Minutes of 6th 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 (1st to 6th semester) to 4 Years (1 to 8 Semestes) 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 1st to 10th 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

Centurion University

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	
		CUTM	Human Values & Professional Ethics	SEC	1-0-1 (02)		2	
IV	5	CUTM	Forensic Chemistry	Core	3-2-0 (05)	23	7	31
		CUTM	Forensic Document Examination	Core	3-2-0 (05)		7	
		CUTM	Forensic Biology, Serology & DNA Fingerprinting	Core	3-2-0 (05)		7	
		CUTM	GSE	GSE	4-2-0 (06)		8	
		CUTM	Personality Development & Soft Skills	SEC	1-0-1 (02)		2	
V	6	CUTM	Forensic Ballistics	Core	3-2-0 (05)	25	7	33
		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	
Total			Credit - T-75, P-34, I-20 & Pj-31			Total Credit - 160	Total Contact Hour - 195	
Total Subjects: - Core-14, GSE–04, DSE–04, AECC-02, SEC–02, VACC-01 and Internship-01								
Credit Distribution: - Core-72, GSE–24, DSE–16, AECC-04, SEC–04, VACC-00, Internship-20 & Project-20								
Note: Students will study new subjects from first semester onwards								

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
		Total Credit & Total				**24**	**28**

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
		Total Credit & Total				**24**	**28**

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 7th 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	

2022-23

Centurion
UNIVERSITY
Shaping Lives...
Empowering Communities...

COURSE BOOK

B.Sc. Forensic Science

Centurion University of Technology& Management

Programme Objective

The Universal Declaration of Human Rights directs the member nations to create such conditions under which the ideals of free human beings, enjoying civil and political freedom from fear and want, can be achieved. The Constitution of India, through its various articles, strives to ensure security and safety of citizens in accordance with the principles of Universal Declaration of Human Rights. However, crime is a violation of these principles. In a country like India, where majority of population is uneducated, social set up is heterogeneous, public-police relations are not very cordial, poverty is rampant and unemployment widespread, it is not surprising that crime rate is increasing exponentially.

If we have to create conditions conducive to harmonious development, we must mitigate the crime rate. This can best be achieved by relying on the support of forensic science system. Unfortunately, in our country, forensic science is not viewed as a core investigative skill in crime detection. In fact, there is a lack of understanding of the forensic process itself. It is for this reason that less than 10% of the police cases are, at present, being referred for forensic examination. Less than 5% are solved by the application of forensic science. The rest are solved by third degree method – a practice which the human rights organizations will not allow in days to come.

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. Course in Forensic Science.

The following are the objectives of this course.

1. To emphasize the importance of scientific methods in crime detection.

2. To disseminate information on the advancements in the field of forensic science.

3. To highlight the importance of forensic science for perseverance of the society.

4. To review the steps necessary for achieving highest excellence in forensic science.

5. To generate talented human resource, commensuration with latest requirements of forensic science.

6. To provide a platform for students and forensic scientists to exchange views, chalk-out collaborative programs and work in a holistic manner for the advancement of forensic science**.**

SEMESTER-I

Sl. No.	Course Code	Course	Credit(T+P+Pj)
1	CUTM2307	Fundamentals of Forensic Science	4+2+0
2	CUTM2308	Introduction to Crime Scene	4+2+0
3	CUTM	DSE	4
4	CUTM1693	Proficiency in English	1+1+0

SEMESTER-II

Sl. No.	Course Code	Course	Credit(T+P+Pj)
1	CUTM2309	Forensic Related Laws	3+0+2
2	CUTM2310	Forensic Psychology	3+1+1
3	CUTM	Generic Science Elective	6
5	CUTM1674	Ability Enhancement Compulsory Course : Environmental Science	0+0+2

SEMESTER- III

Sl. No.	Course Code	Course	Credit(T+P+Pj)
1	CUTM2311	Fingerprint Science & Other Impressions	3+2+0
2	CUTM2312	Instrumental Methods of Analysis	3+2+0
3	CUTM	Generic Science Elective	6
4	CUTM	Discipline Specific Elective	4
5	CUEA4046	SEC - Human Values & Professional Ethics	0

SEMESTER-IV

Sl. No.	Course Code	Course	Credit(T+P+Pj)
1	CUTM2314	Forensic Chemistry	3+2+0
2	CUTM2315	Forensic Document Examination	3+2+0
3	CUTM2316	Forensic Biology, Serology & DNA Fingerprinting	3+2+0
4	CUTM	Generic Science Elective	6
5	CUEA4042	SEC - Life Skill Development	0

