stamp pads, credit card, visa, seal and other mechanical impressions.

**MODULE-1 Basics of Questioned Document Teaching Hours: 15 Hours**

Definition of Questioned Document, Types of Questioned Document, Preliminary Examination of Questioned Document. Basic Tools Needed for Forensic Document Examination- Ultraviolet, Visible, Infrared, and Fluorescence Spectroscopy, Photomicrography, Microphotography, Visible Spectral Comparator, Electrostatic Detection Apparatus. Determining the Age and Relative Age of Documents.

**MODULE-2 Fundamentals of Questioned Document Teaching Hours: 15 Hours**

Comparison of Handwriting, Determination of sequence of strokes, Development of Individuality in Handwriting, Natural Variations and Fundamental Divergences in Handwriting, Class & Individual Characteristics.

Merits and Demerits of Exemplar and Non-Exemplar Samples During Comparison of Handwriting. Standards for Comparison of Handwriting, Comparison of Paper, Ink, Printed Documents, Typed Documents, Xeroxed Documents.

**MODULE-3 Examination of Questioned Document Teaching Hours: 15 Hours**

Alterations in Documents, Including Erasures, Additions, Over-Writing, and Obliterations. Indented and Invisible Writings. Charred Documents. Examination of Counterfeit Indian Currency Notes, Passports, Visas, stamp pads, credit card, visa, seal and other mechanical impressions.

**References and Suggested Readings:**

1. Hardless H.R. (1988). Disputed Documents, Handwriting and Thumbs –Print Identification, Profusely Illustrated. India: Low Book Co.
2. Rev. ED.; Ordway Hilton; Scientific Examination. I of Questioned Documents, Elsevier, NewYork.
3. Charles C. Thomas, I.S.Q.D. Identification System for Questioned Documents; Billy PriorBates Springfield, Illinois, USA.
4. Wilson R. Harrison; Suspect Documents -Their Scientific Examination; Universal LawPublishing, Delhi.
5. Hard less, H.R: Disputed Documents, handwriting and thumbs -print identification: profuselyillustrated, Low Book Co., Allahabad.
6. Morris, Ron, N: Forensic handwriting identification, Acad Press, London.
7. Kurtz Sheila: Graphotypes a new plant on handwriting, analysis, Crown Publishers Inc., USA.
8. Lerinson Jay; Questioned Documents, Acad Press, London.

**CUTM2460: General Physics-II**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200		

\* Note: TA-2 will be in form of assignments or workshops.

**Learning Objectives:**

1. To learn about atom and their characteristics
2. To learn about nucleus and their properties
3. To learn the fundamentals of lasers and holography
4. To learn the basics of electricity and magnetism

**MODULE-1 Atomic and Nuclear Physics Teaching Hours: 15 Hours**

**Atomic Physics:** Structure of atom. Rutherford's model of atom; Bohr model, energy levels, hydrogen spectrum. Idea of discrete energy levels and electron spin: Franck-Hertz and Stern-Gerlach experiments, Significance of four quantum numbers, Pauli's exclusion principle, Orbital magnetic dipole moment, Orbital, spin and total angular momenta, and Vector model of atom.

**Nuclear Physics and Radioactivity:** Composition and size of nucleus, atomic masses, isotopes, isobars, isotones. Alpha, beta and gamma particles/rays and their properties; radioactive decay law. Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number; nuclear fission and fusion.

**MODULE-2 Lasers Teaching Hours: 15 Hours**

**Introduction to Lasers:** Characteristics of laser light, Spontaneous emission, Stimulated emission, Stimulated absorption, Einstein coefficients, Characteristics of laser radiation, Population inversion and condition for light amplification, Essential components of the laser, Optical resonator, CW and pulsed laser, peak power and pulse energy.

**Application of lasers:** Holography: Formation of a hologram, Reconstruction of the hologram, Requirements, Application In forensic investigation.

**MODULE-2 Electricity and Magnetism Teaching Hours: 15 Hours**

**Electric field and potential:** Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry. Conservative nature of

Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. Electrostatic energy of a charged sphere.

**Magnetic Field:** Biot-Savart Law and its simple applications: straight wire and circular loop. Ampere's Circuital Law and its application solenoid and wire. Properties of magnetic field: curl and divergence. Magnetic Force on (a) point charge (b) current carrying Torque on a current loop in a uniform Magnetic Field.

**Electromagnetic Induction:** Faraday's Law. Lenz's Law. Self-Inductance and Mutual Inductance. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and Displacement current.

**Reference books:**

1. Physics of atoms and molecules, B. H. Bransden and C. J. Joachain, 2003, Pearson.
2. Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
3. Laser Fundamentals, William T. Silfvast, 2008, Cambridge University Press.
4. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw.
5. Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education.
6. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edition, 1998, Benjamin Cummings.

**CUTM2461: General Chemistry-II**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200		

\* Note: TA-2 will be in form of assignments or workshops.

**Learning objectives:**

1. To learn about about various analytical techniques.
2. To learn about calibration and standards.
3. To learn about basic electrochemistry.
4. To learn about basic nuclear and radiation chemistry.

**MODULE-1 Analytical Chemistry Teaching Hours: 15 Hours**

**Concepts of Controls & Standards:** Calibration, Positive and Negative control, False positive and false negative results, Reference Standards, Certified Reference Materials, Internal Standards and Internal Standardisation Method, Standard Addition Calibration Method.

**Statistical Evaluation:** Determinant and indeterminate errors, Normal error curve, Accuracy and Precision, Relative and standard deviation, Methods for minimizing errors, Criteria for rejection of observation, Significant figures and computation rules, Error propagation.

**Precipitation:** Desirable properties of gravimetric precipitates, Formation of gravimetric precipitates, Conditions for quantitative precipitations, Contamination in precipitates, Method for removal of impurities in precipitates, Steps involved in quantitative precipitation, Organic precipitants (oxine, dithizone,  $\alpha$ -nitroso-(naphthol, cupferon, dimethyl glyoxime) in chemical analysis.

**Analytical Reagents:** Theoretical and practical aspects of the use of EDTA, cerate, iodate, bromate, chloramine-T, Karl Fischer and periodate reagents in chemical analysis.

**Radio-Analytical Methods:** Elementary theory, Isotope dilution and Neutron activation methods and applications.

**MODULE-2 Electrochemistry Teaching Hours: 15 Hours**

Arrhenius theory of electrolytic dissociation, Hydrolysis of salts, hydrolysis constant, buffer solutions, indicators and theory of acid-base indicators. Migration of ions: transference number and its determination by Hittorf methods. Conductance of electrolyte solutions, molar conductance of electrolyte and its splitting into ionic molar conductance, Kohlrausch law of

independent migration of ions, ionic mobility. Application of conductance measurements: determination of degree of dissociation and dissociation constant of weak electrolytes/acids, solubility of sparingly soluble salts, and Conductometric titrations.

**MODULE-3                      Nuclear and Radiation Chemistry                      Teaching Hours: 15 Hours**

Nucleus and its classification, nuclear forces, nuclear binding energy, stability of nucleus. Radioactivity: Radioactive elements, general characteristics of radioactive decay, decay kinetics (decay constant, half-life, mean life period), units of radioactivity. Nuclear fission: the process, fragments, mass distribution, and fission energy. Nuclear reactor: the natural uranium reactor, classification of reactors, breeder reactor. Nuclear fusion and stellar energy.

**Radiation chemistry:** Elementary ideas of radiation chemistry, radiolysis of water and aqueous solutions, unit of radiation chemical yield (G-value), radiation dosimetry (Fricke's dosimeter), units of radiation energy (Rad, Gray, Rontgen, RBE, Rcm, Sievert)

**Reference Books:**

1. Modern Methods of Chemical Analysis', R.L. Pecscock, L.D. Shields, T. Cairns, and I.C. Mc William, 2nd Edition (1976), John Willey, New York.
2. 'Basic Concepts of Analytical Chemistry', S.M.Khopkar, 2nd edition (1998), New Age International Publications, New Delhi.
3. 'Analytical Chemistry', G.D. Christian, John Willey & sons, New York (2001).
4. Instrumental Methods of Analysis', H.H. Willard, L.L. Merritt, and J.A. Dean, 6th edition (1986), CBS Publishers & Distributors, Shahdara, Delhi.
5. Principles of Instrumental Analysis, D.A. Skoog, F.J. Holler and T.A. Nieman, 5th edition (1998), Horcourt Brace & Company, Florida.
6. Physical Chemistry, P. Atkins and J. De Paul, 8th Edition (2006), International Student Edition, Oxford University Press.
7. Physical Chemistry, P. C. Rakshit, 5th Edition (1988), 4th Reprint (1997), Sarat Book House, Calcutta.
8. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma, and M. S. Pathania, 37th Edition (1998), Shoban Lal Nagin Chand & Co., Jalandhar.
9. Physical Chemistry, K. J. Laidler and J. M. Meiser, 3rd Edition, Houghton Mifflin Comp., New York, International Edition (1999).
10. Essentials of Nuclear Chemistry H. J. Arnikar, 4th Edition (1995), New Age International (p) Ltd., Wiley Eastern Ltd., New Delhi.

**CUTM2462: General Biology-II**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200		

\* Note: TA-2 will be in form of assignments or workshops.

**Learning Objectives:**

1. Knowledge of Human anatomy and physiology
2. Understanding of concept of evolution and ecology
3. Knowledge of Plant anatomy and physiology

**MODULE-1      Animal-Anatomy and Physiology      Teaching Hours: 15 Hours**

Animal cell and Animal tissues- Type, structure, location and function, Basics of Human physiology (Parts and their functions)-Digestive system, Respiratory system, Circulatory system, Excretory system, Skeletal system, Muscular system, Nervous system and Endocrine system, Entomology-General characteristics of Arthropoda, Characteristics features, classification of insects, Life cycle of insect (Flies, Beetles).

**MODULE-2      Evolution and Ecology      Teaching Hours: 15 Hours**

**Evolution:**

Theories of Origin of life, Biological evolution and evidences for biological evolution, Theories of evolution; Mechanism of evolution - variation (mutation and recombination) and natural selection with examples, types of natural selection, Gene flow and genetic drift, Hardy - Weinberg's principle, Adaptive radiation

**Ecology:**

Ecological hierarchy, Habitat and niche, Components of environment, Effect of abiotic factors of environment, Ecological adaptations, Population and population attributes; population interactions, Ecosystem- Components; productivity and decomposition; energy flow; Ecological pyramids; Nutrient cycles; Ecological succession, Ecological services

**MODULE-3      Plant-Anatomy and Physiology      Teaching Hours: 15 Hours**

Plant cell, Morphology of different parts of flowering plants- root, stem, leaf, flower, fruit and seed, Structure of pollen grain and its role in species identification, Diatoms- Characteristic and structure, Plant anatomy-Location and functions of different tissues and tissue systems in flowering plants, Basics of plant physiology-Transport in Plants, Growth and Development.

**References and Suggested Readings:**

1. Jennifer L. Regan, Andrew F. Russo, Cinnamon L. VanPutte (2021) Seeley's Essentials of Anatomy and Physiology, 11th Edition. McGraw Hill
2. Elaine N. Marieb, Suzanne Keller (2017) Essentials of Human Anatomy & Physiology Global Edition, 12th Edition ,Pearson Education
3. Richard Crang, Sheila L. Sobaski (2018) Plant Anatomy: A Concept-Based Approach to the Structure of Seed Plants, 1<sup>st</sup> Edition, Springer
4. S N Pandey, B K Sinha (2005)Plant Physiology, 4<sup>th</sup> Edition, S Chand
5. William G. Hopkins , Norman P A Huner (2013) Introduction to Plant Physiology 4<sup>th</sup> Edition, Wiley India
6. T M Smith, R L Smith (2015) Elements of Ecology Global Edition, 9<sup>th</sup> Edition , Pearson Education India
7. Douglas J. Futuyma (2020), Mark Kirkpatrick Evolution, 4th Edition, Oxford University Press

**CUTM2470: English**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
2	0	0	2	2	25	00:45	50	01:30	100	03:00	-	-	200		

\* Note: TA-2 will be in form of assignments or workshops.

**Learning Objectives:**

1. To develop understanding about basic grammar.
2. To learn how to write different letters, paragraph, essay, etc.

**MODULE-I Basic Grammar Teaching Hours: 15 Hours**

Articles, Verbs: Auxiliaries, Finite and Non Finites, Time and Tens, Subject: Verb Agreement (concord), Active and Passive Voice, Narration, Single word / verb substitution, Common Error, Comparison, Antonym, homonym, Sentence, Building (Vocabulary).

**MODULE-2 Formal and Official Writing Teaching Hours: 15 Hours**

Précis, Essay, Paragraph Writing and Comprehension, Official Correspondence, Memorandum; Circular Letter.

**References and Suggested Readings:**

1. English Grammar- N.D. Turton, ABC of Common Grammatical Error for learners and Teachers.
2. English Grammar- Dr. K.K. Ramchandran et al; business Communication.
3. Technical English- Sharon j Gerson and Steven M Gerson
4. Angela Burt, Quick Solutions to common Error in English.
5. W. Foulsham, The Complete letter writer.
6. John East wood- Oxford guide to English Grammar.

**CUTM2463: Practical-II**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory					Practical		Total			
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks		Hrs	Marks	Hrs
					Marks	Hrs	Marks	Hrs							
0	0	8	4	8							100	6:00	100		

\* Note: TA-2 will be in form of assignments or workshops.

**Learning Objectives:**

At the end of course, students will be gaining the hands on training in the following courses;

**MODULE-I Criminal and Evidence Law**

1. To study a crime case in which an accused was punished under different sections.
2. To study a case in which Drugs and Cosmetic Act was invoked.
3. To study a case in which Explosive Substances Act was invoked.
4. To study a case in which Arms Act was invoked.
5. In light of Section 304B of the Indian Penal Code, cite a case involving dowry death.

**MODULE-2 Fingerprint**

1. To record plane and rolled fingerprints.
2. To identify different fingerprint patterns.
3. To carry out digit classification of fingerprints.
4. To investigate physical method of fingerprint detection.
5. To use different light sources for enhancing to develop fingerprints.

**MODULE-3 Questioned Documents**

1. Authorship identification through handwriting.
2. Identification of forgery in signatures.
3. Detection of tampering in documents.
4. Variation in handwriting under natural conditions.

**MODULE-4 General Physics-II**

1. Determine the divergence and beam spot of a laser beam.



# **SEMESTER-III**



4. Shapiro, D. L.: Forensic Psychology Assessment – An Investigative Approach, Allen & Bacon, 1991.
5. Kleiner, M.: Handbook of Polygraph Testing, Academic Press, 2002.
6. Turrey, B.: Criminal profiling – An Introduction to Behavioral Evidence Analysis, Academic Press, 1999.

**CUTM2465: Forensic Chemistry – I**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200		

**Learning Objectives:**

1. To help students learn basics of forensic chemistry.
2. To help students learn about quality management.
3. To study and understand Narcotics and psychotropic substances.
4. To learn about explosives, arson and petroleum products.

**MODULE-1 Quality Management**

**Teaching Hours: 15 Hours**

**Forensic chemistry:**

- Introduction to forensic chemistry, Types of cases/exhibits received for analysis, Overview of forensic chemical analysis

**Quality management:**

- Introduction to Quality, Quality Assurance, Quality control, TQM
- Definition of Accreditation, History and development of ISO
- Importance of accreditation in Forensic science laboratories, Process of accreditation, Quality system, International Laboratory Accreditation Co-operation (ILAC), Asia Pacific Laboratory Accreditation Co-operation (APLAC). American Society of Crime Laboratory Directors (ASCLD)
- Traceability and Validation of new methods, measurement of uncertainty, Equipment maintenance and calibration
- Proficiency testing, internal audit/External audit, MRM Training and conferences

**MODULE-2 Narcotic Drugs & Explosives**

**Teaching Hours: 15 Hours**

**Narcotic Drugs & Psychotropic Substances:**

- Introduction to NDPS drugs, Controlled Substances, Classification of controlled substances, Precursor chemicals, Narcotic raids and clandestine drug laboratories investigation, Mandatory provisions of NDPS Act, 1985.
- Drug addiction (Physical & Psychological), Drug dependence and Drug Tolerance.
- Designer Drugs, Analysis of Drug of abuse by colour test and TLC.
- Case studies.

**Explosives:**

- Introduction, Classification and chemistry of explosives; Post blast investigation.
- Systematic examination of explosive and explosion residues (organic and inorganic) by colour test and TLC.
- Case studies.

**MODULE-3 Fire & Petroleum products**

**Teaching Hours: 15 Hours**

**Introduction to Fires & Arson Investigation:**

- Introduction to Thermodynamics and Chemistry of Fire, Investigation of Fire and Arson, Forensic Analysis of Fire Debris by Instrumental methods, Case studies.

**Forensic Analysis of Petroleum Products:**

- Introduction to Petroleum Products and Analysis of Petrol, Kerosene and Diesel as per BIS Specifications. Case Studies

**Reference Books:**

1. J ASiegel, P.J Saukko (2000) Encyclopaedia of Forensic Sciences Vol. I, II and III, Acad. Press.
2. NABL -, Guide for Internal audit and Management Review for Laboratories.
3. NABL-210, Assessor Guide Issue No.3, 1.5.2002.
4. DFSS: Manuals of Forensic Sciences.
5. Maudham Bassett et al.; Voget's Textbook of Quantitative Chemical Analysis, 6th Ed. Longman Essex.
6. Brean S. Furniss Etal; A.I. Vogel Textbook of Practical Organic Chemistry, Addison Wesley Longman, Edinburg.
7. D A Skoog, D.M. West, F.J. Holler; Analytical Chemistry – An Introduction, 7th Ed. Saunders College Pub, Philadelphia, USA.
8. Boudreau JE, Etal; Arson & Arson Investigation, Survey & Assessment National Institutes of Law Enforcement, U.S. Deptt. Of Justice, U.S. Govt Printing Press.
9. Dettean J D; Kirk's Fire Investigation, 5th Ed. Prentice Hall, Eaglewood Cliffs, N. J.
10. Yinon Jitrin; Modern Methods & Application in Analysis of Explosives, John Wiley & Sons, England.
11. Working Procedure Manual – Chemistry, Explosives and Narcotics, BPR&D Pub.
12. C.A. Watson; Official and Standardized Methods of Analysis, Royal Society of Chemistry, UK.
13. Feigl; Spot Test in Inorganic Analysis, Elsevier Pub. New Delhi.
14. Feigl; Spot Test in Organic Analysis, Elsevier Pub. New Delhi.
15. Silverman; Organic Chemistry of Drug Design & Drug Action, Elsevier Pub. New Delhi.
16. Abraham Burger; Medicinal Chemistry & Drug Discovery, 6 Vol Set, 6th Ed John Wiley & Sons, NY.
17. NDPS Act, 1985.

**CUTM2466: Forensic Physics – I**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200

**Learning objectives:**

1. Students will be able to explain the properties of the materials, glass and soil nature
2. Students will be able to examine different types of papers and paint.
3. Students will gain understanding of road collisions and reconstruction of the incidents.

**MODULE-1**

**Glass**

**Teaching Hours: 15 Hours**

Introduction to glass, Types of glass and their compositions, Forensic examination of glass fractures under different conditions, determination of direction of impact: hackle marks, backward fragmentation, Physical measurements of glass, color and fluorescence, physical matching, density comparison, physical measurements, refractive index by refractometer, elemental analysis, and interpretation of glass evidence, Case Studies.

**MODULE-2**

**Paints**

**Teaching Hours: 15 Hours**

Introduction, Composition, Manufacture of Paint, types of paint, Forensic Examination of Paints and Coatings: Collection and Preservation of paint samples, macroscopic and microscopic techniques for the characterization of Paint Fragments, Physical, Chemical & Instrumental analysis of paint, interpretation of Paint Evidence, Case Studies.

**MODULE-3**

**Soil**

**Teaching Hours: 15 Hours**

Soil and its composition, Classification of soil, Collection and preservation of soil as a evidence, analysis of soil samples: Physical, chemical and instrumental, interpretation of soil evidence, Soil as a geomarker, Case Studies.

**References and Suggested Readings:**

1. Forensic Science Evidence: Can the Law Keep Up With Science (Criminal Justice: Recent Scholarship by Donald E. Shelton.
2. M. Byrd, *Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence*, CRC Press, Boca Raton (2001).
3. T.J. Gardener and T.M. Anderson, *Criminal Evidence*, 4th Ed., Wadsworth, Belmont (2001).

4. 3. S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2nd Edition, CRC Press, Boca Raton (2005).
5. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, *Techniques of Crime Scene Investigation*, CRC Press, Boca Raton (2013).

**CUTM2467: Basics of Computer & Biometrics**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200		

**Learning Objectives:**

At the end of this course, student will gain understanding about;

1. Number systems
2. Computer fundamentals
3. Basics of Computer Networking and Internet

**MODULE-1 Number Systems and Computer Fundamentals Teaching Hours: 15 Hours**

Introduction to Binary, Octal, Decimal and Hexadecimal Number Systems; Conversion from Binary to Decimal, Decimal to Binary, Binary to Hexadecimal, Hexadecimal to Binary; Representation of signed and unsigned Binary Numbers; Arithmetic, Logical, Relational and Shift Operations on Binary Numbers; ASCII and UTF.

Definition of Computer, History, Key Terms, Hardware and Software, Primary and Secondary Storage Devices; Basics of Operating System, Introduction to Filesystems, Windows and Linux OS architectures; Introduction to Computer Related Crimes.