SEMESTER-V

Sl. No.	Course Code	Course	Credit(T+P+Pj)
1	CUTM2317	Forensic Ballistics	3+2+0
2	CUTM2313	Forensics Physics	3+2+0
3	CUTM2318	Forensic Toxicology	3+2+0
4	CUTM	Generic Science Elective	6
5	CUTM	Discipline Specific Elective	4

SEMESTER-VI

Sl. No.	Course Code	Course	Credit(T+P+Pj)
1	CUTM2319	Forensic Medicine	3+1+1
2	CUTM2320	Digital Forensics	3+2+0
3	CUTM	Discipline Specific Elective	4

SEMESTER-VII

Sl. No.	Course Code	Course	Credit(T+P+Pj)
1	CUTM	Internship	20

SEMESTER-VIII

Sl. No.	Course Code	Course	Credit(T+P+Pj)
1	CUTM	Project	20
2	CUEA4009	Research Methodology and Intellectual Property Right	0

DISCIPLINE SPECIFIC ELECTIVE (DSE)

Sl. No.	Course Code	Course	Credit(T+P+Pj)
1	CUTM2321	Forensic Photography	3+1+0
2	CUTM2322	Forensic Accounting & Fraud Investigation	3+0+1
3	CUTM2323	Wildlife Forensics	3+1+0
4	CUTM2324	Biometry	3+1+0
5	CUTM2325	Forensic Nanotechnology	3+1+0
6	CUTM2326	Mobile Forensics	3+1+0
7	CUTM2327	Multimedia Forensics	3+1+0
8	CUTM2328	Quality Control and Quality Assurance	3+0+1
9	CUTM2329	Criminalistics	3+1+0

GENERIC SPECIFIC ELECTIVE (GSE)

Sl. No.	Course Code	Course	Credit(T+P+Pj)
1	CUTM	Physics	6
2	CUTM	Chemistry	6
3	CUTM	Botany	6
4	CUTM	Zoology	6

COURSE CONTENTS

FUNDAMENTALS OF FORENSIC SCIENCE **Credits: 4+2+0**

Module 1: Basics of forensic Science

Introduction, Definition, need, signification and scope of Forensic Science. Principles of Forensic Science. Domains in Forensic Science: Forensic Biology, Forensic Medicine, Forensic Toxicology, Forensic Osteology and Odontology, Forensic Physics, Forensic Photography, Ballistics, Fingerprint, Questioned Documents, Forensic Psychology, Forensic Anthropology, Wild life Forensic, DNA profiling, Computer Forensic etc.,

Module 2: History and development of forensic science

Specific contribution of scientists in the field of Forensic Science. Development of Forensic Science in India. National and international scenario of teaching and research institution in Forensic Science. Functions of: Forensic Scientist, Police officers, Prosecution, Judicial Officers and Medico legal expert etc. Problem of proof in Forensic Science, corpus dilecti, modus operandi.

Module 3: Organisational setup of Forensic Science Laboratory

Structure and function of State and regional Forensic Science Laboratory, Central Forensic Science Laboratory and facility provided, Mobile Forensic Science Laboratory. Directorate of Forensic Science Service. Police and Forensic scientist relationship, role of FSL in criminal investigation, relationship between forensic expert and judiciary officer, Importance of FSL, National and International scenario of FSL, facilities provided in forensic science laboratory. Ethical issues in FSL.

Module 4: National and International perspective of Forensic Science

National perspective of forensic science: Central and Divisional Fingerprint Bureaus, National Crime Records Bureau, Police & Detective Training Schools, Bureau of Police Research & Development, Police Academies, Police dogs.
International perspectives of forensic science: INTERPOL, FBI, CIA, CSI, Ameripol, Europol, Frontex etc.

Module 5: Crime & Criminology

Crime: Definition of crime, history and development, Victimology, criminological perspective, characteristics of crime, classification of crimes, present scenario of crime in India. Criminal and Criminology: Definition of criminology & criminal, classification of criminals, growth of criminology in India, conservative criminology, liberal criminology, radial criminology.
Criminal behaviour: Introduction of criminal behaviour, theories of criminal behaviour, Ethical issues in forensic science: Definition of ethics, professional standards for practice of Criminalistics, sanction against expert for unethical conduct.

Module 6: Policing System in India

Policing style and principles, police power of investigation, filling of criminal charges, community policing a heterogenous society

Module 7: Criminal Justice System in India

Introduction to penology, Broad concepts of criminal justice system, Correctional measures and rehabilitation of offenders, Human rights and criminal Justice system in India.