**MODULE-2 Basics of Computer Networking and Internet Teaching Hours: 15 Hours**

Definition of Computer Network, Components of Network, Topology and Types of network, Introduction to OSI layer and TCP / IP protocol suite, Communication Devices, IP and MAC Addresses, Understanding Internet, Introduction to websites and webpages; understanding Firewall, IDS and IPS; Introduction to Network and Internet Related Crimes.

**MODULE-3 Introduction to Biometrics Teaching Hours: 15 Hours**

Introduction - Biometric fundamentals - Biometric technologies - Biometrics vs traditional techniques - Characteristics of a good biometric system - Benefits of biometrics - Key biometric processes: verification, identification and biometric matching - Performance measures in biometric systems. Physiological and behavioural biometrics.

**References and Suggested Readings:**

- 
1. Operating Systems | Internals and Design Principles, Ninth Edition by William Stallings
  2. Modern Operating Systems 4e by Tanenbaum
  3. Structured Computer Organization 6/e Paperback by Tanenbaum
  4. Computer Networks: A Top - Down Approach by FOROUZAN
  5. TCP/IP Protocol Suite E/4 by Behrouz A. Forouzan

<b>UGFS S3 CE-1</b>	<b>Core Elective - I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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<b>UGFS S3 SE -3</b>	<b>Skill Based Elective - III</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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Yoga and its benefits

**CUTM2468: Practical-III**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams			University Exams (LPW)	
					TA-1 & TA-2		MSE		Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs					
0	0	8	4	8							100	6:00	100

**Learning Objectives:**

At the end of course, students will be gaining the hands on training in the following courses;

**MODULE-I Forensic Psychology**

1. To cite a crime case where legal procedures pertaining to psychic behavior had to be invoked.
2. To prepare a report on relationship between mental disorders and forensic psychology.
3. To review a crime case involving serial murders. Comment on the psychological traits of the accused.
4. To cite a crime case involving a juvenile and argue for and against lowering the age for categorizing an individual as juvenile.
5. To cite a criminal case in which narco analysis was used as a means to detect deception.

**MODULE-2 Forensic Chemistry-I**

1. Identification of NDPS drugs by colour test and TLC.
2. Detection of low explosives by chemical/colour test and TLC.
3. Examinations of petroleum products as per BIS specifications.
4. Identification of alcoholic beverages as per BIS specifications.
5. Analysis of phenolphthalein in bribe trap cases.

**MODULE-3 Forensic Physics-I**

1. Density gradient analysis of soil samples.
2. Determination of density of glass by specific gravity bottle method
3. Restoration of erased identification marks.
4. Determination of refractive index of glass and liquid.
5. Comparison of broken glass bangles.
6. Physical matching of broken pieces of different objects.
7. Determination of tensile strength of rope/dupatta.
8. Physical examination of paint samples by microscopic method

**MODULE-4 Basics of Computer**

1. Learning how to install and configure Linux OS
2. Understanding basic Windows OS administration (setting IP address, other network settings, adding/removing software/hardware, device driver settings, configuring printer, etc.).
3. Configuring Windows Firewall and Defender
4. Working with Windows Backup and Restore options

# **SEMESTER-IV**



Thermal deaths – electrocution-sexual offences- investigations of victim and accused. Child abuses –human trafficking investigative protocols.

**References and Suggested Readings:**

1. K. Smyth, *The Cause of Death*, Van Nostrand and Company, New York (1982).
2. M. Bernstein, *Forensic odontology in, Introduction to Forensic Sciences*, 2nd Ed., W. G. Eckert (Ed.), CRC Press, Boca Raton (1997).
3. J. Dix, *Handbook for Death Scene Investigations*, CRC Press, Boca Raton (1999).
4. H. B. Baldwin and C. P. Mayin, *Encyclopaedia in Forensic Science*, Volume 1, J. A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).
5. V. J. Geberth, *Practical Homicide Investigation*, CRC Press, Boca Raton (2006).
6. T. Beveland R. M. Gardner, *Bloodstain Pattern Analysis*, 3rd Edition, CRC Press, Boca Raton (2008).

**CUTM2900: Fundamentals of Forensic Toxicology**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200

**Learning Objectives:**

1. To help students learn basic principles of toxicology.
2. To help students learn about xenobiotic and toxic effects.
3. To study and understand concepts of mechanism of toxicity.
4. To learn the concepts of toxicological examination.

**Module-1 Basics of Forensic Toxicology**

**Teaching Hours: 15 Hours**

History, Scope and Significance, Crime scene involving poisons, medico legal aspects of poisoning, Laws related to poisons, nodal agencies and stake holders in forensic toxicology, nature of forensic toxicological examinations, Roles and Responsibilities of forensic toxicologists, drug paraphernalia, poisoning management, Format of autopsy report and laboratory report, expert witness testimony.

**Module-2 Collection and Preservation**

**Teaching Hours: 15 Hours**

Biological and non-biological samples, classes of matrices, National and International guidelines of toxicological sample collection, post-mortem examination, types of viscera, viscera collection and preservation, types of preservatives, types of containers, self-life of samples, Safety measures of toxicological samples handling, Personal Protective Equipment (PPEs).

**Module-3 Extraction and Examination**

**Teaching Hours: 15 Hours**

Extraction of poisons from biological and non-biological samples, Methods of Extraction, Liquid-Liquid extraction, extraction methods for acidic, basic and neutral poisons, extraction of volatile and non-volatile poisons, extraction of plant poisons, common methods of poison detection, chemical tests, Instrumental methods for toxicological examination, Toxicological analysis of decomposed material and body remains, challenges in forensic toxicological examination.

**Reference Books:**

1. Modi JS: Medical Jurisprudence and Toxicology
2. Taylor: Medical Jurisprudence
3. Parikh CK: Medical Jurisprudence and Toxicology
4. Keith Simpsen & Bernard Knight: Forensic Medicine
5. Poison, CJ, DJ Gee, B. Knight: Forensic Medicine
6. Reddy: Forensic Medicine
7. Laboratory Procedure Manual- Forensic Toxicology, DFS, MHA, New Delhi
8. Pharmacology and Therapeutics-Bhandarkar & Satoskar
9. Medical Pharmacology- Tripathy
10. Essentials of Toxicology- Ellenhorn

**CUTM2901: Forensic Ballistics**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200		

**Learning Objectives:**

After studying this paper the students will know –

1. The classification of firearms and their firing mechanisms.
2. The methods of identifying firearms.
3. The characteristics of ammunition.
4. The importance of firearm evidence.
5. The nature of firearm injuries.
6. The methods for characterization of gunshot residue

**MODULE-1                      Firearms and Ammunition                      Teaching Hours: 15 Hours**

Firearms characteristics & classification of firearms, History and background of firearms, Functional assembly & Operating principle of firearms, Characteristics & Working mechanism of Standard: Rifled firearms, Small arms, Shot guns & Non-standard: Improvised, Country made, Imitative firearms, identification of origin. Ammunition & its constructional parts, Classifications of Ammunition on basis of constructional features, Functional assembly of different types of ammunition & their types, Safety aspects for handling firearms and ammunition, cartridge-firing mechanism.

**MODULE-2                      Basics of Ballistics                      Teaching Hours: 15 Hours**

Types of ballistics & their aspects, Internal, External, and Terminal Ballistics, General elementary & other principal problems: Heat problems, Pressure, Recoil, Vibration & Jump, Barrel Fouling, Trajectory formation & its computation, Vacuum Trajectories & its measurement, Influence of earth trajectory, Effect of air resistance on trajectories, Parameters involved in exterior ballistics. Effect of projectile on target based on: nature of target, bullet shape, striking velocity, striking angle and nature of target, intermediate targets, and range.

**MODULE-3      Analysis of Firearm and Gunshot Residues (GSR)      Teaching Hours: 15 Hours**

Identification of firearms, ammunition and their components: Principles, Processing of Firearm Exhibits involved, Class characteristics & Individual characteristics (Identifiable marks)

produced during firing process on cartridge cases & projectiles and their linkage with firearms. Analysis of GSR –Composition of GSR, Location & Collection, Mechanism of formation, Chemical & Instrumental techniques involved in analysis, Shooter Identification technique. Case studies related to firearms cases.

**References and Suggested Readings:**

1. J. Howard Mathews; Charles C. Thomas, Firearms Identification, Vols 1, 2, & 3; Springfield, Illinois.
2. Hatcher, Jury And Weller, Firearms Investigation, Identification And Evidence; Stackpole Books, Harrisburg, P. A.
3. Vincent Di Maio, Gunshot Wounds; CRC Press, Washington, Dc.
4. Brain J. Heard., Hand Book Of Firearms And Ballistics; John Willey, England.
5. TA, Warlow., Firearms, The Law And Forensic Ballistics; Taylor And Francis, Landon.
6. Karl G. Sellier et al., Wound Ballistics And The Scientific Background; Elsevier, London.
7. M. Johari, Identification Of Firearms, Ammunition And Firearms Injuries; BPR&D, New Delhi.

**CUTM2902: Forensic Biology and Wildlife Forensics**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200

**Learning Objectives:**

After studying this course, the students will be able to explain-

1. The significance of biological evidence.
2. The forensic importance of hair evidence.

**MODULE-1                      Introductory Forensic                      Teaching Hours: 15 Hours**

Brief History of Forensic Biology: Developments and Scope in the field of Forensic Biology, Branches of Forensic Biology Different types of biological Evidences and their significance in Forensic Science Collection, Preservation, Packing, Forwarding and Documentation of Biological Evidences.

Types and identification of microbial organisms of forensic significance, case studies.

Introduction to wood and its anatomy, Identification of endangered wood & its significances, case studies.

Forensic Palynology: Introduction and history of palynology, structure of pollen, identification and comparison of pollen, forensic significance, case studies.

Significance of hair evidence. Transfer, persistence and recovery of hair evidence. Structure of human hair. Comparison of hair samples. Morphology and biochemistry of human hair. Comparison of human and animal hair, case studies.

Introduction and classification of fibers, identification and comparisons of fibers and different microscopic, spectroscopic and chromatographic techniques, case studies.

**MODULE-2                      Forensic Limnology & Forensic Entomology                      Teaching Hours: 15 Hours**

**Forensic Limnology-diatoms:**

Introduction to Forensic Limnology, Role of algae & fungi in Forensic Science, Introduction to Diatoms, Identification of diatoms from biological matrices from soil & water, Diatoms testing, Legal aspects of Diatoms, Case Studies.

**Forensic Entomology:**

Introduction and History of Forensic Entomology, Anatomy and Taxonomy of Forensically relevant Insects (Diptera), Insect Succession (in buried bodies, burnt bodies, decomposed bodies above the soil and in water) & Factors that affect Insect Succession, Estimating Post-mortem Interval/ Time since infestation from invertebrate development rates, Forensically important Aquatic Insects, Insects as weapons and Threats to National Security, Collection of entomological evidence during death investigations, Forensic Entomology and the Law, Case studies.

<b>MODULE-3</b>	<b>Wildlife Forensics</b>	<b>Teaching Hours: 15 Hours</b>
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Definition and advances in wildlife forensics, Threats to the natural resources and wild species inhabiting globally, Importance of Wildlife Conservation, Classification of Species as per IUCN Red Data Book, Introduction to CITES and CBD, Wildlife (Protection) Act, 1972 of India and other related acts, Different Methods of Poaching, Conventional methods of species identification, Morphological identification and examination of wildlife parts and products, Application of DNA technologies used in Wildlife Forensics.

**References and Suggested Readings:**

1. MariaTeresa,Tersigni-Tarrant, Natalie R. Shirley; “Forensic Anthropology: An Introduction”, CRC Press, Taylor & Francis Group, 2012.
2. AngiChristensen, N.Passalacqua,& E. Bartelink; “Forensic Anthropology: Current Methods and Practices”, Academic Press, Elsevier, 2014.
3. Anil Mahajan & Surinder Nath; “Application areas of Anthropology”, Reliance Publishing House, 1992.
4. Megan Brickley&Roxanna Ferllini; “Forensic Anthropology: Case Studies from Europe”, Charles C. Thomas Publisher, Springfield, Illinois, USA, 2007.
5. Whitaker, D.K. and MacDonalD, D.U. (1989), Forensic Dentistry, Wolfe Medical Publications Ltd.

<b>UGFS S4 CE-2</b>	<b>Core Elective - II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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<b>UGFS S4 SE -3</b>	<b>Skill based Elective - IV</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**CUTM2903: Practical-IV**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams			University Exams (LPW)	
					TA-1 & TA-2		MSE		Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs					
0	0	8	4	8							100	6:00	100

**Learning Objectives:**

At the end of course, students will be gaining the hands on training in the following courses;

**MODULE-1 Forensic Medicine**

1. To design a questionnaire for the first responder to the death scene.
2. To design a protocol to deal with the media at the crime scene.
3. To design a checklist for the forensic scientists at the death scene.
4. To design a canvass form giving description of an unidentified victim.
5. To analyze and preserve bite marks.
- 6.

**MODULE-2 Forensic Toxicology**

1. Extraction of heavy metals using wet digestion and dry digestion.
2. Extraction of volatile and non-volatile poisons
3. Analysis of heavy metals using colour tests (reinsch test).
4. Colour test and TLC of various plant poisons and pesticides
5. Analysis of drug using UV-Vis spectroscopy.

**MODULE-3 Forensic Ballistics**

1. To describe, with the aid of diagrams, the firing mechanisms of different types of firearms
2. To correlate the velocity of bullet with the impact it produces on the target
3. To correlate the striking angle of the bullet with the impact on the target.
4. To estimate the range of fired bullets and to carry out the comparison of fired bullets as well as cartridge cases.
5. To identify gunshot residue.
6. To correlate the nature of injuries with distance from which the bullet was fired.
7. To differentiate, with the aid of diagram, contact wounds, close range wounds and distant wounds.

**MODULE-4 Forensic Biology and Wildlife Forensics**

1. Microscopic examination of hairs – identification of species origin.
2. Examination of natural fibre like cotton, jute, coir and silk by microscope.
3. Examination of diatoms from different water bodies.
4. Examination of pollen grains of forensic relevant plants.
5. Examination of wood by microscopy method
6. To study life cycle of housefly and interpret time since death

# **SEMESTER-V**

**CUTM2904: Forensic Anthropology**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200

**Learning objectives:**

At the end of course, students will be able to explain;

1. How wildlife forensics aid in conserving natural resources.
2. How forensic entomology assists in death investigations.
- 3.

**MODULE-1 Basics of anthropology and application in forensics Teaching Hours: 15 Hours**

Forensic Anthropology – History - Scope and development - Role of forensic anthropologist – Collection and preservation of evidences - Human osteology - Determination of age, sex, stature- Determination of personal identity by superimposition technique - Video image analysis - Facial reconstruction – Legal provisions and tools involved in it - Pathology of bones and its importance in identification.

**MODULE-2 Basics of odontology and application in forensics Teaching Hours: 15 Hours**

Forensic Odontology: Introduction - Structure and types of teeth - Dentition and dental formula – Dental diseases - Determination of age, sex and race from teeth - Role of teeth in mass disaster – Forensic significance in identification.

**MODULE-3 Disaster Victim Identification (DVI) Teaching Hours: 15 Hours**

Identification of burnt bones, skeletal remains in accidents, crimes and mass disaster, Examination and identification of dead bodies in mass disasters, mutilated bodies, fragmentary skeletal remains and bones, Determination of age, sex, race and species origin from bones and assessment of stature.

**Reference Books:**

1. Forensic Biology. Richard Li, Sue Norman, Jane Schober. Edition Published :2015. ISBN 1439889724, 9781439889725. Published by CRC Press.
2. “Environmental Biology (Principles of Ecology)” by Verma P S and Agarwal V K

3. Wildlife Forensics: Methods and Applications. Editor(s):Jane E. Huffman, John R. Wallace. First Edition published :2012. Print ISBN:9780470662588 |Online ISBN:9781119953142 |DOI:10.1002/9781119953142. Published by John Wiley & Sons, Ltd.
4. Wildlife Forensic Investigation: Principles and Practice. John E. Cooper and Margaret E. Cooper. First Edition published : 2013. ISBN-10 : : 19-NBSI ;1493119344 -331 dehsilbuP .1493119344by CRC Press.
5. Webiste : <https://moef.gov.in/en/>
6. Webiste : <http://nbaindia.org/>
7. Webiste : <https://www.iucn.org/>

**CUTM2905: Digital Forensics and Cyber Law**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200

**Learning Objectives:** After studying this paper, the students would be able to:

1. Understand the different types of crimes in the cyberspace.
2. Get familiar with the principles of Digital Forensics.
3. Learn the basics of Incident Response and principles pertaining to digital evidence.
4. Get an overview of the different sections of IT Act and laws related to the admissibility of digital evidences.

**MODULE-1 Forms of Cyber-Crime and Introduction to Digital Forensics Teaching Hours: 15 Hours**

Cyber-crime – Overview, Internal and External Attacks, Online and Offline Attacks.

Cyber-crime against Individual and Organization – Email spoofing, Phishing: types and techniques, spamming, unauthorized access to computer, Denial-of-Service (DoS) attack and its types, DDoS attack, Computer sabotage, Malwares and its types, E-mail bombing, Salami Attack, Software Piracy, Industrial Espionage; Cyber-crime against women and children, Crimes on social media, Online and Banking frauds, Intellectual Property Frauds. Different stages of cyber- attack.

Digital Forensics – Introduction, Objective, Methodology, Rules and Services of Digital Forensics, various branches of digital forensics - Live Forensics, Disk Forensics, Network Forensics, Mobile Device Forensics etc.

**MODULE-2 Incident Response and Digital Evidence Teaching Hours: 15 Hours**

Incident Response and First Responder at crime scene – role, toolkit, stages of response, Do's and Don'ts. Types and source of Digital Evidences, Principles for collection of digital evidence, Best Evidence Rule, Forensic Readiness: Planning and Pre-search requirement, Qualities and Ethics of a good forensic investigator, Code of Ethics, benefits and challenges in digital forensics, Search, Seizure Collection and Preservation of Volatile and Non-volatile evidence; Introduction to Imaging, Hashing, Deleted data recovery.

**MODULE-3 Introduction to IT Act and Cyber Laws Teaching Hours: 15 Hours**

IT Act 2000 - Objectives, Applicability, Non-applicability, Definitions, Amendments and Limitations; Digital Signature and its legal recognition, Electronic records and their legal recognition, Electronic Evidence, Electronic governance, Controller and Certifying Authorities; Information Technology (Amendment) Act 2008 – Objective, Applicability and Jurisdiction; Various cyber-crimes under Sections 43 (a) to (j), 43A, 65, 66, 66A to 66F, 67, 67A, 67B, 70, 70A, 70B, 80 etc. along with respective penalties, punishment and fines. Penal Provisions for Phishing, Spam, Virus, Worms, Malware, Hacking, Trespass and Stalking; Relevant Sections of Indian Evidence Act.

**References and Suggested Readings:**

1. Nina Godbole and Sunit Belapore, “Cyber Security: Understanding Cyber-crimes, Computer Forensics and Legal Perspectives”, Wiley Publications, 2011.
2. Bill Nelson, Amelia Phillips and Christopher Steuart, “Guide to Computer Forensics and Investigations, 5th Edition”, Cengage, 2010 BBS.
3. William Stallings. “Cryptography and Network Security: Principles and Practices, 5th Edition”, Prentice Hall Publication Inc., 2003.
4. Majid Yar, “Cybercrime and Society”, Sage Publications, 2006.
5. Michael E. Whiteman and Herbert J. Mattord, “Principles of Information Security”, Vikas Publishing House, New Delhi, 2003.
6. EC-Council, “Computer Hacking Forensic Investigator v.3”.
7. Harish Chander; “Cyber Laws and IT Protection”, PHI Learning Pvt. Ltd, 2012.
8. Karnika Seth; “Computers, Internet and New Technology Laws”, Lexis Nexis Buttersworth Wadhwa, 2012.

**CUTM2906: Forensic Chemistry – II**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200		

**Learning objectives:**

After studying this course, the students will be able to explain –

1. The importance of Forensic Chemistry
2. Forensic chemical evidences
3. Significance of chemical evidences in forensic science
4. Petroleum analysis
5. Fire investigation and significance
6. Explosives evidences and investigation.

**MODULE-1**

**Teaching Hours: 15 Hours**

**Alcoholic Beverages:** Forensic Analysis of alcoholic beverages, country made liquor, illicit liquor and medicinal preparations containing alcohol as constituents. Case studies.

**Bribe Trap:** Examination of Chemicals (Phenolphthalein) used in Bribe trap cases. Case studies.

**Inks:** Forensic Examination of inks by various techniques, Dating and aging of inks

**Polymers:** Forensic examination of plastics and Adhesives.

**MODULE-2 Food Chemistry**

**Teaching Hours: 15 Hours**

Study of common food adulterants, Analysis of Lipids and fats: Physical examination of lipids, Chemical examination of lipids (Acid value, Saponification value, Ester value, Acetyl value, Iodine value), Test for hydrogenated oils and fats, Detection and Determination of rancidity, Analysis of butter and butter fats, Analysis of adulterated and non-adulterated oils.

Analysis of dairy products: Milk and its products for adulteration.

**MODULE-3 Narcotic drugs & and psychotropic substances**

**Teaching Hours: 15 Hours**

Crime scene search for narcotics, drugs and psychotropic substances – Searching a suspect, a dwelling, a vehicle- Clandestine drug laboratories Investigation-Collection and preservation of drug evidence- Testing of narcotics, drugs and psychotropic substances- Isolation techniques for purifying narcotics, drugs and psychotropic substances –Presumptive and screening tests for narcotics, drugs and psychotropic substances-Microcrystalline testing of drugs of abuse.

**Suggested Readings:**

1. Moffat, A.C.: Osselton, D. M. Widdop, B.: Clarke's Analysis of Drugs and Poisons in Pharmaceuticals, body fluids and postmortem material, 3rd ed., Pharmaceutical Press 2004.
2. Bogusz, M. J., Hand Book of Analytical Separations, Vol. 2: Forensic Science, 1st ed., Elsevier Science, 2000.
3. Siegel, J.A., Saukko, P. J., Knupfer, G.,: Encyclopedia of Forensic Sciences (Vol3), Academic Press, 2000.
4. Eckert; An Introduction to Forensic Science, CRC Press
5. James, S. H. and Nordby, J. J.: Forensic Science: An Introduction to Scientific and Investigative Techniques, 2003.
6. Saferstein, R: Criminalistics - An Introduction to Forensic Science, Prentice Hall, 1995.
7. Sarkar, S: Fuels and Combustion, Orient Longman, 1990
8. Verma, R. M: Analytical Chemistry – Theory and Practice, CBS Pub., 1994
9. Svehla, G. Ed.: Vogel's Qualitative Inorganic Analysis, Longman, 1331.
10. Bassett: Vogel's Text Book of Quantitative Inorganic Analysis, Longman, 1978
11. Vogel, A. I: Text Book of Practical Organic Chemistry including Qualitative Organic Analysis, ELBS, 1971.
12. Skoog, D. A., West, D. M. and Holler, F. J: Analytical Chemistry: An Introduction, Saunders College, 1994.
13. Siegel, J. A, Saukko, P. J. and Knupfer, G. C: Encyclopedia of Forensic Sciences, Academic Press, 2000.
14. Townsends, A. (Ed): Encyclopedia of Analytical Science, Academic Press, 2005.
15. Beveridge, A: Forensic Investigation of Explosives, Taylor & Francis, 2000.
16. Yallop, H. J: Explosion Investigation, Forensic Science Society & Scottish Academic Press, 1980.
17. Narayanan, T. V: Modern Techniques of Bomb Detection and Disposal, R. A. Security System, 1995.
18. Yinon, J. and Zitrin, S: The Analysis of Explosives, Oxford: Pergamon, 1981
19. An Introduction to Physics and chemistry of Petroleum
20. Kinghorn: Introduction to Petrochemicals Sukumar Maiti
21. D.W.Waples : Geochemistry in Petroleum Exploration

22. A.L.Waddams : Petroleum Geochemistry and Geology Chemicals from Petroleum
23. Day& Underwood :Analytical Chemistry
24. H. J. Arnikar Essentials of Nuclear Chemistry, 4th Edition Wiley Eastern (1987).
25. 38. H. J. M. Bowen. Buttler and Tanner Chemical Applications of Radioisotopes, (1969).
26. G Friedlander, T. W. Kennedy, E. S. Macias and J. M. Miller, Introduction of Nuclear and Radiochemistry, 3rd Edition, John Wiley (1981).
27. P.D.Vowels and D.W: Experiments in Environmental chemistry.

**CUTM2907: Instrumental Techniques-I**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200

**Learning objectives:**

1. To know about various microscopes, their parts and working
2. To know about basic analytical techniques
3. To know about pH and buffer systems
4. To learn about various electrophoretic techniques
5. To learn about separation and extraction techniques

**MODULE-1**

**Microscopy**

**Teaching Hours: 15 Hours**

Mirrors & Lenses, Basic principles of microscopy, Simple and Compound microscope, Study of different types of microscopes: Light Microscope & Electron Microscope: Comparison microscope, Phase contrast microscope, Stereoscopic microscope, Polarizing microscope, Fluorescence microscopy, IR microscopy, Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM).

**MODULE-2**

**Teaching Hours: 15 Hours**

**Biological / Biochemical Analytical Techniques:** Introduction to pH, Buffer systems and pH meter, Physiological solution, Theories of Precipitation, Coagulation, Sedimentation & Centrifugation, Different centrifugation techniques: Density Gradient Centrifugation, Differential Centrifugation & Preparative Centrifugation.

**Electrophoretic techniques:** Zone electrophoresis (ZE), Paper electrophoresis (PE), Classical gel electrophoresis (CGE), Starch gel electrophoresis (SGE), Poly acrylamide gel electrophoresis (PAGE), SDS-PAGE, Isoelectric focusing (IEF) & Two dimensional SDS-PAGE.

**MODULE-3**

**Teaching Hours: 15 Hours**

**Electromagnetic Spectrum:** Electromagnetic radiations, Absorption & Emission Spectra, General properties of electromagnetic radiations: Wave and Quantum mechanical properties, Atomic & molecular spectra, Florescence & Phosphorescence, Jablonski Diagram.

**Theoretical Concepts of Separation and Extraction techniques:** Adsorption, Absorption & Partition, Partition co-efficient, Solvent extraction and Multiple extraction, Supercritical Fluid Extraction, Accelerated Solvent Extraction, Solid Phase Extraction & Solid Phase Micro

Extraction, Plate theory and concept of theoretical plates with respect to peak width and peak intensity, Rate theory and van Deemter equation, Concept of Retention factor and Retention time.

**Reference Books:**

1. D.A.Skoog, F.J.Holler and T.A.Neman, Harcourt Principles of Instrumental Analysis college publishers, Singapore
2. G.D.Christian and J.E.O'Reilly, Instrumental Analysis, Allyn and Bacon, Inc., Boston.
3. F.W.Fifield and D.Kealey, Principles and practice of Analytical Chemistry, International Textbook Company, London. SCHOOL OF FORENSIC SCIENCES M. Sc. Forensic Sciences
4. R.P.Bauman, Absorption Spectroscopy, John Wiley, New York.
5. M.Donhrow, Instrumental Methods in Analytical Chemistry; Their Principles and practice Vol.2, optical method, Pitaman, New York.
6. G.G.Guilbanlt, Practical Fluorescence: Theory, Methods and Practice, Marcel Dekker, New York.
7. S.Udenfriend, Fluorescence Assay in Biology and Medicine, Academic Press, New York.
8. W.J.Price, Spectrochemical Analysis by Atomic Absorption, Hyden, London.
9. R.S.Alger, Electron Paramagnetic Resonance: Techniques and Applications, Interscience, New York.
10. Analytical Chemistry by open Learning, John Wiley & Sons, New York.
11. J.C.Giddings, Dynamics of Chromatography, Marcel Dekker, New York.
12. R.C.Grob, Modern Techniques of Gas Chromatography, Marcel Dekker, New York.
13. J.A.Dean, Chemical Separation Methods, Ban Nostrand Reinhold Co., New York.
14. R.E.Smith, Ion Chromatography Applications, C.R.C. Press, Inc., Boca Raton.
15. R.E.Smith, Supercritical Fluid Technology, C.R.C. Press, Inc., Boca Raton.
16. G.Zweig and J.R.Whitaker, Paper Chromatography and Electrophoresis, Academic Press, New York.
17. Safferstein: Forensic Science Handbook Vol. I, II, III.
18. Lee Honry: An Introduction to Forensic Science
19. Egon Stahl: Thin Layer Chromatography

<b>UGFS S5 CE-3</b>	<b>Core Elective - III</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**CUTM2908: Practical-V**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams			University Exams (LPW)	
					TA-1 & TA-2		MSE		Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs					
0	0	8	4	8							100	6:00	100

**Learning Objectives:**

At the end of course, students will be gaining the hands on training in the following courses;

**MODULE-1 Forensic Anthropology**

7. Determination of age from skull and teeth
8. To determine the sex from skull.
9. To determine sex from pelvis.
10. To study identification and description of bones and their measurements.
11. To investigate the differences between animal and human bones.
- 12.

**MODULE-2 Digital Forensics & Cyber Law**

1. Acquisition and Preservation of Volatile data from standalone computer.
2. Hash Calculation the files using different algorithms.
3. Recovery of Deleted Files and Folders
4. Imaging of data storage media using different file formats
5. Recovery Password from the protected word, pdf and rar files.

**MODULE-3 Forensic Chemistry-II**

1. To carry out qualitative test of ethyl alcohol.
2. To perform confirmatory test for ethyl alcohol and methyl alcohol
3. To identify drugs of abuse by spot tests.
4. To perform TLC of drugs of abuse
5. To carry out qualitative test for bribe trap by UV and TLC
6. To perform microcrystalline tests for drugs of abuse.
7. To study the case and prepare a report on clandestine drug investigation.
8. To study the case and prepare a report on narcotic drugs investigation.

**MODULE-4 Instrumental Techniques-I**

1. To study the Parts of Compound Microscope

2. Preparation of buffer
3. pH metric titration of strong acid vs. strong base and weak acid vs. strong base.
4. Extraction of plant-based drugs by Soxhlet.
5. To understand & perform calibration of the instrument

# **SEMESTER-VI**

**CUTM2914: Forensic Physics – II**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200		

**Learning Objectives:**

After studying this course, the students will be able to explain –

1. Tool marks, Tyre marks, Foot print, Lip and Ear print, and their nature in forensic science
2. Fiber evidences
3. Restoration of erased marks

**MODULE-1 Tool Mark & Fiber Evidence**

**Teaching Hours: 15 Hours**

Introduction to tool marks, Types of tool marks, Class characteristics and individual characteristics of tool marks, Collection and Preservation of tool marks, Forensic examination of tool marks, Case Studies.

Fibre evidence – artificial and man-made fibres. Collection of fibre evidence. Identification and comparison of fibres. Cloth evidence – importance, collection, analysis of adhering material. Matching of pieces.

**MODULE-2 Restoration of erased marks & Bite marks**

**Teaching Hours: 15 Hours**

**Erased marks:**

Principle of restoration of erased marks, Techniques involved for alteration of individual markings, Restoration of erased and obliterated marks on various surfaces, Photography and Forensic assessment of methods for restoration of obliterated marks, case studies.

**Bite marks:**

Objectives and forensic importance of bite-mark examination, the typical bite marks morphology, types of bite marks, Evidence collection from victims and suspects, Photography, lifting, preservation of bite marks, casting of bite marks, Identification and comparison of bite marks, Case Studies.

**MODULE-3 Tyre Prints and Impressions**

**Teaching Hours: 15 Hours**

**Tyre Impressions:**

Introduction to tire impressions, Collection and Preservation of the tire impression evidence, Forensic Significance of skid marks, Forensic Examination for identification and comparison, Case Studies.

**Footprints & Shoe impression examination:**

Introduction to footprints & Shoe impression, locating impressions at the scene of crime, Evidence collection: Collection, Lifting/Casting and Preservation of foot/footwear impressions, importance of Gait pattern, Forensic Identification and Methods of comparison, Case Studies.

**Lip print:**

Introduction to Cheiloscropy and history of lip prints, Classification of lip prints, Collection, Development, Identification and Comparison of lip prints.

**Ear Prints:**

Introduction to the history of ear prints, Morphology of the ear, Procedure of taking standards from the suspects, Identification and comparison of ear prints.

**References and Suggested Readings:**

1. Forensic Science Evidence: Can the Law Keep Up With Science (Criminal Justice: Recent Scholarship by Donald E. Shelton
2. M. Byrd, *Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence*, CRC Press, Boca Raton (2001).
3. T.J. Gardener and T.M. Anderson, *Criminal Evidence*, 4th Ed., Wadsworth, Belmont (2001).
4. S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2nd Edition, CRC Press, Boca Raton (2005).
5. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, *Techniques of Crime Scene Investigation*, CRC Press, Boca Raton (2013).

**CUTM2915: Information Security Audit and Compliance**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200

**Learning Objectives:** After studying this paper, the students would be able to:

1. Understand the various concepts of information security, risks, threats and vulnerabilities.
2. Understand the various policy standards, baselines, and classification of information assets.
3. Get familiar with the concepts of risk management and other security technologies like firewalls, VPNs, Honeypots, IPS and IDS.
4. Comprehend the techniques for implementing information security and its subsequent management.

**MODULE-1 Introduction to Information Security**

**Teaching Hours: 15 Hours**

Basics of Information Security – CIA Triad, Threats and vulnerabilities, Policy standards, Procedures, Guidelines and Baselines, Information Asset Classification: Classification of Information, Information Assets - Owner, Custodian, User Access Control, Authentication and Authorization; System Development Lifecycle and SSDLC -Investigation, Analysis, Logical and Physical Design, Implementation and security; CCNS Security Model; Attacks: Malicious code, Backdoors, Password crack.

**MODULE-2 Risk Management and Security Technologies**

**Teaching Hours: 15 Hours**

Overview of Risk, Risk Identification- asset identification and recovery, Information Asset valuation, Vulnerability and Threat identification; Risk Assessment- likelihood, risk determination, Identification of controls, documentation; Risk Control Strategies- defend, transfer, mitigate, accept and terminate; Cost Benefit Analysis (CBA), Quantitative v/s Qualitative Risk Control Practices.

Access Controls- identification, authorization, authentication and accountability; Firewalls-processing modes, types, generations, configuration and content filters; Remote Access and VPNs; Intrusion Detection and Prevention System (IDPS)- types, Detection methods, Response behaviour, approaches, strengths and limitations, deployment and effectiveness measurement; Honeypots and Honeynets, Scanning and Analysis Tools- ports scanners, firewall analysis tools, operating system detection tools, vulnerability scanners and packet sniffers; Biometric Access Controls.

**MODULE-3 Security Planning, Implementation and Maintenance Teaching Hours: 15 Hours**

Information Security Planning and Governance, IS Policies- EISP, ISSP, SysSP, policy management; NIST Security Models, IETF Security Architecture, Baselining and Best Business Practices, Security Education, Training and Awareness Program; Business Impact Analysis, Incident Response Planning, Disaster Recovery Planning, Crisis Management.

Information Security Project Management, Conversion Strategies and Bull's Eye Model, Consideration for Organizational Change, Information Systems Security Certification and Accreditation- certification vs accreditation, NIST SP 800-37, National Information Assurance Certification and Accreditation Process (NIACAP), ISO 27001/27002 system certification and accreditation; Security Management Maintenance Models- NIST SP 800-100, Security Maintenance Model, Monitoring Internal and External Environment, Vulnerability Assessment and Remediation; Digital Forensics- The team, methodology.

**References and Suggested Readings:**

1. Michael E. Whiteman and Herbert J. Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2003.
2. William Stallings. "Cryptography and Network Security: Principles and Practices, 5<sup>th</sup> Edition", Prentice Hall Publication Inc., 2003.
3. Majid Yar, "Cybercrime and Society", Sage Publications, 2006.
4. EC-Council, "Computer Hacking Forensic Investigator v.3".
5. Atul Kahate, "Cryptography and Network Security", 9<sup>rd</sup> Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2009.

**CUTM2916: Basics of Immunology and Forensic Serology**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams			University Exams (LPW)	
					TA-1 & TA-2		MSE		Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs					
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200

**Learning objectives:**

At the end of this course, students will be able to explain;

1. The significance of serological evidence.
2. The importance of biological fluids-blood, urine, semen, saliva, sweat and milk-in crime investigations.
3. The usefulness of genetic markers in forensic investigations.
4. The forensic importance of bloodstain patterns.

**MODULE-1 Immunology Teaching Hours: 15 Hours**

Introduction and history of Immunology, Innate and Acquired immunity

Antigen – Epitope, essential factors for antigenicity, haptens and adjuvant.

Antibody: structure and function, antigenic determinants on immunoglobulins, isotypic, allotypic and ideotypic variants, antigen and antibody interactions, and their importance.

Major histocompatibility complex and their importance in Forensics, Antigen Processing and presentation. Generation of humoral and cell mediated immune responses, B-cell receptor, T-cell receptor, Cytokines and their role in immune regulation.

**MODULE-2 Basics of Serology Teaching Hours: 15 Hours**

Blood and its composition, Haemoglobin and its variants, History and genetics of ABO and Rh blood grouping system and its significance in forensic investigation, Other forensically relevant blood group like MN, I, P, Kell, Duffy, Kidd, Lewis, Lutheran and Bombay blood group, Secretors and non- secretors, HLA antigens and its importance.

**MODULE-3 Forensic Identification of Biological Fluids Teaching Hours: 15 Hours**

Study of blood stain patterns, Composition, presumptive and confirmatory tests for blood, semen, saliva, urine, and other biological fluids, origin of species, Blood grouping of dried blood stains, semen, saliva stains (Absorption, Elution, Absorption Inhibition method, and mixed

agglutination), Recent developments in detection of various body fluids by spectroscopic techniques (FTIR and Raman). Polymorphic enzymes and their forensic significance.

**Reference Books:**

1. The examination and Typing of Blood Stains in the crime laboratory – B J Culliford, U. S. Dept. of Justice, Washington D. C.
2. Blood Group Serology – Boorman KE, Dodd BE and LOncoln PJ, Chuchill Livingstone Inc. New York.
3. Laboratory Procedure Manual - Forensic Serology (2005), Directorate of Forensic Science, MHA, New Delhi.
4. Laboratory Procedure Manual – DNA Profiling (2005), Directorate of Forensic Science, MHA, New Delhi.
5. Molecular Biology of the Cell, 6th Edition (2014) – Bruce Alberts, et al., Garland Science, ISBN: 978-0815341055.
6. Forensic DNA Typing, Second Edition: Biology, Technology, and Genetics of STR Markers 2nd Edition (2005) - John M. Butler, Academic Press, ISBN:0121479528.
7. Forensic Science: An Introduction to Scientific and Investigative Techniques – StuartH. James, Jon J. Nordby, CRC Press, ISBN:0849327474.
8. An Introduction to Forensic Genetics 2ndEdition (2010) - William Goodwin, Adrian Linacre and SibteHadi, Wiley-Blackwell, ISBN: 978-0470710197.

**CUTM2917: Instrumental Techniques – II**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200

**Learning objectives:**

1. To learn about various spectroscopic techniques
2. To learn about various chromatographic and hyphenated techniques
3. To learn about various elemental techniques.

**MODULE-1 Spectroscopic Techniques Teaching Hours: 15 Hours**

UV-Visible spectroscopy: Theory, Instrumentation and Applications; Infrared Spectroscopy: Molecular vibration, Theory of IR absorption, IR Sources and Instrumentation, FT-IR Applications; Raman Spectroscopy: Theory of Raman spectroscopy, Instrumentation and Applications. Differences & Similarities between Raman & IR spectroscopy. FT-NIR spectroscopy: Theory, Instrumentation & Applications, Neutron Magnetic Resonance: Theory, Instrumentation & Application, Mass Spectrometry: Theory, Instrumentation and Applications.

**MODULE-2 Chromatographic Techniques Teaching Hours: 15 Hours**

Introduction to Chromatography: Partition, Adsorption, Ion exchange, Affinity Chromatography, Size Exclusion Chromatography, their principle and types of chromatography. Forensic applications of Chromatography.

Gas Chromatography: Principle, instrumentation and applications. Gas-liquid and gas-solid chromatography, GC – MS, GC – MS – MS (Tandem).

Gas Chromatography – Head Space: Principle, instrumentation and applications.

High Performance Liquid Chromatography: Principle, instrumentation and applications, LC – MS, LC – MS – MS (Tandem).

**MODULE-3 Elemental Techniques Teaching Hours: 15 Hours**

Atomic Absorption Spectroscopy: Theory, Instrumentation and Applications.

Atomic Emission Spectroscopy: Theory, Instrumentation and Applications.

ICP-OES: Theory, Instrumentation and Applications.

ICP-MS: Theory, Instrumentation and Applications.

X-Ray Spectroscopy: Theory, Types, Instrumentation and Applications.

EDXRF: Theory, Instrumentation and Applications.

**Reference Books:**

1. D.A.Skoog, F.J.Holler and T.A.Neman, Harcourt Principles of Instrumental Analysis college publishers, Singapore
2. G.D.Christian and J.E.O'Reilly, Instrumental Analysis, Allyn and Bacon, Inc., Boston.
3. F.W.Fifield and D.Kealey, Principles and practice of Analytical Chemistry, International Textbook Company, London. SCHOOL OF FORENSIC SCIENCES M. Sc. Forensic Sciences
4. R.P.Bauman, Absorption Spectroscopy, John Wiley, New York.
5. M.Donhrow, Instrumental Methods in Analytical Chemistry; Their Principles and practice Vol.2, optical method, Pitaman, New York.
6. G.G.Guilbanlt, Practical Fluorescence: Theory, Methods and Practice, Marcel Dekker, New York.
7. S.Udenfriend, Fluorescence Assay in Biology and Medicine, Academic Press, New York.
8. W.J.Price, Spectrochemical Analysis by Atomic Absorption, Hyden, London.
9. R.S.Alger, Electron Paramagnetic Resonance: Techniques and Applications, Interscience, New York.
10. Analytical Chemistry by open Learning, John Wiley & Sons, New York.
11. J.C.Giddings, Dynamics of Chromatography, Marcel Dekker, New York.
12. R.C.Grob, Modern Techniques of Gas Chromatography, Marcel Dekker, New York.
13. J.A.Dean, Chemical Separation Methods, Ban Nostrand Reinhold Co., New York.
14. R.E.Smith, Ion Chromatography Applications, C.R.C. Press, Inc., Boca Raton.
15. R.E.Smith, Supercritical Fluid Technology, C.R.C. Press, Inc., Boca Raton.
16. G.Zweig and J.R.Whitaker, Paper Chromatography and Electrophoresis, Academic Press, New York.
17. Safferstein: Forensic Science Handbook Vol. I, II, III.
18. Lee Honry: An Introduction to Forensic Science
19. Egon Stahl: Thin Layer Chromatography.

<b>UGFS S6 CE-4</b>	<b>Core Elective - IV</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**CUTM2918: Practical-VI**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams			University Exams (LPW)	
					TA-1 & TA-2		MSE		Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs					
0	0	8	4	8							100	6:00	100

**Learning Objectives:**

At the end of course, students will be gaining the hands on training in the following courses;

**MODULE-I Forensic Physics-II**

**Practical:**

1. To identify and compare tool marks.
2. To compare cut or torn cloth samples by physical matching.
3. Casting of foot and tyre impressions
4. Identification and comparison of ear prints and lip prints
5. Casting of bite marks
6. Development of latent foot marks

**MODULE-2 Information Security Audit and Compliance**

1. Secure configuration of ports and services of windows system
2. Encrypting and Decrypting the partition using Bit Locker
3. Creating sandbox and honeypots for analysis of malwares
4. Vulnerability scanning using different tools
5. Creating different rules and Configuring firewall

**MODULE-3 Basics of Immunology and Forensic Serology**

1. Physical, biochemical and spectrophotometric examination of blood stains.
2. Examination of seminal stains by crystal tests, biochemical and microscopical analysis.
3. Examination of saliva and its stains.
4. Biochemical and microscopic examination of urine.
5. Determination of origin of species from biological fluids.
6. Blood group typing of biological fluid stains by absorption elution, absorption inhibition and mixed agglutination techniques.
7. Isolation of DNA from blood and its quantification.
8. Collection and extraction of DNA using FTA card.

**MODULE-4 Instrumental Techniques-II**

1. UV-Visible spectroscopic determination of chemical dyes of forensic importance
2. To understand and perform quantitation by calibration graph method, internal standard method and standard edition method with the help of any one pharmaceutical drugs.
3. Validation of a method (drugs, pesticide) by anyone instrumental technique

# **SEMESTER-VII**

# Specialization-1

# “Forensic Physics & Ballistics”

**CUTM2919: Lasers and Spectroscopy**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	0	0	3	3	25	00:45	50	01:30	100	03:00	-	-	200

**Learning Objectives:**

At the end of this course, students will be able to explain;

1. Light sources and basic components of optical spectrometer
2. Light detectors and Gratings
3. Vacuum pumps and gauges
4. Optical fibers
5. Spectroscopic techniques and their application

**MODULE-1 Basic components of optical spectroscopy Teaching Hours: 15 Hours**

**Light sources and spectrometer:** CW & pulsed light sources (Lasers), Sodium lamp, a brief review of Lasers, Q-switching and Mode locking to generate short and ultra-short laser pulses, Laser output profile. Prisms and gratings, Czerny-Turner Spectrometer/ Monochromator, Resolution and dispersion of Prism and grating spectrometer, Charge Coupled Devices (CCD), Photodiodes and Photomultiplier tubes.

**MODULE-2 Vacuum Science and Optical Fibre Teaching Hours: 15 Hours**

**Vacuum Science and Technology:** Types of Vacuum and different flow regimes, Conductance, pumping speed and Throughput, Creation of vacuum: Vacuum pumps, Rotary vane pump and Turbo-molecular pump, measuring the vacuum: Pirani and Penning gauges, Vacuum chamber and their components, Requirement of vacuum for an experiment (e.g. CRT, Fragmentation studies of a molecule etc.).

**Optical Fibers:** Advantages of optical fiber communication over normal medium, Step index and graded-index fibers, Numerical aperture, single mode and multimode fiber. Relative refractive index, losses in optical fiber communication.

**MODULE-3 Spectroscopic Techniques Teaching Hours: 15 Hours**

Absorption and emission spectroscopy, Raman Spectroscopy and its application. Principle of Fourier Transform Infrared (FTIR) spectroscopy, Fluorescence spectroscopy, Laser Induced Breakdown Spectroscopy, Application of laser spectroscopy.

**Reference books:**

1. Laser Fundamentals, William T. Silfvast, 2008, Cambridge University Press.
2. Laser Spectroscopy 1: Basic Principles, Wolfgang Demtröder, 2014, 5<sup>th</sup> edition, Springer.
3. Laser Spectroscopy 2: Experimental Techniques, Wolfgang Demtröder, 2016, 5<sup>th</sup> edition, Springer.
4. Vacuum Physics and Techniques, T. A. Delchar, Chapman and Hall.
5. Introduction to Fibre Optics, A. K. Ghatak & K. Thyagarajan, 1998, Cambridge University Press.

**CUTM2920: Advancement in Forensic Ballistics and Armour Material**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams			University Exams (LPW)	
					TA-1 & TA-2		MSE		Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs					
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200

**Learning objectives:**

At the end of this course, students will be able to explain;

1. The classification of firearms and their firing mechanisms.
2. The methods of identifying firearms.
3. The characteristics of ammunition.
4. The importance of firearm evidence.
5. The nature of firearm injuries.
6. The methods for characterization of gunshot residue.

**MODULE-1 Ballistics & its forensic aspects Teaching Hours: 15 Hours**

Introduction to forensic ballistics, Arms Act, Classification of firearms, firing mechanism, measurement of strength of barrel, trigger pull, assembling and dismantling of firearms, Ammunition and its types, safety aspects for handling of firearm and ammunition.

Concepts of Internal Ballistics, various factors affecting the internal ballistics, Theory of recoil and its measurement

**MODULE-2 Core concepts of External & Terminal Ballistics Teaching Hours: 15 Hours**

Principles of external ballistics, Trajectory Formation & its computation, effect of air resistance on trajectory, Angle of Fall, Influence of Earth on Trajectory, base drag, yaw, shape of projectile and stability, ballistics coefficient and limiting velocity, Ballistics tables, measurements of trajectory parameters, Escape velocity & Ricochet.

Effect of projectile on hitting the target, Ricochet and its effects, stopping power of the bullet, Introduction to wound ballistics & its forensic significance, nature of wounds and injuries, Determination of nature, range and time of firing, GSR analysis

**MODULE-3 Instrumental techniques used for ballistic evidence analysis Teaching Hours: 15 Hours**

Bore scope, Comparison Microscope, Stereo microscope, travelling microscope, Scanning Electron microscope, EDXRF, BDAS, IBIS, Management and reconstruction of cases involving firearm; Report writing and court findings

Principles and practice of identification of origin of ammunition and their components, purpose and procedure for test firing.

**Reference Books:**

1. J. Howard Mathews; Charles C. Thomas, Firearms Identification, Vols 1,2,& 3; Springfield, Illinois;
2. Hatcher, Jury And Weller, Firearms Investigation, Identification And Evidence; Stackpole Books, Harrisburg, P A
3. Vincent Di Maio, Gunshot Wounds; Crc Press, Washington, Dc;
4. Brain J. Heard;, Hand Book Of Firearms And Ballistics; John Willey, England;
5. TA, Warlow; Firearms, The Law And Forensic Ballistics; Taylor And Francis, Landon;
6. Karl G. Sellier et al ; Wound Ballistics And The Scientific Background; Elsevier, London
7. M. Johari, Identification Of Firearms, Ammunition And Firearms Injuries; BPR&D, New Delhi;
8. L V. Hogg; The Cartridges Guide - A Small Arms Ammunition Identification Manual; The Stackpole Co., Harrisburg, P A
9. Gary J. Ordog, Management Of Gunshot Wounds, Elsevier, New York
10. Working Procedures Manual: Ballistics, BPR&D Pub.
11. S.K.Sharma, cyber laws and crime.
12. Fry & Nystron, security monitoring, O. reilly
13. Tipton Krause, Information security management, Aner Bach
14. Schneiner, hacking the code, Syngrrers.

**CUTM2921: Audio and Video Analysis**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams			University Exams (LPW)	
					TA-1 & TA-2		MSE		Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs					
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200

**Learning objectives:**

At the end of this course, students will be able to explain;

1. Voice identification, handling of audio recording evidences and speaker profiling
2. The authenticity of audio recordings
3. Video/image analysis and CCTV analysis
4. Biometric Analysis for Identification of Individual

**MODULE-1 Introduction to voice identification/speaker recognition. Teaching Hours: 15 Hours**

Introduction to voice identification/speaker recognition and its forensic importance, History of voice analysis, Voice production and its uniqueness, collection of standards for comparison, handling of audio recording evidences & its physical examination, Components of speaker recognition- feature extraction, pattern matching and comparison, normalization techniques, speaker profiling, enhancement of speech signal/audio recordings, establishing the authenticity and integrity of audio recordings.

**MODULE-2 Approaches to speaker recognition Teaching Hours: 15 Hours**

Approaches to speaker recognition, phonetic Transcription, linguistic & phonetic analysis, acoustic parameters for examining speech samples, Fourier analysis, frequency & time domain representation of speech signal, analogue to digital conversion

Alcohol speech relationships, Techniques used in forensic audio/voice examination and analysis

Report writing, Limitations, Precautions, Related Case Studies and its admissibility in court proceedings

**MODULE-3 Video/Image analysis Teaching Hours: 15 Hours**

Concepts of Video/Image analysis, establishing the authenticity of video/image files, Processing of video/image evidences, Enhancement techniques, Specific frame analysis, technical

parameters of video/image, Biometric Analysis for Identification of Individual, Scope & its forensic application in the field of security, CCTV analysis

Related Case Studies and its admissibility in court proceedings.

**Reference books:**

1. Forensic Speaker Identification by Phil Rose & James R Robertson
2. Forensic Voice Identification by Harry Hollien
3. The Acoustic Analysis of Speech by Ray D Kent & Charles Read
4. Speech Language & Hearing Disorders by Franklin H Silverman
5. Voice Recognition by Richard L Klevans & Robert D Rodman
6. Multimedia Forensics and Security: Foundations, Innovations, and Applications by Mohamed Mostafa Fouad et al
7. Multimedia Forensics and Security by Chang-Tsun Li
8. Intelligent Video Surveillance Systems by Jean-Yves Dufour
9. Digital Image Processing by Rafael Gonzalez & Richard Woods
10. Digital Image forensics by Roy, A. et al

**CUTM2939: Research Methodology**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200		

**Learning objectives:**

At the end of this course, students will be able to explain;

1. Literature review
2. The development of a research plan
3. Data collection, interpretation and errors
4. Important components for writing the research paper and thesis
5. Basics of Ethical issues, Intellectual property rights, Copy right

**MODULE-1 Basics of research**

**Teaching Hours: 15 Hours**

Objectives and types of research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical. Research Formulation, Literature review and Development of hypothesis. Research design and methods, developing a research plan - Exploration, Description, Diagnosis, and Experimentation. Determining experimental and sample designs.

**MODULE-2 Data analysis methods**

**Teaching Hours: 15 Hours**

Data Collection and analysis: Methods of data collection – Sampling Methods and Data Processing. Data Analysis: Types of data, Basic concept of frequency distribution, measure of central values – Mean, median and mode, measure of dispersion, range, mean deviation and standard deviation, probability, theory and classical definition of probability, Bayes theorem of probability, conditional probability and coincidence probability, Chi-square test, ANOVA, SPSS. Types of Errors and Interpretation of Findings

**MODULE-3 Scientific reports and thesis writing**

**Teaching Hours: 15 Hours**

Reporting and thesis writing: Structure and components of scientific reports and thesis, Significance and Different steps in the preparation, Illustrations, Bibliography. Presentations: Oral and Poster, Importance of effective communication in scientific research.

Basics of Ethical issues, Intellectual property rights, Copy right, Reproduction of published material: Plagiarism in scientific research and communications.

**Reference books:**

1. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2 volumes.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
4. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.
5. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
6. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
7. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall. 12.
- Satarkar, S.V., 2000. Intellectual property rights and Copy right. EssEss Publications.

<b>UGFS S7 CE- 5</b>	<b>Core Elective - V</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**CUTM2922: Practical-VII**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams			University Exams (LPW)	
					TA-1 & TA-2		MSE		Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs					
0	0	8	4	8							100	6:00	100

**Learning Objectives:**

At the end of course, students will be gaining the hands on training in the following courses;

**MODULE-1 Lasers and Spectroscopy**

**List of Practical:**

1. Measurement of wavelength of laser using diffraction grating.
2. Measurement of the Prism angle, Angle of minimum deviation and Refractive index of a prism using spectrometer.
3. To determine the Resolving Power of a Prism.
4. Determination of Numerical Aperture of given optical fibre and find its acceptance cone.
5. Determine the wavelength of Sodium light using diffraction grating.

**MODULE-2 Advancement in Forensic Ballistics and Armour Material**

1. Characteristics of Firearms-Caliber, Choke, Trigger pull, and Proof marks.
2. Examination and comparison of fired bullet with reference to caliber, rifling characteristics, and identification of firearm
3. Examination and comparison of fired cartridge case with reference to caliber, firing pin, breech face, chamber indentations, extraction, and ejector marks by comparison microscope
4. Determination of shot numbers from size and weight of shots
5. Identification of propellants
6. Chemical tests for powder residue and barrel wash
7. Instrumental examination of GSR



## **Specialization-2**

# **“Fingerprints and Questioned Documents”**

**CUTM2923: Advanced Fingerprint Technologies**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200		

**Learning objectives:**

At the end of this course, students will be able to explain;

1. Basics of fingerprint development techniques
2. Significance of ridgeology and poroscopy

**MODULE-1 Advanced Fingerprint Development Techniques Teaching Hours: 15 Hours**

Development of fingerprint from porous surfaces

- Development of fingerprint from non-porous surfaces
- Development of fingerprint from nanoparticles
- Molecular finger print residues found on various substrates

**MODULE-2 Introduction & Importance of ridgeology and poroscopy Teaching Hours: 15 Hours**

For individual identification. Application of the pores dimensions and ridge dimensions in the identification- scope of establishing the identification – characteristics and traits. Application of edgeoscopy- personal identification using fingerprints.

**MODULE-3 Teaching Hours: 15 Hours**

Automated fingerprint Identification and imaging systems

**Reference Books:**

1. David R. Ashbaugh; Quantitative and Qualitative Friction Ridge Analysis, CRC Press (1999)
2. E. Roland Menzel; Fingerprint Detection with Lasers, 2nd Ed., Marcel Dekker, Inc. USA (1999)
3. James F. Cowger; Friction Ridge skin, CRC Press London, (1993)
4. Mehta, M.K; Identification of Thumb Impression & Cross Examination of Finger Prints, N.M. Tripathi Pub. Bombay (1980)
5. Moenssens; Finger Prints Techniques, Chitton Book Co. Philadelphia, NY (1975)

6. Chatterjee S.K.; Speculation in Finger Print Identification, Jantralekha Printing Works, Kolkata (1981)
7. Cowger, James F; Friction ridge skin- Comparison and Identification of fingerprints, CRC Press, NY (1993)
8. Cook Nancy; Classifying Finger Prints, Innovative learning pub. Mento Park (1995)
9. Cossidy M.J; Footwear Identification, Royal Canadian Mounted Police, Ontario, Canada (1980)
10. J A Seigel, P.J Saukoo and G C Knupfer; Encyclopedia of Forensic Sciences Vol. I, II and III, Acad. Press (2000)
11. Smith B.C, Holland MM, Sweel DL & Dizinno. A; DNA & Forensic Odontology- Manual of Forensic Odontology, Colorado Springs, USA (1995)
12. Hillison, S; Dental Anthropology, Cambridge Univ. Press, UK (1996)
13. Kasprzak J; Possibilities of Cheiloscopy in Forensic Science (1980)
14. Iannarelli, A V; Ear Identification, Forensic Identification series, Paramount (1989).
15. Henry C. Lee & R. E. Ganesslen; Advances in Finger Print Technology, CRC Press, London (1991).
16. Saxena, B.L.; Law and techniques relating to identification of handwriting, disputed documents, finger prints, foots and detection of forgeries, Central Law Agency, Allahabad (1990)
17. Hardless, H.R; Disputed documents examination and fingerprints Identification (with Illustrations, Sketches, Diagrams, Photos etc), Law Book Co. Allahabad (1995)
18. Menzel, E Roland; Fingerprint detection with lasers, Marcel Dekker, NY (1999)
19. Jain L C; Intelligent Biometric Techniques in Fingerprint and face recognition, CRC Press Ohio (1999)
20. Bridges B C; Criminal Inverstigation, Practical fingerprinting, Thumb Impressions, Hand writing expert testimony opinion Evidence, University Book Agency, Allahabd (2000)
21. Maltoni, Davide; Handbook of fingerprint recognition, Springer Verlag, NY (2003)
22. Ratha Nalini; Automatic Fingerprint recognition system, Springer Pub., NY (2004)

**CUTM2924: Advances in Forensic Document Examination**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200		

**Learning objectives:**

At the end of this course, students will be able to explain;

1. The basics of forensic document examination
2. Examination of alterations in documents
3. Forensic examination of different types of documents

**MODULE-1 Basics of Document and handwriting examination. Teaching Hours: 15 Hours**

Roles of Forensic Document Examiner, Scope of document examination, basic tools needed for forensic documents examination and their significance, Types of documents for examination, Care and Handling of Document Exhibits, Individuality in handwriting, natural variations, tremors in handwriting, handwriting comparison, Basics of Forensic linguistics and stylistics, its importance in writer identification.

**MODULE-2 Examination of special class of writings and impressions. Teaching Hours: 15 Hours**

Disguised writing and anonymous letters, Examination of alterations in documents, Examination, preservation and decipherment of secret writing, Indented writings and charred writings, seal and other mechanical impressions, Forgeries & its types, related case studies, Determination of age of document and writings, reporting of the cases and related case studies.

**MODULE-3 Forensic Examination of different types of Document Teaching Hours: 15 Hours**

Examination of Photostat (Xerox) copies, carbon copies, fax message, type writings, printed matter, Examination of e-documents & digital signature, counterfeit currency notes, passports, visa, credit cards, debit cards, legal deeds, postal stamps, etc, Related Case Studies.

Types of computer printers and their working: dot-matrix, daisywheel, line printers, ink-jet, thermal jet and laser printers, Examination of Computer printouts.

**References:**

1. Koppenhaver, K. (2010). Forensic Document Examination: Principles and Practice (1 st Ed.).
2. Osborn, A. (1929). Questioned documents. 2d. ed (1st ed.). Albany, N.Y.: Boyd printing Company.
3. Hilton, O. (1993). Scientific examination of questioned documents (1st ed.). Boca Raton: CRC Press.
4. Harrison, W. (1958). Suspect documents.
5. Kelly, J., & Lindblom, B. (2006). Scientific examination of questioned documents. Boca Raton, FL: CRC/Taylor & Francis.
6. Ellen, D. (2006). Scientific examination of documents. Boca Raton, FL: Taylor & Francis.
7. Huber, R., & Headrick, A. (1999). Handwriting identification (1st ed.). Boca Raton: CRC Press.

**CUTM2925: Forensic Accounting and Auditing**  
**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200

**Learning objectives:**

At the end of this course, students will be able to explain;

1. Forensic Accounting and frauds
2. Money Laundering and Fraud deterrence
3. Investigation of frauds and Legal Framework for Forensic Accounting

**MODULE-1 Forensic Accounting and frauds Teaching Hours: 15 Hours**

Principles and concepts of Forensic Accounting, Forensic auditing, Fraud triangle, types of frauds, methods for fraud detection, types of Financial Statement Frauds, Responsibility of Management and Auditors, reporting financial frauds, theory of fraud perpetrator, Litigation support bankruptcy, product liability, business valuations

Occupational frauds and abuses, Asset misappropriation, cheque tampering, false refunds, credit/debit card fraud.

**MODULE-2 Money Laundering and Fraud deterrence Teaching Hours: 15 Hours**

Basic concepts of money laundering, history, methods & related laws, fraud deterrence, international money laundering council, banking operations- national/international, commercial & economic damages and their factors, Investigative protocols for fraud detection, Corruption and Bribery, fraudulent schemes, Currency transaction

Tracing Illicit Transactions, examination, analysis and interpretation of electronic data relating to fraud, cyber crime loss evaluations, investigation of e-data, capturing digital media-hard drives, emails, deleted overwritten files, data recovery and extraction.

**MODULE-3 Investigation of frauds and Legal Framework for Forensic Accounting Teaching Hours: 15 Hours**

Fictitious revenues generation, Concealed liabilities and expenditures, Red flags, Whistle blowers and responses to fraud, Evidence collection and data analysis and interpretation, reporting methods, Prevention and detection of conflicts of interest, Law in relation to cyber-crimes, Ethics for Forensic Accountants, Code of Ethics, Code of Professional Standards, Laws Related to Fraud, Individual Rights during Examination, Criminal Prosecutions for Fraud, The Civil Justice System, expert testimony, Intellectual property rights

**Reference books:**

1. Money Laundering: A guide for criminal Investigation by John Madinger, Sydney A. Zalopany CRC Press New York (1999)
2. Financial Investigation and Forensic Accounting by George Manning CRC Press, New York USA (1999)
3. Corporate Fraud Hand Book by Joseph T Wells, John Wiley Sons Canada (2004)
4. Principles of Fraud Examination by Joseph T. Wells, John Wiley Sons Canada (2005)

**CUTM2939: Research Methodology**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200		

**Learning objectives:**

At the end of this course, students will be able to explain;

1. Literature review
2. The development of a research plan
3. Data collection, interpretation and errors
4. Important components for writing the research paper and thesis
5. Basics of Ethical issues, Intellectual property rights, Copy right

**MODULE-1 Basics of research**

**Teaching Hours: 15 Hours**

Objectives and types of research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical. Research Formulation, Literature review and Development of hypothesis. Research design and methods, developing a research plan - Exploration, Description, Diagnosis, and Experimentation. Determining experimental and sample designs.

**MODULE-2 Data analysis methods**

**Teaching Hours: 15 Hours**

Data Collection and analysis: Methods of data collection – Sampling Methods and Data Processing. Data Analysis: Types of data, Basic concept of frequency distribution, measure of central values – Mean, median and mode, measure of dispersion, range, mean deviation and standard deviation, probability, theory and classical definition of probability, Bayes theorem of probability, conditional probability and coincidence probability, Chi-square test, ANOVA, SPSS. Types of Errors and Interpretation of Findings

**MODULE-3 Scientific reports and thesis writing**

**Teaching Hours: 15 Hours**

Reporting and thesis writing: Structure and components of scientific reports and thesis, Significance and Different steps in the preparation, Illustrations, Bibliography. Presentations: Oral and Poster, Importance of effective communication in scientific research.

Basics of Ethical issues, Intellectual property rights, Copy right, Reproduction of published material: Plagiarism in scientific research and communications.

**Reference books:**

1. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2 volumes.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
4. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.
5. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
6. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
7. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall. 12.
- Satarkar, S.V., 2000. Intellectual property rights and Copy right. EssEss Publications.

<b>UGFS S7 CE- 5</b>	<b>Core Elective - V</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**CUTM2926: Practical-VII**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams			University Exams (LPW)	
					TA-1 & TA-2		MSE		Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs					
0	0	8	4	8							100	6:00	100

**Learning Objectives:**

At the end of course, students will be gaining the hands on training in the following courses;

**MODULE-1 Modern Trends in Fingerprint Science**

1. Analysis of fingerprints with microscopic techniques for the ridge dimensions with the complete identification profiling
2. Comparison of males' and females' fingerprints with the specific reference to the ridge dimensions
3. Development of latent finger prints using Ninhydrin.
4. Development of latent finger prints using iodine fuming
5. Development of latent finger prints using Nanoparticles
6. Understanding AFIS method of fingerprints analysis
7. Palatoprints
8. Cheiloscopy
9. Importance of molecular fingerprints with special refernce to fingerprint residues using instrumental methods

**MODULE-2 Advances in Forensic Document Examination**

1. Examination and Identification of handwriting on the basis of class and individual characteristics.
2. Examination and identification of forged signatures.
3. Identification of disguised in handwriting
4. Examination and identification of natural variations in handwritings
5. Examination of additions, alterations, and obliterations in the documents.
6. Examination of security features of currency notes, passports, visa
7. Examination of rubber seal impressions
8. Determination of sequence of strokes

**MODULE-3 Forensic Accounting and Auditing**

1. Examination of ink by TLC
2. Examination of ink by GCMS
3. Examination of ink by LCMS
4. Examination of ageing of paper
5. Examination of currency notes
6. Examination of Passport
7. Examination of Stamp
8. Examination of Rubber Stamp Impressions
9. Related case studies

**MODULE-4                      Research Methodology**

1. Calculation of mean, median and mode
2. Calculation of standard deviation
3. Calculation of variance
4. Perform chi square test on a given set of data
5. Perform T-test and student's T-test on a given set of values

## **Specialization-3**

# **“Forensic Chemistry and Toxicology”**

**CUTM2927: Forensic Pharmacy and Pharmacology of Controlled  
Drugs**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200

\* Note: TA-2 will be in form of assignments or workshops

**Learning objectives:**

1. To help students learn basics of pharmacology.
2. To help students learn concepts forensic pharmacology.
3. To study and understand action of various drugs.

**MODULE-1 Basic Principles of Forensic Pharmacy Teaching Hours: 15 Hours**

Introduction to Pharmacology and Forensic Pharmacy, Branches of Pharmacology, Scope of Forensic Pharmacy, Pharmacopoeias IP, USP, EP, pharmacognosy, pharmacovigilance, Nature and Source of drug, forms of drugs, classification of drugs, Prodrug and soft drug concept, Drug synthesis, Route of administration of Drugs, Factor affecting the effects of Drug, Ferguson's principle, Adverse drug reactions and drug induced side effects.

**MODULE -2 Concepts of Pharmacology Teaching Hours: 15 Hours**

Pharmacokinetics, Bioavailability, Bioequivalence and Bioaccumulation, Efficacy and potency, Dose response relationship, Pharmacodynamics, Phase-I and Phase-II mechanism, Drug Therapeutic Index, Drug Receptor concept, types of receptors and mechanism of action, Pharmacokinetic drug interactions, various biological barriers, Agonism, Antagonism, Addition, Synergism, Potentiation, drug addiction and drug dependence, drug tolerance, drug hypersensitivity.

**MODULE-3 Pharmacology of Different classes of controlled drugs Teaching Hours: 15 Hours**

Pharmacology of neurotransmitters like GABA, Glutamate, Glycine, Serotonin, Dopamine, General Anaesthetics, Neuroleptics, Sedatives, Hypnotics, Alcohol, antihypertensive drugs,

Antidepressant, Anti-stimulants, anti-maniacs & hallucinogens, Anti-infective drugs Antipyretics, NSAIDs, and antipsychotics, Case Studies

Detection of prohibited drugs (anabolic steroids, peptide hormones, growth factors and mimetics, betagonist, metabolic modulators, diuretics and masking agents and beta blockers by different techniques)

**Reference Books:**

1. Klaassen, C. D.: Casarett and Doull's Toxicology: The Basic Science of Poisons, 5th ed, McGraw-Hill, 1995.
2. Moffat, A.C.: Osselton, D. M. Widdop, B.: Clarke's Analysis of Drugs and Poisons in Pharmaceuticals, body fluids and post-mortem material, 3rd ed., Pharmaceutical Press 2004.
3. Bogusz, M. J.: Hand Book of Analytical Separations, Vol. 2: Forensic Science, 1st ed., Elsevier Science, 2000.
4. Siegel, J.A., Saukko, P. J., Knupfer, G.: Encyclopaedia of Forensic Sciences (Vol3), Academic Press, 2000.
5. Rang, P.H., Dale, M.M., Ritter, M.J.: Pharmacology, 4th ed., Harcourt/Churchill Livingstone, 2000.
6. Paranjape, H.M., Bothara, G.K., Jain, M.M.: Fundamentals of Pharmacology, 1st ed., Nirali Prakashan, 1990.
7. Budhiraja, R.D.: Elementary Pharmacology and Toxicology, Popular Prakashan, 2nd ed., 1999.
8. Wiseman, H and Henry J.: Management Of Poisoning, A Handbook for Health care workers, 1st ed., A.I.T.B.S, 2002
9. Hardman, J. G. and Limbird, L. E.: Goodman and Gilman's The Pharmacological basis of Therapeutics, 9th ed., McGraw-Hill, 1996
10. Stolmen, A.; Progress in Chemical Toxicology: Academic Press, New York (1963)
11. Modi, Jaisingh, P.; Textbook of Medical Jurisprudence & Toxicology, M.M. Tripathi Publication (2001)
12. Pillay, V. V.; Handbook of Forensic Medicine and Toxicology, Paras Pub., 2001
13. Curry, A. S: Poison Detection in Human Organ

**CUTM2928: Advanced Forensic Toxicology**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams			University Exams (LPW)	
					TA-1 & TA-2		MSE		Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs					
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200

\* Note: TA-2 will be in form of assignments or workshops

**Learning objectives:**

1. To help students learn basic principles of toxicology.
2. To help students learn about xenobiotics and toxic effects.
3. To study and understand concepts of mechanism of toxicity.

**Module-1 Concepts of Toxicology**

**Teaching Hours: 15 Hours**

Branches of toxicology, Toxicants and Types of Toxicants, Dose and related terms used in toxicology, Sources of poisoning, duration and frequency of exposure, modals of toxicity testing, Laws and Regulations in toxicological testing, Regulatory bodies national and International, Risk and Hazard characterization, Global Harmonization System (GHS), Good Laboratory Practice (GLP).

**Module-2 Principles of Toxicology**

**Teaching Hours: 15 Hours**

Dose-effects and dose-response relationship, types of toxicity, Factors affecting toxicity – species and strain, age, sex, nutritional status, hormones, environmental factors, circadian rhythms, Enzyme Induction and Inhibition, molecular mechanism of toxicity, role of electrophiles and nucleophiles in toxicity, translocation of toxicants, toxico-kinetics and toxico-dynamics processes, detoxification of xenobiotics, biotransformation of xenobiotics, bioaccumulation of xenobiotics, anti-dotal therapy.

**Module-3 Toxic effects of Xenobiotics**

**Teaching Hours: 15 Hours**

Toxic effects of drugs, mechanism of drug toxicity, Toxic effects of pesticides, mechanism of pesticide toxicity, toxicity, Toxic effects of heavy metals, mechanism of heavy metal toxicity, Toxic effects of Alcohol and solvents, mechanism of poisonous liquor, Toxic effects of plantpoisons, Toxic effects of insects and animal poison, toxicity symptoms and treatment of xenobiotics.

Reference books:

1. Curry: Analytical Methods in Human Toxicology, Part II, 1986.
2. Gupta, P.K. Fundamentals of Toxicology: Essential Concepts and Applications. India, Elsevier Science, 2016.
3. Casarett & Doll Toxicology: The Basic Science of poisons.
4. Clark, E.G.C.: Isolation and identification of Drugs, 1966
5. Curry, A.S.: Poison Detection in Human Organs, 1976
6. Curry, A.S.: Advances in Forensic Chemical Toxicology, 1972
7. Holfmann, F.G.: Handbook of Drug and Alcohol Abuse.
8. Turner: Drugs & Poisons.
9. Samford: Poisons Their Isolation Identification
10. Stoleman: Progress in Chemical Toxicology.
11. Sunshine, I: Guidelines for Analytical Toxicology Programme, Vol-I, CRC press, 1950.
12. Sunshine, I: Handbook of Analytical Toxicology, press, 1969.
13. Mule, S. J. et al.: Immunoassays for Drugs subjects to ab, CRC Press, 1974
14. Connors, K.: A text book of Pharmaceuticals analysis, Interscience, New York, 1975

**CUTM2929: Modern and Applied Analytical Forensic Chemistry**  
**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200

\* Note: TA-2 will be in form of assignments or workshops

**Learning objectives:**

1. To help students learn advanced aspects of forensic drug chemistry.
2. To help students learn the concepts of petro-forensics and international guidelines about fire forensics.
3. To study and understand various chromatographic and spectroscopic techniques.

**MODULE-1 Advanced Forensic Drug Chemistry**

**Teaching Hours: 15 Hours**

Drug Trafficking, Forensic examination of drugs/Narcotics - Cannabis, Phenethylamines (Amphetamine, Methamphetamine), Hydroxyl derivative (Ephedrine), Ketone Derivative (Cathinone), Methoxy Derivative (Mescaline), Tertiary Amines (Cocaine and Opiates), Tryptamines (Psilocin and Psilocybin), Anabolic Steroids, Miscellaneous Controlled Substances (Barbiturates, Benzodiazepines, GHB, Ketamine and LSD).

Presumptive/Screening and Confirmatory Methods: Colour/spot test, microscopic examination, Microcrystalline tests, Thin-Layer Chromatography, Sample Preparation before TLC Specimen, Extraction Evaluation of TLC for Drug Screening, Immunoassay Methods, Other instrumental techniques involved in analysis. Format of NDPS Report Writing & Court Room Testimony. Case studies.

**MODULE-2**

**Teaching Hours: 15 Hours**

**Petro Forensics:**

Distillation and fractionation of petroleum. Commercial uses of different petroleum fractions. Physical Properties of Petroleum Products Analytical Techniques: Quantitative and Qualitative Steps in Analysis of Petroleum, Analysis of traces of petroleum products in forensic exhibits. Case studies.

**Fire Chemistry:**

Scientific Investigation of Fire, NFPA 921 and NFPA 1033, Separation and analytical techniques of ignitable liquid residues, Interpretation of Data Obtained from Fire Debris, Quality Assurance in Fire debris Analysis, Report Writing and Court Testimony. Case studies.

**MODULE-3**

**Teaching Hours: 15 Hours**

**Explosives Chemistry:**

Introduction and assessment of explosives, Oxygen balance, Explosive Power Index, Heat and Temperature of Explosion, Pressure of explosion, Mechanism of Ignition and hot spot formation. Thermal decomposition, physical and chemical aspects of combustion, Deflagration and Detonation, Analysis of low and high explosives by different instrumental techniques, Quality control, Proficiency Testing, Interpretation and Significance of Results. Case studies.

**Chemical Warfare Agents:**

Classification, physical and biochemical properties, toxic effects detection by Biosensors and various instrumental techniques.

**Reference Books:**

1. Clarke's Analysis of Drugs and Poisons, (Formerly Isolation & Identification of Drugs) 9rd Ed. 2 Vol. Set.
2. Clark, E.G.C.: Isolation and identification of Drugs, VI and Vol. II, 1966, 1975-1986.
3. Modi, Text Book of Medical Jurisprudence Forensic Medicines and Toxicology (1999) CBS Pub. New Delhi.
4. Saferstien (1982) Forensic Science, Handbook, Vol. I, II & III, Prentice Hall Inc. USA.
5. DFS -Working Procedure Manual- Narcotics.
6. E. Stahl (1969) Thin Layer Chromatography: A Laboratory Handbook.
7. Saferstein (1976) Criminalistics.
8. Klaassen, C. D.: Casarett and Doull's Toxicology: The Basic Science of Poisons, 5th ed, McGraw-Hill, 1995.
9. Moffat, A.C.: Osselton, D. M. Widdop, B.: Clarke's Analysis of Drugs and Poisons in Pharmaceuticals, body fluids and post-mortem material, 3rd ed., Pharmaceutical Press 2004.
10. Bogusz, M. J., Hand Book of Analytical Separations, Vol. 2: Forensic Science, 1st ed., Elsevier Science, 2000.
11. Siegel, J.A., Saukko, P. J., Knupfer, G.: Encyclopaedia of Forensic Sciences (Vol. 3), Academic Press, 2000.
12. Rang, P.H., Dale, M.M., Ritter, M.J.: Pharmacology, 4th ed., Harcourt/Churchill Livingstone, 2000.
13. Paranjape, H.M., Bothara, G.K., Jain, M.M.: Fundamentals of Pharmacology, 1st ed., Nirali Prakashan, 1990.
14. Budhiraja, R.D.: Elementary Pharmacology and Toxicology, Popular Prakashan, 2nd ed., 1999.
15. Wiseman, H and Henry J.: Management Of Poisoning, A Handbook for Healthcare workers, 1st ed., A.I.T.B.S, 2002.
16. Hardman, J. G. and Limbird, L. E.: Goodman and Gilman's The Pharmacological basis of Therapeutics, 9th edn., McGraw-Hill, 1996.
17. Laboratory procedure Manual, Forensic Toxicology: DFS, 2005.
18. Sunshine, I; Methods for Analytical Toxicology, CRC Press USA (1975).
19. Cravey, R.H; Baselt, R.C.: Introduction to Forensic Toxicology, Biochemical Publications, Davis, C.A. (1981).
20. Stolmen, A; Progress in Chemical Toxicology: Academic Press, New York (1963).
21. Modi, Jaisingh, P.; Textbook of Medical Jurisprudence & Toxicology, M.M. Tripathi Publication (2001).
22. Eckert; An Introduction to Forensic Science, CRC Press.

23. Pillay, V. V.; Handbook of Forensic Medicine and Toxicology, Paras Pub., 2001.
24. Curry, A. S: Poison Detection in Human Organ.
25. James, S. H. and Nordby, J. J.: Forensic Science: An Introduction to Scientific and Investigative Techniques, 2003.
26. Saferstein, R: Criminalistics - An Introduction to Forensic Science, Prentice Hall, 1995.
27. Sarkar, S: Fuels and Combustion, Orient Longman, 1990.
28. Verma, R. M: Analytical Chemistry – Theory and Practice, CBS Pub., 1994.
29. Svehla, G. Ed.: Vogel's Qualitative Inorganic Analysis, Longman, 1331.
30. Bassett: Vogel's Text Book of Quantitative Inorganic Analysis, Longman, 1331.
31. Vogel, A. I: Text Book of Practical Organic Chemistry including Qualitative Organic Analysis, ELBS, 1971.
32. Skoog, D. A., West, D. M. and Holler, F. J: Analytical Chemistry: An Introduction, Saunders College, 1994.
33. Siegel, J. A, Saukko, P. J. and Knupfer, G. C: Encyclopaedia of Forensic Sciences, Academic Press, 2000.
34. Townsends, A. (Ed): Encyclopaedia of Analytical Science, Academic Press, 2005.
35. Beveridge, A: Forensic Investigation of Explosives, Taylor & Francis, 2000.
36. Yallop, H. J: Explosion Investigation, Forensic Science Society & Scottish Academic Press, 1980.
37. Narayanan, T. V: Modern Techniques of Bomb Detection and Disposal, R. A. Security System, 1995.
38. Yinon, J. and Zitrin, S: The Analysis of Explosives, Oxford: Pergamon, 1981.
39. An Introduction to Physics and chemistry of Petroleum.
40. Kinghorn: Introduction to Petrochemicals Sukumar Maiti.
41. D.W. Waples: Geochemistry in Petroleum Exploration.
42. A.L. Waddams: Petroleum Geochemistry and Geology Chemicals from Petroleum.
43. Day & Underwood: Analytical Chemistry.

**CUTM2939: Research Methodology**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200

\* Note: TA-2 will be in form of assignments or workshops

**Learning objectives:** At the end of this course, students will be able to explain;

1. Literature review
2. The development of a research plan
3. Data collection, interpretation and errors
4. Important components for writing the research paper and thesis
5. Basics of Ethical issues, Intellectual property rights, Copy right

**MODULE-1 Basics of research**

**Teaching Hours: 15 Hours**

Objectives and types of research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical. Research Formulation, Literature review and Development of hypothesis.

Research design and methods, developing a research plan - Exploration, Description, Diagnosis, and Experimentation. Determining experimental and sample designs

**MODULE-2 Data analysis methods**

**Teaching Hours: 15 Hours**

Data Collection and analysis: Methods of data collection – Sampling Methods and Data Processing. Data Analysis: Types of data, Basic concept of frequency distribution, measure of central values – Mean, median and mode, measure of dispersion, range, mean deviation and standard deviation, probability, theory and classical definition of probability, Bayes theorem of probability, conditional probability and coincidence probability, Chi-square test, ANOVA, SPSS. Types of Errors and Interpretation of Findings

**MODULE-3 Scientific reports and thesis writing**

**Teaching Hours: 15 Hours**

Reporting and thesis writing: Structure and components of scientific reports and thesis, Significance and Different steps in the preparation, Illustrations, Bibliography. Presentations: Oral and Poster, Importance of effective communication in scientific research.

Basics of Ethical issues, Intellectual property rights, Copy right, Reproduction of published material: Plagiarism in scientific research and communications.

**Reference books:**

1. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2 volumes.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
4. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.
5. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
6. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
7. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall. 12.
- Satarkar, S.V., 2000. Intellectual property rights and Copy right. EssEss Publications.

<b>'UGFS S7 CE-5</b>	<b>Core Elective - V</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**CUTM2930: Practical-VII**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams			University Exams (LPW)	
					TA-1 & TA-2		MSE		Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs					
0	0	8	4	8							100	6:00	100

**Learning Objectives:**

At the end of course, students will be gaining the hands on training in the following courses;

**MODULE-I Forensic Pharmacy and Pharmacology of Controlled Drugs**

1. Qualitative and Quantitative analysis of paracetamol
2. Concepts and Parts identification of GC, GC-MS & HPLC.
3. LLE & DLLME based extraction of drugs.
4. Detection of drug classes by imaging system like Raman.
5. Detection of Sugars in Anti-diabetic drugs by IC.
6. Organic composition profiling of drug class by CHNS/O.
7. Detection of anabolic agents in supplements by GCMS.

**MODULE-2 Advanced Forensic Toxicology**

1. Preparation of standard and working solutions.
2. Plotting of calibration curve and quantification using UV-Vis Spectroscopy
3. Analysis of organochlorine, Organophosphorus, Carbamates and Pyrethroids by colour tests, TLC, GC-MS methods.
4. Identification of common plant poisons Oleander, Dhatura, Calotropis and Ricin.
5. Analysis of alcohol and derivatives by head-space gas chromatography (HS-GC).
6. Extraction and Analysis of heavy metals by microwave extraction and ICP-MS.

Analysis of non-volatile drugs by HPLC

**MODULE-3 Modern and Applied Analytical Forensic Chemistry**

1. Microcrystalline tests for Narcotic drugs.
2. Separation of Psychotropic substance by TLC.

3. Separation of Cannabis/Opium by TLC, UV, FTIR
4. Analysis of high explosives by TLC, UV, FTIR
5. Qualitative Analysis of fire residues by GC-MS and GC-MS.
6. Analysis of dye in petrol and kerosene by UV spectrophotometry and TLC.
7. Analysis of NDPS drugs and explosives by instrumental techniques.

#### **MODULE-4                      Research Methodology**

1. Calculation of mean, median and mode
2. Calculation of standard deviation
3. Calculation of variance
4. Perform chi square test on a given set of data
5. Perform T-test and student's T-test on a given set of values

# Specialization-4

# “Forensic Biology and Biotechnology”

**CUTM2931: Fundamentals of Biological Chemistry**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams			University Exams (LPW)	
					TA-1 & TA-2		MSE		Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs					
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200

\* Note: TA-2 will be in form of assignments or workshops

**Learning objectives:**

At the end of course, students will be able to demonstrate understanding about;

1. Fundamentals of biomolecules
2. Chemistry of Carbohydrates, Proteins and Lipids
3. Basics of Enzymes and Enzyme kinetics

**MODULE-1 Biomolecules Teaching Hours: 15 Hours**

Chemical foundations of Biology: pH, acids, bases pK, buffers, Atomic bonds and Molecular interactions: Weak bonds (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction), Covalent bonds,

Bioenergetics: Basic principles, Laws of thermodynamics, Equilibria and concept of free energy, Standard free energy, free energy change.

**MODULE-2 Chemistry of Carbohydrates, Lipids and Proteins Teaching Hours: 15 Hours**

**Chemistry of Carbohydrates:** Definition, biological importance and classification. Monosaccharides Isomerism, anomerism. Sugar derivatives, Disaccharides, Polysaccharides. Structures of starch, glycogen and glycosaminoglycan.

**Chemistry of Lipids:** Definition, Biological importance and classification. Fats and fatty acids. Introduction to compound lipids. Hydrophobic and hydrophilic groups. Cholesterol. Bile salts. Micelle. Bimolecular leaflet, Lipoproteins – formation, function and turnover.

**Chemistry of Proteins:** Biological importance, classification of amino acids, amino acid racemization, and titration curve of amino acids, Proteins and peptides – Composition of proteins – Primary, Secondary and Tertiary structure of protein. Simple, conjugated, globular and fibrous proteins, denaturation and denaturation.

**MODULE-3 Enzymology Teaching Hours: 15 Hours**

- Enzymes: Properties, Nomenclature, Classification,
- Enzyme kinetics, Mechanism of enzyme action,
- Enzyme inhibition
- Regulation of enzyme action.

**Reference Books:**

1. Lehninger Principles of Biochemistry 6th Edition (2012) – Nelson and Cox, W.H. Freeman, ISBN: 978-1429234146
2. L. Stryer, Biochemistry, 5th Edition, (2002) Freeman &Co. New York
3. Wang, Xing, Kuruc, Matthew. 2019. Functional Proteomics, Springer.
4. E.D. Hoffmann, V. Stroobant. 2007. Mass Spectrometry: Principles and Applications, John Wiley & Sons Ltd. The Atrium, Southern Gate, Chichester, West Sussex PO198SQ, England.
5. D. Kambhampati. 2004. Protein Microarray Technology, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany.

**CUTM2932: Molecular Biology and rDNA technology**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams			University Exams (LPW)	
					TA-1 & TA-2		MSE		Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs					
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200

\* Note: TA-2 will be in form of assignments or workshops

**Learning objectives:**

At the end of this course, students will be able to explain;

1. Basics of Molecular Biology
2. Genetic Engineering and rDNA technology
3. Fundamentals of rDNA technology

**MODULE-1 Basics of Molecular Biology and advanced techniques Teaching Hours: 15 Hours**

- Organization of genome in prokaryotes and eukaryotes
- Chemical structure of DNA and RNA
- DNA replication: Enzymes and accessory proteins, Mechanism of DNA replication in prokaryotes and eukaryotes.
- Procedure for collection and preservation of biological sample for DNA analysis.
- Techniques of DNA isolation and its quantitation.
- Polymerase Chain Reaction and its variants in PCR and primer designing
- DNA separation and detection techniques
- Methods of DNA sequencing
- Florescence in situ hybridization (FISH) for genome analysis and Chromosome micro-dissection

**MODULE-2 Central Dogma of Genetic Engineering and rDNA technology Teaching Hours: 15 Hours**

- Transcription: RNA polymerases, features of prokaryotic and eukaryotic promoters,
- Assembly of transcription initiation complex in prokaryotes and eukaryotes and its regulation;
- Synthesis and processing of prokaryotic and eukaryotic transcripts. Transport of RNA within eukaryotic cell.

- Translation: Structure and role of t-RNA in protein synthesis, ribosome structure, basic features of genetic code and its deciphering, translation (initiation, elongation and termination in detail in prokaryotes as well as eukaryotes).

**MODULE-3 Fundamentals of rDNA technology Teaching Hours: 15 Hours**

- General introduction and concept of recombinant DNA technology.
- DNA modifying enzymes
- Cloning strategies: Genomic libraries, cDNA libraries, single gene cloning.
- Vectors: Types of vectors and choice of vectors- Plasmids, cosmids, lambda phage vectors, shuttle vectors, BACs and YACs
- Choice of hosts, Methods for transferring recombinant DNA to host cells (Transformation and Transfection)
- Expression systems in Eukaryotic cells, Yeast, Bacteria, Insect cell lines, Gene screening
- Biosafety guidelines and containment strategies.

**Reference Books:**

1. Forensic DNA Typing, Second Edition: Biology, Technology, and Genetics of STR Markers 2nd Edition (2005) - John M. Butler, Academic Press, ISBN:0121479528
2. Advanced Topics in Forensic DNA Typing: Methodology (2011), John M. Butler, Academic Press, ISBN: 978-0123745132
3. Advanced Topics in Forensic DNA Typing: Interpretation, (2014) - John Butler, Academic Press, ISBN:19780124052130
4. Forensic DNA Analysis Technological Development and Innovative Applications, 1<sup>st</sup> ed. (2021) - Elena Pilli and Andrea Berti, Apple Academic Press, Inc., ISBN 9781771889056
5. Forensic DNA Profiling - A Practical Guide to Assigning Likelihood Ratios, 1<sup>st</sup> ed. (2020) - Jo-Anne Bright and Michael D. Coble, CRC Press, ISBN: 9780367029029
6. Forensic Practitioner's Guide to The Interpretation of Complex DNA Profiles, 1<sup>st</sup> ed. (2020) - Peter Gill et. al., Academic Press, ISBN: 978-0-12-820562-4
7. Interpreting Complex Forensic DNA Evidence, 1<sup>st</sup> ed. (2020) - Jane Moira Taupin, CRC Press, ISBN:978-1-138-49567-8
8. An Introduction to Forensic Genetics, 2<sup>nd</sup> Edition (2010) - William Goodwin, Adrian Linacre and SibteHadi, Wiley-Blackwell, ISBN: 978-0470710197
9. Forensic Genetics in the Governance of Crime, 1<sup>st</sup> ed. (2019) - Helena Machado and Rafaela Granja, Palgrave Macmillan, ISBN 978-981-15-2429-5
10. High-Throughput Next Generation Sequencing – Methods and applications, 1<sup>st</sup> ed. (2011), Young Min Kwon and Steven C. Rieke, Humana Press, ISBN: 9781617790881
11. Next Generation DNA Led Technologies, 1<sup>st</sup> ed. (2016), SharadaAvadhanam et. al., Springer, ISBN: 978-981-287-669-0
12. Next Generation Sequencing – Methods and Protocols, 1<sup>st</sup> ed. (2018) - Steven R. Head et. al., Humana Press, ISBN: 978-1-4939-7514-3
13. A Primer of Conservation Genetics. 2004. Richard Frankham, Jonathan D. Ballou, David A. Briscoe. Cambridge University Press. <http://www.cambridge.org/9780521831109>

14. An Introduction to Population Genetics Theory and Applications. Rasmus Nielsen, Montgomery Slatkin. Publisher: Sinauer Associates, Year of Publication-2013.
15. Population Genomics :Concepts, Approaches and Applications. Edited by Om P. Rajora. Publisher : Springer International Publishing. DOI: 10.1007/978-3-030-04589-0. Year of Publication : 2019.
16. Conservation and the genetics of populations / Fred W. Allendorf, Gordon Luikart, Sally N. Aitken; with illustrations by AgostinhoAntunes. – 2nd ed. ISBN 978-0-470-67146-7. Year of Publication : 2013. Publisher: John Wiley & Sons, Ltd
17. Population genetics by Matthew B. Hamilton. 2009. ISBN 978-1-4051-3277-0. Publisher: John Wiley & Sons, Ltd

**CUTM2933: Forensics Genomics and DNA Profiling**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200		

\* Note: TA-2 will be in form of assignments or workshops

**Learning objectives:**

At the end of this course, students will be able to explain;

1. STR profiling
2. Application of lineage markers in DNA Forensics
3. Fundamentals of bioinformatics and its application in Forensics

**MODULE-1 Advanced topics in STR Profiling Teaching Hours: 15 Hours**

- Modern techniques for DNA extraction and quantification
- STR Profiling, Types of errors, Result interpretation and Report Writing
- DNA Mixtures – Current status of tools and guidelines
- Paternity/maternity indices, Sibship indices

**MODULE-2 Application of lineage markers in DNA Forensics Teaching Hours: 15 Hours**

- Mitochondrial DNA analysis for human and related databases
- Advanced Y-STR and X-STR analysis and its significance in establishing paternal relationships.
- Identity, Phenotypic and ancestry informative markers
- Genealogy and its applications in forensic genetics
- Quality assurance and quality control in DNA forensics
- Molecular autopsy and tissue identification by DNA and RNA
- Concepts in Next Generation Sequencing (NGS) and Genome analysis

**MODULE-3 Fundamentals of bioinformatics and its application in Forensics Teaching Hours: 15 Hours**

- Biological Data: The form of biological information
- Primer designing for forensically important markers
- Various databases for lineage and mtDNA markers

- Databases – Format and Annotation: Conventions for database indexing and specification of search terms, common sequence file formats, annotated sequence databases - primary sequence databases, organism specific databases
- Data – Access, Retrieval and Submission: Standard search engines; Data retrieval tools – Entrez, Submission of (new and revised) data, data submission tools
- Sequence Similarity Searches: Local v/s global, Distance metrics. Similarity and homology, Scoring matrices, Dynamic programming algorithms, Needleman-Wunsch and Smith-waterman, FASTA, BLAST and other variants of BLAST
- Multiple Sequence Alignment and Whole genome analysis, existing software tools for MSA
- Database management tools in DNA Forensics: CODIS and DNAXs
- Other Databases and Online-Tools: NCBI, STRBase, STRidER, PhyloTreemt, SNPforID Browser, popSTR browser, ALFRED, scientific literature

### References:

- Forensic DNA Typing, Second Edition: Biology, Technology, and Genetics of STR Markers 2nd Edition (2005) - John M. Butler, Academic Press, ISBN:0121479528
- Advanced Topics in Forensic DNA Typing: Methodology (2011), John M. Butler, Academic Press, ISBN: 978-0123745132
- Advanced Topics in Forensic DNA Typing: Interpretation, (2014) - John Butler, Academic Press, ISBN:19780124052130
- Forensic DNA Analysis Technological Development and Innovative Applications, 1st ed. (2021) - Elena Pilli and Andrea Berti, Apple Academic Press, Inc., ISBN 9781771889056
- Forensic DNA Profiling - A Practical Guide to Assigning Likelihood Ratios, 1st ed. (2020) - Jo-Anne Bright and Michael D. Coble, CRC Press, ISBN: 9780367029029
- Forensic Practitioner's Guide to The Interpretation of Complex DNA Profiles, 1st ed. (2020) - Peter Gill et. al., Academic Press, ISBN: 978-0-12-820562-4
- Interpreting Complex Forensic DNA Evidence, 1st ed. (2020) - Jane Moira Taupin, CRC Press, ISBN:978-1-138-49567-8
- An Introduction to Forensic Genetics, 2nd Edition (2010) - William Goodwin, Adrian Linacre and Sibte Hadi, Wiley-Blackwell, ISBN: 978-0470710197
- Forensic Genetics in the Governance of Crime, 1st ed. (2019) - Helena Machado and Rafaela Granja, Palgrave Macmillan, ISBN 978-981-15-2429-5
- High-Throughput Next Generation Sequencing – Methods and applications, 1st ed. (2011), Young Min Kwon and Steven C. Rieke, Humana Press, ISBN: 9781617790881
- Next Generation DNA Led Technologies, 1st ed. (2016), Sharada Avadhanam et. al., Springer, ISBN: 978-981-287-669-0
- Next Generation Sequencing – Methods and Protocols, 1st ed. (2018) - Steven R. Head et. al., Humana Press, ISBN: 978-1-4939-7514-3
- A Primer of Conservation Genetics. 2004. Richard Frankham, Jonathan D. Ballou, David A. Briscoe. Cambridge University Press. <http://www.cambridge.org/9780521831109>
- An Introduction to Population Genetics Theory and Applications. Rasmus Nielsen, Montgomery Slatkin. Publisher: Sinauer Associates, Year of Publication-2013.

- Population Genomics :Concepts, Approaches and Applications. Edited by Om P. Rajora. Publisher : Springer International Publishing. DOI: 10.1007/978-3-030-04589-0. Year of Publication : 2019.
- Conservation and the genetics of populations / Fred W. Allendorf, Gordon Luikart, Sally N. Aitken; with illustrations by Agostinho Antunes. – 2nd ed. ISBN 978-0-470-67146-7. Year of Publication : 2013. Publisher: John Wiley & Sons, Ltd
- Population genetics by Matthew B. Hamilton. 2009. ISBN 978-1-4051-3277-0. Publisher: John Wiley & Sons, Ltd

**CUTM2939: Research Methodology**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams			University Exams (LPW)	
					TA-1 & TA-2		MSE		Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs					
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200

\* Note: TA-2 will be in form of assignments or workshops

**Learning objectives:** At the end of this course, students will be able to explain;

1. Literature review
2. The development of a research plan
3. Data collection, interpretation and errors
4. Important components for writing the research paper and thesis
5. Basics of Ethical issues, Intellectual property rights, Copy right

**MODULE-1 Basics of research**

**Teaching Hours: 15 Hours**

Objectives and types of research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical. Research Formulation, Literature review and Development of hypothesis.

Research design and methods, developing a research plan - Exploration, Description, Diagnosis, and Experimentation. Determining experimental and sample designs.

**MODULE-2 Data analysis methods**

**Teaching Hours: 15 Hours**

Data Collection and analysis: Methods of data collection – Sampling Methods and Data Processing. Data Analysis: Types of data, Basic concept of frequency distribution, measure of central values – Mean, median and mode, measure of dispersion, range, mean deviation and standard deviation, probability, theory and classical definition of probability, Bayes theorem of probability, conditional probability and coincidence probability, Chi-square test, ANOVA, SPSS. Types of Errors and Interpretation of Findings.

**MODULE-3 Scientific reports and thesis writing**

**Teaching Hours: 15 Hours**

Reporting and thesis writing: Structure and components of scientific reports and thesis, Significance and Different steps in the preparation, Illustrations, Bibliography. Presentations: Oral and Poster, Importance of effective communication in scientific research.

Basics of Ethical issues, Intellectual property rights, Copy right, Reproduction of published material: Plagiarism in scientific research and communications.

**Reference books:**

1. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International.
  2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2 volumes.
  3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
  4. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.
  5. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
  6. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
  7. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall. 12.
- Satarkar, S.V., 2000. Intellectual property rights and Copy right. EssEss Publications.

<b>UGFS S7 CE- 5</b>	<b>Core Elective - V</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**CUTM2934: Practical-VII**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams			University Exams (LPW)	
					TA-1 & TA-2		MSE		Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs					
0	0	8	4	8							100	6:00	100

**Learning Objectives:**

At the end of course, students will be gaining the hands on training in the following courses;

**MODULE-1 Fundamentals of Biological Chemistry**

1. Estimation of Protein, Sugar, Lipid and Cholesterol
2. Protein Extraction and Separation by SDS PAGE
3. Denaturation and renaturation of Protein
4. Measuring time dependent activity of an enzyme
5. Estimation of Km and Vmax for an enzyme.

**MODULE-2 Molecular Biology and rDNA technology**

- DNA extraction from biological samples
- Polymerase Chain Reaction
- Sanger Sequencing

**MODULE-3 Forensics Genomics and DNA Profiling**

- STR Profiling and report writing using simulated evidences
- Analysis of lineage markers (Y-STR and mtDNA) from simulated samples
- Primer designing and sequence alignment for forensic markers
- Data retrieval and analysis from various databases: NCBI, PubMed Central, STRidER
- Construction of phylogenetic tree and phylogeographic analysis using various tools
- Extraction of proteins from different body fluids
- Native PAGE, and Iso electric focusing
- Intrinsic fluorescence of body fluids
- Application of Swiss PDB viewer, Rasmol, NCBI database and FASTA sequence

**MODULE-4                      Research Methodology**

1. Calculation of mean, median and mode
2. Calculation of standard deviation
3. Calculation of variance
4. Perform chi square test on a given set of data
5. Perform T-test and student's T-test on a given set of values

# **Specialization-5**

# **“Cyber Forensic”**

**CUTM2935: Advanced Digital Forensics**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200

\* Note: TA-2 will be in form of assignments or workshops

**Learning Objectives:** After studying this paper the students will be able to –

1. Understand the various stages of digital forensics investigation
2. Get familiar with the various artifacts and their sources, found in Windows Operating System.
3. Get a basic understanding of the various artifacts and evidences found in Linux and MAC forensics.
4. Identify the working of various tools and techniques used for digital forensics examination.
5. Get familiar with the various issues and challenges faced by digital forensic investigators.

**MODULE-1 Cyber-crime Investigation and Digital Forensics Teaching Hours: 15 Hours**

Introduction to cyber-crime investigation, Conducting an Investigation, preparing for search and seizure, securing crime scene, seizing digital evidence at SOC; Daubert Standards; ISO/IEC 27037: 2012; Forensics Investigation Process- Pre-search consideration, Collection of Evidences from crime scene, Acquisition, & Preservation, Examination and Analysis, Documentation and Reporting, Maintaining the Chain of Custody; Collection of Volatile and Persistent Data.

Hashing Algorithms; Cloning of Digital Exhibits, Different Imaging Formats– Raw Format, Proprietary Formats, Advanced Forensic Formats; Imaging vs Cloning/Copying; Data Acquisition from live systems, Shutdown Systems, Remote systems, RAID Servers and Encrypted systems; Validating Data Acquisitions techniques (Linux and Windows); Digital Forensics Standard Operating Procedures. Software and Hardware Tools used in Forensic Analysis – Open Source and Proprietary tools; Challenges and issues in Cyber-crime investigation and Digital forensics.

**MODULE-2 Forensic Analysis of Windows System Artifacts Teaching Hours: 15 Hours**

File Systems, Registry, Event logs, Shortcut files, Executables; Windows registry, startup tasks, Jumplists, Volume Shadow Backup, Shellbags; Forensic Analysis of the Registry – Use of registry viewers, Amcache.hve, Shimcache.hve, Regedit; Extracting USB related artifacts and examination of protected storages. Email investigations; Data recovery – Tools and techniques; Malware and

Ransomware Analysis; Recycle Bin Forensics (INFO, \$I, \$R files); Anti-forensic techniques and their detection: Data Wiping, Partition Deletion, Bit-Shifting, Alternate Data Streams (ADS), Hidden files, Data in the Slack Space and Unallocated Space, Steganography and Steganalysis, File Extension Mismatch, Disk Encryption etc.

**MODULE-3 Forensic Analysis of Linux and MAC System Artifacts Teaching Hours: 15 Hours**

Linux File-system and Artifacts – Introduction and Architecture of Linux OS, Booting Process, Basics of Linux file-system, Use of built-in command line tools for forensic investigation – dd, dcfldd, fdisk, mkfs, mount, unmount, md5sum, sha1sum, dmseg, grep, find, pstree, ls, kill, history, xxd; Hash Computation and Verification; Checking File Extension Mismatch, Keyword Searching, Fragmentation of Forensic Images; Ownership and Permissions, Hidden files, User Accounts and Logs; Mounting of hard disk having forensic image; Timeline analysis.

MAC File-system and Artifacts – Introduction to MAC OS and File-system, Booting Process in MAC, System Services, Hidden directories, System Logs and user artifacts; Forensic Acquisition and Analysis of Plists; Function of File Vault, Keychain.

**Suggested Reading and Books:**

1. Bill Nelson, Amelia Phillips and Christopher Steuart, “Guide to Computer Forensics and Investigations, 5<sup>th</sup> Edition”, Cengage, 2010 BBS.
2. Dr. Darren Hayes, “A Practical Guide to Computer Forensics Investigation”, Pearson Publishers, 2014.
3. EC-Council, “Computer Hacking Forensic Investigator v.3”.
4. Eoghan Casey; “Handbook of Digital forensics and Investigation”, Elsevier Academic Press, 2009.
5. Nina Godbole and Sunit Belapore; “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley Publications, 2011.
6. Harlan Carvey; “Windows Forensic Analysis Toolkit”, Syngress, 2012.
7. Anthony Reyes, Jack Wiles; “The Best Damn Cybercrime and Digital Forensic Book”, Syngress, USA, 2007.
8. Dr. Philip Polstra, “Linux Forensics with Python and shell scripting”, Pentester Academy, 2015.
9. Jessie Varsalone and Rob Maxwell, “MAC OS X Forensic Field Guide: Digital Forensics Field Guides”, Syngress, 2015.

**CUTM2936: Mobile and Network Forensics**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200

\* Note: TA-2 will be in form of assignments or workshops

**Learning Objectives:** After studying this paper the students will be able to –

1. Get familiar with the different mobile and network-based technologies.
2. Identify the various artifacts of evidentiary value found in mobile phone devices.
3. Appreciate the different data acquisition techniques used in mobile device forensics.
4. Understand the various evidences to be collected from different networking devices and to analyse the same.
5. Identify the different tools and techniques used for forensic analysis of mobile phones and computer networks.
6. Get to know about the challenges in forensic investigation of mobile phones and computer networks.
7. Get familiar with the basics of cloud computing and Forensics.

**MODULE-1 Introduction to Mobile and Network Technologies Teaching Hours: 15 Hours**

Mobile Technologies - Asynchronous Transfer Mode (ATM), Wireless Application Protocol (WAP); Cellular technologies including Advanced Mobile Phone System (AMPS), Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA) and Global System for Mobile Communications (GSM); Functions of Subscriber Identity Module (SIM), International Mobile Equipment Identity (IMEI), Bluetooth and Mobile Payment Gateways; Understanding of the mobile phone operating systems – Android, iOS, Windows; Basics of Rooting \ Jailbreaking.

Basics of Networking - Server, client, routers, Shared Printers and other peripherals, Network Interface Card. Network Devices – hubs, Switches, routers, repeaters; Network Topologies; Introduction to OSI model and TCP/IP model; HTTP, World Wide Web, Web Browsers, Web Servers, Domain Names, URL and DNS; IP addressing – types and classes; Types of Networks – LAN, MAN, WAN and PAN; Routers and Routing Protocols; Basics of Wi-Fi; Basics of Cloud Computing.

**MODULE-2 Mobile Device Forensics Teaching Hours: 15 Hours**

Introduction to Mobile Forensic, Types of Evidence present in mobile phones - SIM card, Internal, and evidences in SD card; SIM Card File-system and architecture; Different Stages of Forensic Investigation, Building Mobile Forensic Toolkit, Seizure and Preservation of mobile phones, Data Acquisition, Examination and Analysis, Tool Selection; Data Acquisition Methods –

Manual, Physical, Logical, File System, Advanced Logical, Selective and Qualcomm Acquisition. Extraction of data from damaged phones: JTAG, Chip-off and Micro-Read; Good Forensic Practices; Tracking of mobile phone location. Analysis of mobile data like SMS, call logs, contacts, media files, recordings and important mobile application data (IM Chats like WhatsApp, telegram, iMessage, Email clients, Calendar, Reminder and Note apps); Challenges and Issues in Mobile forensics; CDR and IPDR analysis; Introduction to iOS Device Forensics.

**MODULE-3 Network Forensics and Analysis**

**Teaching Hours: 15 Hours**

Common Network Attacks; Post-mortem and Real-time analysis, Live Packet Capturing and Analysis; Searching and collection of evidences from the network; Monitoring of computer network and activities; Log files as Evidence: Legality of using Logs, Ensuring log file accuracy, Log Management System and its functions, Centralized Logging, Challenges and issues in log management and analysis; Event Correlation: Pre-requisites and approaches; Condensing Logs, Security Information and Event Management System (SIEM), tools for SIEM – Splunk, EDR CrowdStrike etc. Log capturing and analysis tools; Collection and Analysis of Router, Firewall and IDS logs; Evidence collection and analysis from CCTV DVRs; Network Packet Analyzer tools; Forensic analysis of online browsing activity and related artifacts; Introduction to Cloud Forensics.

**Suggested Reading and Reference Books:**

1. Behrouz. A Forouzan; "Data Communication and Networking", 4th Edition, TMH, 2000.
2. Anita Goel; "Computer Fundamentals", Pearson Publications, 2010.
3. Satish Bommisetty, Rohit Tamma and Heather Mahalik, "Practical Mobile Forensics – Dive into mobile Forensics on iOS, Android, Windows and Blackberry Devices with action-packed, practical guide", PACKT Publishing, 2015.
4. Iosif I. Androulidakis, "Mobile Phone Security and Forensics – A Practical Approach", Springer New York Heidelberg, 2012.
5. Sherri Davidoff and Jonathan Ham; "Network Forensics – Tracking Hackers through Cyberspace", Pearson Publications, 2012.
6. Samir Datt; "Learning Network Forensics – Identify and Safeguard your Networks against both Internal and External Threats, hackers and malware attacks", PACKT Publishing, 2016.
7. EC-Council, "Computer Hacking Forensic Investigation, v.3".
8. Jonathan Zdziarski, "iOS Forensic Investigative Methods", 2012.
9. Terrence V. Lillard; "Digital Forensics for Network, Internet and Cloud Computing: A Forensic Evidence Guide for moving Targets and Data", Syngress Publications, 2010.

**CUTM2937: Vulnerability Assessment and Penetration Testing**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200

\* Note: TA-2 will be in form of assignments or workshops

**Learning Objectives:** After studying this paper the students will be able to –

1. Understand the need for security assessments and vulnerability management governance.
2. Get familiar with the various tools and techniques used for penetration testing and vulnerability assessment.
3. Identify the modus operandi of different attacks and security assessment pre-requisites.
4. Study the importance of penetration testing and vulnerability assessment in the cyberspace.

**MODULE-1 Vulnerability Management Governance and Security Assessment  
Teaching Hours: 15 Hours**

Security Basics, Understanding the need for security assessment, penetration testing lifecycle, OWASP top 10 and testing guide, target scoping and planning, deciding upon the type of vulnerability, Estimating resources and deliverables, Preparing test plans, Information Gathering: Passive and Active Information Gathering.

**MODULE-2 Penetration Testing Basics Tools and Techniques Teaching Hours: 15 Hours**

Setting up the virtual lab, Using Kali Linux: Linux File-System, user privileges, file permissions, editing files, data manipulations, managing networking, Netcat; Bash and Python Scripting; Using the Metasploit Framework; Open-source Intelligence Gathering tools and Techniques, Finding Vulnerabilities and Capturing Traffic; Enumeration and Vulnerability Assessment; Gaining Remote Access, Cracking Passwords, Creating Backdoors using Backdoor Factory; Social Engineering; Client-side Exploitation.

**MODULE-3 Vulnerability Assessment Techniques Teaching Hours: 15 Hours**

Importance of web application security testing, Application Profiling, Common Web Application Security Testing tools, Privilege Escalation, Threat Modelling, Maintaining Access and Clearing

Tracks, Vulnerability Scoring, Bypassing Anti-virus Applications; Vulnerability Reporting and Metrics- Importance of Reporting, type of reports, reporting tools, collaborative vulnerability management with Faraday v2.6 Metrics.

**Suggested Reading and Reference Books:**

1. Sagar Rahalkar, "Network Vulnerability Assessment: Identify security loopholes in your network's infrastructure", Packt Publishing, Birmingham, 2011.
2. Georgia Weidman, "Penetration Testing: A Hands-on Introduction to Hacking", No Starch Press Inc., USA, 2014.
3. Rafay Baloch, "Ethical Hacking and Penetration Testing Guide", CRC Press, Taylor and Francis, USA, 2015.
4. Patrick Engebreston, "The Basics of Hacking and Penetration Testing", Syngress Press, Elsevier, 2011.

**CUTM2939: Research Methodology**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme										
Th	Tu	Pr	C	TCH	Theory						Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs							
3	1	0	4	4	25	00:45	50	01:30	100	03:00	-	-	200		

\* Note: TA-2 will be in form of assignments or workshops

**Learning objectives:** At the end of this course, students will be able to explain;

1. Literature review
2. The development of a research plan
3. Data collection, interpretation and errors
4. Important components for writing the research paper and thesis
5. Basics of Ethical issues, Intellectual property rights, Copy right

**MODULE-1 Basics of research**

**Teaching Hours: 15 Hours**

Objectives and types of research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical. Research Formulation, Literature review and Development of hypothesis

Research design and methods, developing a research plan - Exploration, Description, Diagnosis, and Experimentation. Determining experimental and sample designs

**MODULE-2 Data analysis methods**

**Teaching Hours: 15 Hours**

Data Collection and analysis: Methods of data collection – Sampling Methods and Data Processing. Data Analysis: Types of data, Basic concept of frequency distribution, measure of central values – Mean, median and mode, measure of dispersion, range, mean deviation and standard deviation, probability, theory and classical definition of probability, Bayes theorem of probability, conditional probability and coincidence probability, Chi-square test, ANOVA, SPSS. Types of Errors and Interpretation of Findings

**MODULE-3 Scientific reports and thesis writing**

**Teaching Hours: 15 Hours**

Reporting and thesis writing: Structure and components of scientific reports and thesis, Significance and Different steps in the preparation, Illustrations, Bibliography. Presentations: Oral and Poster, Importance of effective communication in scientific research. Basics of Ethical issues, Intellectual property rights, Copy right, Reproduction of published material: Plagiarism in scientific research and communications.

**Reference books:**

1. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2 volumes.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
4. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.
5. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
6. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
7. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall. 12.
- Satarkar, S.V., 2000. Intellectual property rights and Copy right. EssEss Publications.

<b>UGFS S7 CE- 5</b>	<b>Core Elective - V</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**CUTM2938: Practical-VII**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams			University Exams (LPW)	
					TA-1 & TA-2		MSE		Marks	Hrs		Marks	Hrs
					Marks	Hrs	Marks	Hrs					
0	0	8	4	8							100	6:00	100

**Learning Objectives:**

At the end of course, students will be gaining the hands on training in the following courses;

**MODULE-1                      Advanced Digital Forensics**

1. Windows Registry and Log Data Analysis
2. Hiding and Un-hiding information using steganography
3. Recovery and analysis of slack space data
4. Tracking and analysing of source of email
5. Static and Behavioural analysis of Malware

**MODULE-2                      Mobile and Network Forensics**

1. Data Acquisition and Analysis of Android Phones
2. Analysis of Mobile Applications
3. Traffic Analysis of Network by Live packet capturing
4. Network scanning using different tools
5. Analysing Browser History and Browser Caches of windows system

**MODULE-3                      Vulnerability Assessment and Penetration Testing**

1. Banner Grabbing and Enumeration of web server
2. Port Scanning and Google Dorking
3. Vulnerability Assessment of a website / web application
4. Social Engineering Exploit using Kali Linux
5. Erasing tracks using different tools

**MODULE-4                      Research Methodology**

1. Calculation of mean, median and mode
2. Calculation of standard deviation
3. Calculation of variance
4. Perform chi square test on a given set of data

5. Perform T-test and student's T-test on a given set of values

**SEMESTER-VIII**

<b>UGFS S8-SP 1/2/3/4/5- Entern</b>	<b>Internship</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>0</b>	<b>0</b>	<b>48</b>	<b>24</b>
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# **SEMESTER -IX**

**CUTM2947: Ethics in Science Education and Research**

**Teaching and Evaluation Scheme**

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory						Practical		Total
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
2	0	0	2	2	25	00:45	50	01:30	100	03:00	-	-	200

\* Note: TA-2 will be in form of assignments or workshops

**Learning objectives:**

At the end of course, students will be able to explain;

1. Ethics in Academic Research
2. Postulates for Maintaining Ethical Standards in Higher Education
3. Ethics with respect to science and research
4. Publication ethics

**MODULE-1 Ethics in Higher Education and Academic Research Teaching Hours: 15 Hours**

Ethics in Academic Research, Issues in Research Ethics, Postulates for Maintaining Ethical Standards in Higher Education like; Reliability and Integrity, Objectivity, Genuineness, Respect for Intellectual Property, Novelty in Publication, Confidentiality and Anonymity, Agreement for Consent, Concerns of Ethics in Academic Structure.

**MODULE-2 Ethics of Research and Publication Teaching Hours: 15 Hours**

Ethics with respect to science and research, Collaborative Research and Sharing of Credits, Ethical Conventions of Publications, Research Supervisor-Student Relationship, General Responsibilities of Authors, Ethical Conventions of Publications, Peer-Reviewed Scholarly Journals, Predatory journals, Scientific misconducts: falsification, fabrication, and plagiarism, Impact factor of Journals, H-Index.

**MODULE-3 Publication Ethics Teaching Hours: 15 Hours**

Publication ethics: definition, introduction and importance, Best practices/standards setting initiatives and guidelines: COPE, WAME, etc. Conflicts of interest, Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, Violation of publication ethics, authorship and contributor ship, Identification of publication misconduct, complaints and appeals.

**Suggested Readings:**

1. Ethics in Science Education Research and Governance, Edited by K Muralidhar Amit Ghosh AK Singhvi, Indian National Science Academy 2019.
2. Charles E. Harris et al, Engineering Ethics, Cengage, 2009
3. N. N. Das, Ethical Considerations.
4. R. Subramaniam, Professional Ethics Oxford University Press
5. Ranjit Kumar, Research methodology- a step by step guide for beginners, Sage publications, 2011

<b>PGFS S9-SP 1/2/3/4/5- P2</b>	<b>Open Seminar and Comprehensive Viva -I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>3</b>
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<b>PGFS S9-SP 1/2/3/4/5- P3</b>	<b>M.Sc. Project (To Be continued in 10th Semester)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>12</b>
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**SEMESTER -X**

<b>PGFS S10- SP 1/2/3/4/5- P1</b>	<b>Open Seminar and Comprehensive Viva -II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>3</b>
<b>PGFS S10- SP 1/2/3/4/5- P2</b>	<b>M.Sc. Project</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>0</b>	<b>0</b>	<b>48</b>	<b>24</b>

**SYLLABUS FOR CORE ELECTIVES**

**GROUP-A**

<b>CUTM2473</b>	<b>Anti-Dope Forensics</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**Learning objectives:**

At the end of course, students will be able to explain;

1. Anti-Dope Forensics & Drugs of Abuse in Sports
2. Pharmacodynamics and Pharmacokinetics of Dope drugs
3. Dope testing in Humans & Animals

**MODULE-1 Introduction to Anti-Dope Forensics & Drugs of Abuse in Sports Teaching Hours: 15 Hours**

Doping & Sports Forensics; Problem of Doping in Sports; Types of Sports under anti-doping norms; Introduction to Dope Drugs; New medicines and medical technologies; Stimulants, Anabolic Steroids, Energy Boosters, Contraband Drugs, Growth Hormones, Diuretics, Synthetic Oxygen Carriers, Blood Doping, Insulin, Gene Doping; Therapeutic drug use exemptions.

**MODULE-2 Pharmacovigilance and Legal aspects Teaching Hours: 15 Hours**

Pharmacodynamics and Pharmacokinetics of Dope drugs; Protecting the health of the athlete and maintaining clean sport; Healthcare providers at major sporting events; National & International Laws governing doping in sports; Anti- Doping Agencies NADA & WADA; Need of Doping Education & Awareness among athletes.

**MODULE-3 Testing & Analysis Teaching Hours: 15 Hours**

Dope testing in Humans & Animals; Guidelines for dope testing; Role of Body Fluids in Analysis of Dope drugs (Blood, Urine, and Saliva & Sweat); International Standards for Dope testing Laboratories and Accreditation, Effective Testing Programs. Case Studies.

**Suggested readings:**

1. W. Goodwin, A. Linacre, H. Sibte, An Introduction to Forensic Genetics, John Wiley & Sons, England, 2007, pp. 17-25.
2. World Anti-Doping Agency (WADA), The World Anti-Doping Code, Montreal, 2009 (accessed April 2011) <http://www.wada-ama.org>.
3. At-a-Glance - About Anti-Doping." World Anti-Doping Agency. N.p., 04 July 2014. Web. 18 Apr. 2016.
4. At-a-Glance - The Doping Control Process." World Anti-Doping Agency. N.p., 04 July 2014. Web. 18 Apr. 2016.
5. Reardon, Claudia L., and Creado, Shane. "Drug Abuse in Athletes." Substance Abuse and Rehabilitation (2014): 95-105. Web. 29 Feb. 2016.
6. 2016 Prohibited List." World Anti-Doping Agency. N.p., 29 Sept. 2015. Web. 18 Apr. 2016.
7. Moston, S., & Engelberg, T. (2016). Detecting Doping in Sport (1st ed.). Routledge. <https://doi.org/10.4324/9781315718514>.

<b>CUTM-2909</b>	<b>Incident Response Management</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**Learning objectives:**

At the end of course, students will be able to explain;

1. Key concepts of information security
2. Incident response
3. Steps involved in Incident handling

**MODULE-1 Introduction to Incident Response**

**Teaching Hours: 15 Hours**

Computer Security Incident, Key Concepts of Information Security, Incident Management, Purpose of Incident Management, Need and Goals of Incident Response, Incident Response Plan, Signs / Indicators of an Incident, Incident Categories, Incident Prioritization, Incident Response, Incident Handling, Estimating Cost of an Incident, Incident Reporting, Incident Response Team, Incident Response Team Members Roles and Responsibilities.

**MODULE-2 Management of Incident Response**

**Teaching Hours: 15 Hours**

Steps of Incident Response / Handling: 1: Identification, 2: Incident Recording, 3: Initial Response, 4: Communicating the Incident, 5: Containment, 6: Formulating a Response Strategy, 7: Classification, 8: Investigation, 9: Data Collection, 10: Forensic Analysis, 11: Evidence Protection, 12: Notifying External Agencies, 13: Eradication, 14: Systems Recovery, 15: Documentation, 16: Damage and Cost Assessment, 17: Lessons Learned, 18. Review and Update the Response Policies.

**MODULE-3 Goals of Incident Response**

**Teaching Hours: 15 Hours**

Goals of Incident Response, Incident Response Plan, Incident Identification, Incident Prioritization, Incident Handling, Estimating Cost of an Incident, Incident Reporting, Incident Reporting Organizations, Vulnerability Resources.

**References and Suggested Readings:**

1. CERT IN Guidelines.
2. ENISA Manuals
3. Computer Incident Response and Forensics Team Management: Conducting a Successful Incident Response, Leighton Johnson, Syngress
4. Incident Handling and Response: A Holistic Approach for an efficient Security Incident Management by Jithin Alex,
5. The Computer Incident Response Planning Handbook: Executable Plans for Protecting Information at Risk, N.K. McCarthy, Incident Response & Computer Forensics, Jason T. Luttgens, McGraw-Hill.

<b>CUTM2910</b>	<b>Multimedia Forensics</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**Learning objectives:**

1. Introduction to multimedia forensics and multimedia files
2. Source identification of multimedia evidences
3. Enhancement and authentication of multimedia exhibits
4. Content analysis of the files

**MODULE-1 Introduction to Multimedia Forensics Teaching Hours: 15 Hours**

Need of multimedia forensics, multimedia tools, their applications, forgeries in media files, Handling and preservation of multimedia files, Legal Aspects of digital multimedia evidence, and recovery of audio and video files, copyright infringement, plagiarism and related laws.

**MODULE-2 Audio, Video and Image Examination Teaching Hours: 15 Hours**

Authentication of audio, video and image file, enhancement techniques, forensic voice analysis, video/image analysis, Digital Signal Processing, Origin and integrity of multimedia files, digital watermarking, LPC, DFT and FFT, Multimedia file Formats, Tools for Analysis

**MODULE-3 CCTV Forensics: Teaching Hours: 15 Hours**

Role and functioning of CCTV cameras, Types of CCTVs, CCTV footage analysis, Handling, Preservation and transport of CCTV footages, Video Management system, CCTV surveillance, Intelligent Video analytics and related case studies

**Reference books:**

1. Forensic Speaker Identification by Phil Rose & James R Robertson
2. Forensic Voice Identification by Harry Hollien
3. The Acoustic Analysis of Speech by Ray D Kent & Charles Read
4. Voice Recognition by Richard L Klevans & Robert D Rodman
5. Multimedia Forensics and Security: Foundations, Innovations, and Applications by Mohamed Mostafa Fouad et al.
6. Multimedia Forensics and Security by Chang-Tsun Li
7. Intelligent Video Surveillance Systems by Jean-Yves Dufour
8. Digital Image Processing by Rafael Gonzalez & Richard Woods
9. Digital Image forensics by Roy, A. et al

<b>CUTM2911</b>	<b>Forensic Statistics</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**Learning objectives:**

At the end of course, students will be able to explain;

1. Importance of statistics in Forensic Science
2. Different types of distributions; Normal, Binomial and Poisson
3. Concept of probability theory, Chi square test, Student's t-test etc.

**MODULE-1 Introduction to statistics Teaching Hours: 15 Hours**

Importance of statistics in interpreting forensic data in research work and quality control, Data, Population, Distribution, Location, Random experiment, Brief introduction to sampling and data collection, Frequency distribution, Concept of measures of central tendencies, Normal distribution, Arithmetic mean, Median & Mode concept of measures of dispersion, Variance, Normal distribution, Variance, Standard Deviation, Coefficient of variation.

**MODULE-2 Introduction to Probability distribution functions Teaching Hours: 15 Hours**

Concept of probability, Definitions of probability, Discrete random variables and probability distributions, Addition, multiplication and Bayer's theorem & applications, Probability in Forensic Evidence, Concept of random variable, Discrete and continuous, Some examples, Concept of probability distribution, Binomial, Poisson, Normal distribution, Definitions, statements of properties of above distribution and examples, Simple linear regression and correlation, Concept of computational methodology, Examples, Concept of tests of hypothesis, Null and alternative hypothesis, Critical region, Types of errors & level of significance

**MODULE-3 Statistical tools and techniques Teaching Hours: 15 Hours**

Large samples tests, Test for single mean, Difference of means, Single proportion and difference of proportion examples - Chi square test for goodness of fit and test for independence of attributes, Examples, Hypothesis testing for one or two population means, Student's t-test, t-test for simple mean, Difference of means, Examples. Hypothesis testing for small sample sizes and multinomial experiments, Fisher's exact test, Analysis of variance and multiple comparison tests, F-test for equality of variance, Examples, Concept of analysis of variance, Computational procedure for ANOVA one way and two way classification, Examples.

**Suggested Reading:**

1. David Lucy: Introduction to Statistics for Forensic Scientists, Wiley, 2004
2. Colin Aitken & Franco Taroni: Statistics and Evaluation of Evidence for Forensic Scientists (Statics in practice)
3. Wing kam Fung & Yue-Quing Hu: Statistical DNA Forensics, Theory Methods & Computation, Wiley, 2008.
4. I. W. Evett & B. S. Wier: Interpreting DNA Evidence – Statistical Genetics for Forensic Scientists, 1998
5. Miller, J. C. and Miller, J. N.: Statistics for Analytical Chemistry, Ellis Horwood, 1988
6. Fisher, R. A.: Statistical Methods for Research Workers, John Wiley, 1954
7. Sokal, R. R. and Rolf, F. J.: Biometry – Principles and Practices of Statistics in Biological Research, Freeman, 1981
8. Bhaskar Rao T.: Methods of Biostatistics, Paras, 2001.
9. Rama Krishnan P., Biostatistics, Saras, 1995.
10. Meier, P. C. and Zund, R. E.: Statistical Methods in Analytical Chemistry, Wiley, 2000.
11. Rao, V. K., Biostatistics – A Manual of Statistical methods for use in Health, Nutrition and Anthropology, Jaypee Medical Pub., 1996.

<b>CUTM2912</b>	<b>Accident Investigations</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**Learning objectives:**

At the end of course, students will be able to explain;

1. Motor vehicle accident
2. The analysis of Pre-crash and Post-crash movement
3. Tachograph data & Tachograph charts

**MODULE-1 Motor Vehicle Accidents**

**Teaching Hours: 15 Hours**

Accident scene, Sources of forensic information, Eyewitness accounts, Extent of vehicle damage, Visibility conditions, Photographs of accident site, Estimation of speed, Tire marks, skid marks, scuff marks, Maintenance of vehicles, Abandoned vehicles, Importance of air bags, Railway accidents.

**MODULE-2 Accident Analysis**

**Teaching Hours: 15 Hours**

Pre-crash movement, Post-crash movement, Collision model, Gauging driver's reaction, Occupants's kinematics, Types of injuries resulting from accident, Biomechanics of injuries, Hit and run investigations, Trace evidence at accident sites.

**MODULE-3 Tachographs**

**Teaching Hours: 15 Hours**

Forensic significance of tachograph data, Tachograph charts, Principles of chart analysis, Accuracy of speed record, Tire slip effects, Falsification and diagnostic signals, Route tracing.

**References and Suggested Readings:**

1. T.S. Ferry, Modern Accident Investigation and Analysis, Wiley, New York (1988).
2. D. Lowe, The Tachograph, 2nd Edition, Kogan Page, London (1989).
3. T.L. Bohan and A.C. Damask, Forensic Accident Investigation: Motor Vehicles, Michie Butterworth, Charlottesville (1995).
4. S.C. Batterman and S.D. Batterman in Encyclopedia of Forensic Sciences, Volume 1, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).

<b>CUTM2913</b>	<b>Immunology and Immunological Techniques</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**Learning objectives:**

At the end of course, students will be able to explain;

1. Immunology
2. Fundamentals of Antigen and Antibody
3. Different techniques to study antigen-antibody interactions

**MODULE-1 Overview of Immunology Teaching Hours: 15 Hours**

Phylogeny of immune system, Innate and Acquired immunity, Clonal nature of immune response, Cells and Organs of the immune system: Hematopoiesis and differentiation, B-lymphocytes, T-lymphocytes, Macrophages, Dendritic cells, Natural killer cells, Lymphokine activated killer cells, Eosinophils, Neutrophils and Mast cells, Organization and structure of lymphoid organs.

**MODULE-2 Antigen and Antibody Teaching Hours: 15 Hours**

Antigen – Epitope, essential factors for antigenicity, haptenes and adjuvant. Antibody: structure and function, antigenic determinants on immunoglobulins, isotypic, allotypic and idiotypic variants, antigen and antibody interactions, and their importance, Major histocompatibility complex and their importance in Forensics, Antigen Processing and presentation, Cytokines and their role in immune regulation.

**MODULE-3 Immunotechniques Teaching Hours: 15 Hours**

Different techniques to study antigen-antibody interactions, immunodiffusion, Immunoelectrophoresis, radioimmunoassay, ELISA, immunohistochemistry, development of dot blot, Flow cytometry, production of monoclonal and polyclonal antibodies, hybridoma technology, Vaccine, Concepts of vaccines, whole-organism vaccines, recombinant vaccines, DNA vaccine, synthetic peptide and multivalent sub unit vaccines., different strategies of vaccinedevelopment.

**Reference Books**

1. 1.J. Owen, J. Punt, S. Stranford, (2012) Kuby Immunology (8th Edition), WH Freeman and Company, USA.
2. 2.J.M. Berg, J.L. Tymoczko, L. Stryer. (2012) Biochemistry (7th Edition), WH Freeman and Company, USA.
3. 3.D. Male, J. Brostoff, D. Roth, I. Roitt, (2012) Immunology (8th Edition), Saunders, Elsevier, USA.
4. 4.K. Murphy (2011) Janeway's Immunobiology (1th Edition), Garland Science, USA.
5. 5. A. Abbas, A. Lichtman, S. Pillai, (2014) Cellular and Molecular Immunology (8th Edition), Saunders, Elsevier, USA.

CORE ELECTIVE- GROUP-B

CUTM2940	Clinical Toxicology	L	T	P	Cr	2	0	0	2
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**Learning objectives:**

At the end of course, students will be able to explain;

1. General principle of clinical toxicology
2. Epidemiological toxicity & drug toxicology
3. Heavy metal & Pesticide induced toxicity

**MODULE-1 Overview of Clinical Toxicology**

**Teaching Hours: 15 Hours**

General principle of clinical toxicology, acute, sub-acute, sub-chronic and chronic toxicity, human healthcare, Estimation of LD50 and ED50, Symptoms of clinical toxicity, Assessment of clinical symptoms, complete blood count profile, kidney and liver function test, urine test etc., Erythrocyte sedimentation rate (ESR) determination and its importance in the diagnosis of certain diseases, Duties and responsibilities of registered medical practitioner, forensic investigator and police person, Green toxicology for the protection human and environment health.

**MODULE-2 Epidemiological toxicity & drug toxicology**

**Teaching Hours: 15 Hours**

Epidemiological toxicity, poisoning, risk assessment and characterization methods, exposure and hazard assessment, Drug safety and evaluation, drug toxicology, adverse reaction of drug, Carcinogenic and non-carcinogenic effects of environmental toxicants, head and neck cancer, cancer risk assessment, Neurobehavioral dysfunctions in children and adults, occupational hazards, chronic poisoning and adverse consequences.

**MODULE-3**

**Teaching Hours: 15 Hours**

**Heavy metal induced toxicity:** Signs and Symptoms of arsenic, lead, cadmium, mercury toxicity, oxidative stress, Analysis of heavy metal in tissue and body fluids, food items, extraction techniques of these heavy metal and their determination, Determination of trace metals present in cosmetic products and their toxic effects, method of clinical assessment, common antidotes.

**Pesticide induced toxicity:** Types of pesticides, classification, uses, harmful clinical effect and treatment, Pesticide poisoning in farmers, suicides, depression and neuropsychological effects, assessment of clinical symptoms, general health questionnaire (GHQ), Mechanism of action of pesticide toxicity, first aid in pesticide poisoning, method of clinical assessment, common antidotes.

**References and Suggested Readings:**

1. Modi JS: Medical Jurisprudence and Toxicology
2. Brent , J. , K. L. Wallace , K. K. Burkhardt , et al., eds. Critical Care Toxicology . Philadelphia: Elsevier Mosby , 2005.
3. Parikh CK: Medical Jurisprudence and Toxicology

4. Mancuso , J. D. , M. Ostafi n , and M. Lovell , Postdeployment evaluaton of health risk communication after exposure to a toxic industrial chemical . Mil. Med . 173 : 369 – 374 , 2008 .
5. Laboratory Procedure Manual- Forensic Toxicology, DFS, MHA, New Delhi
6. Pharmacology and Therapeutics-Bhandarkar & Satoskar 8. Essentials of Toxicology- Ellenhorn

<b>CUTM2941</b>	<b>Forensic DNA Analysis</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**Learning objectives:**

At the end of course, students will be able to explain;

1. Basics of DNA
2. Forensic DNA typing
3. Paternity testing

**MODULE-1 Basics of DNA**

**Teaching Hours: 15 Hours**

Importance of DNA as an evidence in forensic investigation, sequence polymorphisms, individualization of evidence. Structures and functions of nucleic acids, Mitochondrial DNA and its importance. Collection of different biological specimens for DNA analysis.

**MODULE- Forensic DNA Typing**

**Teaching Hours: 15 Hours**

Principles of extraction and quantification of DNA, Fundamentals of Polymerase chain reaction and its application in forensic DNA analysis, Restriction fragment length polymorphism (RFLP) – genetic markers used in RFLP, typing procedure and interpretation of results, DNA markers, Role of fluorescent dyes, Introduction of Touch DNA in solving crimes.

**MODULE-3 Parentage Testing**

**Teaching Hours: 15 Hours**

Genetics of paternity in human, Mandelian laws and its relevance in paternity testing, Mathematical basis of parentage identification, Report Writing: Role of DNA typing in identifying unrecognizable bodies. Allele frequency determination, Hardy-Weinberg law, Probability determination in a population database

**References and Suggested Readings:**

1. J.M. Butler, Forensic DNA Typing, Elsevier, Burlington (2005).
2. K. Inman and N. Rudin, An Introduction to Forensic DNA Analysis, CRC Press, Boca Raton (1997).
3. H. Coleman and E. Swenson, DNA in the Courtroom: A Trial Watcher’s Guide, GeneLex Corporation, Washington (1994).
4. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher’s, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).

<b>CUTM2942</b>	<b>Forensic Engineering</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**Learning objectives:**

At the end of course, students will be able to explain;

1. Basics of forensic engineering
2. Role and Responsibility of an Engineer at design

**MODULE-1 General**

**Teaching Hours: 15 Hours**

Scope and need of forensic engineering, basic principles, scientific methods and its application to forensic engineering Definition, Types and root causes of Engineering Failures, Historical context, data collection and information dissemination.

**MODULE-2 Case Studies on Engineering Failure**

**Teaching Hours: 15 Hours**

Learning from failure: Case studies based on material failure, product failure, structural failure, electrical - mechanical failure, Construction, Chemical, Fires, Blast and Mining related failure.

**MODULE-3 Role and Responsibility and Standards**

**Teaching Hours: 15 Hours**

Role and Responsibility of an Engineer at design, construction and maintenance stage, Relevant standards for forensic engineering inspections and investigations. Recommendations for Design and Construction Improvements.

**References and Suggested Readings:**

1. Crime scene management–A scientific approach M.S.Dahiya (2009)
2. Vehicular accident Investigation and reconstruction Kirk (2000)
3. Forensic Engineering Investigation Noon (2009)
4. Forensic Engineering Carper (2000)
5. Forensic Science James Nordby (2005)

<b>CUTM2943</b>	<b>Applied Cryptography</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**Learning Objectives:**

After studying this paper the students will know –

1. The basics concepts of security and cryptography
2. Computer-based symmetric and asymmetric cryptography algorithms
3. Public-Key Infrastructure and Internet Security Protocols.
4. User Authentication Mechanisms and Network Security.

**MODULE-1 Concepts of Security and Cryptography Techniques Teaching Hours: 15 Hours**

Need for security, security approaches, basics of cryptography techniques, Substitution and Transposition ciphers, Symmetric and Asymmetric key cryptography, Possible types of attacks, Data Encryption Standard (DES), International Data Encryption Algorithm (IDEA), RC4, Advanced Encryption Standard (AES), Blowfish.

**MODULE-2 Asymmetric Key Algorithms, PKI and Internet Security Protocols Teaching Hours: 15 Hours**

Overview of asymmetric key cryptography, RSA Algorithm, Digital Signatures, Attacks on digital signatures, problems with public-key exchange; Introduction to Public-Key Infrastructure, Digital Certificates, Private-key management, Public-key cryptography standards, XML, PKI and security; SSL-TLS, HTTPS v/s SHTTP, Secure Electronic Transaction (SET), SSL v/s SET, Email Security, Wireless Application Protocol (WAP), IEEE 802.11 Security, Security in GSM and 3G.

**MODULE-3 User Authentication Mechanisms and Network Security Teaching Hours: 15 Hours**

Introduction, Authentication Basics, Passwords, Authentication Tokens, Certificate-based authentication, Biometric Authentication, Kerberos, Key Distribution Center (KDC), Single Sign On (SSO) approaches, attacks on authentication schemes; Introduction to Network Security, Firewalls- types and techniques, IP Security, Virtual Private Networks (VPNs), Intrusion, IDS and IPS.

**Suggested Readings:**

1. Atul Kahate, "Cryptography and Network Security", 9rd Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2009.
2. Nina Godbole and Sunit Belapore, "Cyber Security: Understanding Cyber-crimes, Computer Forensics and Legal Perspectives", Wiley Publications, 2011.
3. William Stallings. "Cryptography and Network Security: Principles and Practices, 5th Edition", Prentice Hall Publication Inc., 2003.

<b>CUTM2944</b>	<b>Data Science &amp; Artificial Intelligence</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**Learning Objectives:**

1. To understand concept of Artificial Intelligence, Machine Learning and Deep Learning
2. To learn various Machine Learning and Deep Learning techniques
3. To create models to understand applications of AI
4. Understand the importance of the body language and gesture

**MODULE-1 Introduction to Python**

**Teaching Hours: 15 Hours**

**Python:** Setting up Environment, Basic Python Commands, Creating Python Scripts, Conditions, Loops, List, Dictionary, User Defined Functions, Introduction to Anaconda, Working with NumPy, Pandas and Matplotlib.

**Mathematics for Machine Learning:** Vectors, Matrices, Linear Equations, Mean, Median, Mod, Standard Deviation and Variance, Probability, Correlation, Regression, Handling and Representing Data.

**MODULE-2 Machine Learning (ML)**

**Teaching Hours: 15 Hours**

**Hours**

Definition and History of AI, Defining Machine Learning, Applications of ML, Issues and Challenges in ML, Types of ML. Basics of Supervised Learning, Prediction, Classification, Understanding Datasets, Feature Selection, Feature Normalization, Data Cleaning, Training, Testing & Validation Sets, Different Models of Supervised Learning, Hyper parameters, Measuring Performance, Accuracy and Loss Underfitting & Over fitting, Basics of Unsupervised Learning, Different Models of Unsupervised Learning.

**MODULE- 3 Neural Network:**

**Teaching Hours: 15 Hours**

Understanding Biological Brain, Defining Artificial Neural Network (ANN), Applications of ANN & DL. Defining & Building a Perceptron, Feed Forward, Back propagation, Single-layer & Multi-layer ANNs, building an ANN Model, Activation & Loss Functions, Compiling & Evaluating a Model. Convolutional Neural Networks (CNN): Understanding Convolutions, Pooling, Building & Fitting CNN Models, Evaluating Model Performance. Recurrent Neural Networks (RNN): Basic RNN Architecture, Applications of RNN, Building &

Fitting RNN Models, Evaluating Model Performance. Long Short-Term Memory Networks (LSTM): LSTM Network Architecture, Understanding LSTM, Building LSTMs.

**References books:**

1. Mathematics for Machine Learning 1st Edition by Marc Peter Deisenroth
2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition by Aurélien Géron
3. Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2, 3rd Edition by Sebastian Raschka and Vahid Mirjalili
4. Hands-On Neural Networks with Keras: Design and create neural networks using deep learning and artificial intelligence principles 1st Edition by Niloy Purkait

5. Deep Learning with Keras: Implementing deep learning models and neural networks with the power of Python by Antonio Gulli, Sujit Pal. Practical Machine Learning for Computer Vision 1st Edition by Valliappa Lakshmanan, Martin Görner and Ryan Gillard
6. Learning OpenCV 4 Computer Vision with Python 3: Get to grips with tools, techniques, and algorithms for computer vision and machine learning, 3<sup>rd</sup> Edition by Joseph Howse and Joe Minichino
7. Natural Language Processing in Action: Understanding, analyzing, and generating text with Python 1st Edition by Hobson Lane, Hannes Hapke and Cole Howard.
8. Machine Learning for Cybersecurity Cookbook: Over 80 recipes on how to implement machine learning algorithms for building security systems using Python by Emmanuel Tsukerman.

<b>CUTM2945</b>	<b>Forensic Photography</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**MODULE-1 Basics of Photography**

**Teaching Hours: 15 Hours**

Photography History, Types of Cameras, lenses, filters, films, exposing, Reprofit unit, Specialized photography-UV, IR, close up, transmitted light, side light, trick photography, contact print photography, oblique light photography. Photography using scientific equipment and instruments, Development & printing process of photographs, different kinds of developers and fixers.

**MODULE-2 Types of Forensic Photographical Techniques**

**Teaching Hours: 15 Hours**

Photomicrography and macro photography, Digital photography, Scope of photography in various disciplines of forensic science-finger prints, foot prints, physics, chemistry, biology, ballistics, computer forensics etc. basic concepts of videography/high speed videography, application of videography in police work, Detection of manipulated digital image for identification, photography as secondary evidence. Crime scene and laboratory photography.

**MODULE-3 Photography in Forensics**

**Teaching Hours: 15 Hours**

Software for digital photography, file formats - jpg, gif, bmp, tiff, raw etc., digital watermarking, photogrammetry, radiography, image enhancement of mutilated/soiled/old documents, Faro technology for 3D documentation of crime scene CCTV image enhancement, processing of digital images and its manipulation. Case studies. Laws relating to digital evidence and its admissibility.

**References and Suggested Readings:**

1. Ang Tom; "The Complete Photographer", Dorling Kindersley Ltd., 2010.
2. Gernsheim Helmut; "A concise history of Photography", 9<sup>rd</sup>Ed., Dover Publications, 1316.
3. Freeman Michael; "The Complete Guide to Digital Photography", 4<sup>th</sup>Ed., Lark Books, 1945.
4. Farrell Ian; "Complete Guide to Digital Photography", Quercus Publications, 2013.
5. Edge Martin; "The Underwater Photographer", Focal Press, 2010.
6. Bergner Joachim, E. Gelbke, W. Mehliß; "Practical Photomicrography", Focal Press, 1366.
7. White Laurie; "Advance Infrared Photography", Amherst Media, 1335. Feininger Andreas; "The Complete Photographer", Prentice Hall, 1365.

**Skill Based Elective**

<b>CUTM2469</b>	<b>Communication skill</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**Learning objectives:**

At the end of course, students will be able to;

1. Improve the communication skills
2. Understand the importance of the body language and gesture

**MODULE-1 Importance and process of Communication Teaching Hours: 15 Hours**

Verbal and Non-verbal process of Communication, How to face an interview, Group Discussion, How plan and conduct the Interviewer, importance of body language and gesture in interview, eye contact and appearance during interview process.

**MODULE-2 Different skills and Its importance Teaching Hours: 15 Hours**

Listening, Developing Reading Skills, Developing Conversational skills, Technical Writing skills.

**References and Suggested Readings:**

1. Sreevalsan, MC; Spoken English, Vikash Publishing House, New Delhi.
2. Communication Skills; Sanjay Kumar, Pushphate, Oxford.
3. Krishna Mohan, Meera Banarjee, Developing Communication Skills.
4. Frank O' Connor, Phonetics, Pengiun.
5. Business Correspondence and Report Writing- Sharma and Krishna Mohan- Tata Mgraw.

<b>CUTM2470</b>	<b>English</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**Learning objectives:**

At the end of course, students will be able to;

1. Improve English speaking
2. Communicate official letters and circular

**MODULE-1 Basic Grammar Teaching Hours: 15 Hours**

Articles , Verbs: Auxiliaries, Finite and Non Finites, Time and Tense , Subject: Verb Agreement (concord), Active and Passive Voice, Narration, Single word / verb substitution, Common Error, Comparison, Antonym, homonym, Sentence, Building (Vocabulary).

**MODULE-2 Formal and Official Writing Teaching Hours: 15 Hours**

Précis, Essay, Paragraph Writing and Comprehension, Official Correspondence, Memorandum; Circular Letter.

**References and Suggested Readings:**

1. English Grammar- N.D. Turton, ABC of Common Grammatical Error for learners and Teachers.
2. English Grammar- Dr. K.K. Ramchandran etal; business Communication.
3. Technical English- Sharon j Gerson and Steven M Gerson
4. Angela Burt, Quick Solutions to common Error in English.
5. W. Foulsham, The Complete letter writer.
6. John East wood- Oxford guide to English Grammar.

<b>CUTM-2471</b>	<b>Yoga and its benefits-I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**Learning objectives:**

At the end of course, students will be able;

1. To perform various Pranayam
2. To understand the power of meditation
3. To understand the impact of yoga on health

**MODULE-1 Self and Self Identity Teaching Hours: 15 Hours**

- Concept of Self and Self-identity
- Indian Concept of Self with reference to Satva, Rajas and Tamas Guna
- Constituent of Panch Kosh
- Components of Self – Attitude, Beliefs, Values

**MODULE-2 Pranayama Teaching Hours: 15 Hours**

Foundations of Yoga: History, Evolution of Yoga and Schools of Yoga.

Perform any five; Anulom vilom, Bhastrika, Kapalbhanti, Shitali, Sitkari, Bhramari, Surya bhedan, Chandra Bhedan

<b>CUTM2472</b>	<b>Yoga and its benefits-II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
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**Learning objectives:**

At the end of course, students will be able;

1. To apply the knowledge yoga in the well-being of self and society
2. To explain the concept of Spiritualism and Integral Humanity
3. To perform various Asanas

**MODULE-1 Development of Spiritual Self Teaching Hours: 15 Hours**

- Concept of Spiritual Self, Spiritualism and Integral Humanity
- Process of Self-awareness, Self-observation, Introspection and Austerity
- Concept of Sthitpragya (Bhagwad Geeta Ch-2)
- Yoga as a tool for Integration of Individual and Universal Self (Ashtang Yog)

**MODULE-2 Perform Asanas, (Any Twelve) Teaching Hours: 15 Hours**

a) Sitting Posture: Matsyendrasana, Kukkutasana, Vakrasana, JanuShirshasana, Bakasana

b) Sleeping Posture: Ardha Salbhasana, Navkasana, Mandukasana, Matsyasana, Setubandhasana

c) Standing Posture: Katichakrasana, Ustrasana, Garudasana, Virbhadrasana, Adho mukhasana