Practical's:

1. To study the Do's and Don'ts in the Forensic Science Laboratory.
2. To prepare a poster on various domains of forensic science.
3. To prepare a poster on the contribution of various scientists in forensic science.
4. To prepare a poster on the forensic teaching and research institutes in India.
5. To prepare a case study of famous criminal and civil cases in India.
6. To prepare a poster on the hierarchy and functions of working professionals in Central Forensic Science Laboratory.
7. To study the different forensic science kits available in the Forensic Science Laboratory.
8. To understand the roles of forensic experts of various divisions of the Forensic Science Laboratory. (Role Play)
9. To study the types, causes and rate of crimes in India.
10. To prepare a poster on functions and hierarchy of the Policing System and Criminal Justice System in India.

Suggested Readings

1. Henry Lee's Crime Scene Handbook: Henry C Lee
2. Forensic Biology: Shrikant H. Lade
3. Crime Scene Processing and Laboratory Work Book: Patric Jones
4. Forensic Science: An Introduction to Scientific and Investigative Techniques 3rd ed.: Stuart H. James
5. Criminalistics: An Introduction to Forensic Science, 9th edition.: Richard Saferstein
6. Computer Crime and Computer Forensic: Dr. R.K. Tiwari
7. Criminal Profiling: An Introduction to a Behavioral Evidence Analysis, 3rd edition.: Brent E. Turvey
8. Forensic Science in Criminal Investigation and Trial, 4th edition.: B.R. Sharma
9. Handbook of Forensic Psychology: Dr. Veer raghavan crime scene, sketching of crime scene, searching, collection, preservation, packing of physical evidence, documentation of crime scene, forwarding or dispatch of exhibit in to the laboratory, chain of custody, collection of standard/reference samples.
10. Crime Scene Management with Special Emphasis on National Level Crime Cases: Dr. Rukmani Krishnamurthy under publishing
11. Text Book of Medical Jurisprudence, Forensic Medicine and Toxicology: Parikh C.K.
12. The Identification of Firearms and Forensic ballistics: Barrard and Gerald
13. M. Byrd, *Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence*, CRC Press, Boca Raton (2001).
14. Richard Saferstein: Forensic science from the crime scene to the crime lab.
15. S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2nd Edition, CRC Press, Boca Raton (2005).
16. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, *Techniques of Crime Scene Investigation*, CRC Press, Boca Raton (2013).

INTRODUCTION TO CRIME SCENE **Credits: 4+2+0**

Module 1: Crime Scene Evidence

Introduction to evidence, Importance of evidence, Classification of crime scene evidence, Locard's principle of exchange, Handling of evidences, Precautions, Evidence collection methodologies and materials, Collection, preservation, labelling, sealing and forwarding of evidences, Chain of custody.

Module 2: Crime Scene Investigation

Steps of CSI- Self-protection, Medical Assessment, Secure the crime scene, Search for evidence, Crime Scene Documentation (Note taking, Photography, Sketching and Videography), Role of first responding officer, Coordination between police personnel and forensic scientists at crime scenes. The evaluation of 5Ws -who? what? when? where? why? and 1H -how?

Module 3: Crime Scene management

Types of crime scenes- Macroscopic, Microscopic, Indoor and Outdoor. Set up involved in CSM- Components of Crime Scene Management- Information management, manpower management, technology management & logistics management, Role of crime scene managers and FRO, Duties of various officers at crime scene, educational background & hierarchy of forensic expert. Crime scene security, contamination control, documentation protocols and maintaining health & safety procedures.

Unit 4: Crime Scene Reconstruction

Defining crime scene reconstruction, nature & importance of crime scene reconstruction, basic principles of physical evidence and crime scene reconstruction, stages of crime scene reconstruction, types of crime scene reconstruction- (Specific Type of Incident/Crime Reconstruction, Specific Events Reconstruction, Degree of Involvement Reconstruction and Specific Type of Physical Evidence Reconstruction), Crime Scene Staging, Sequence of events recording, Documentation required for Crime scene reconstruction, Computerized Reconstruction (Faro).

Unit 5: Report Writing

Introduction, Expert report, General guidelines, Importance of report, Nature of report, Types of report, Report format, Length of report, Common reporting mistakes, Tips to Keep in Mind When Writing an Expert Report, Do's and Don'ts while preparing forensic report, Legal challenges, Legal considerations of report: Sec 45 of IEA, Sec 293 of Cr.P.C.

Module 6: Investigating Tools and Techniques

Forensic Kits, Microscopic Techniques, Spectroscopic techniques, Chromatographic techniques and Specialised Forensic Tools and Techniques.

Module 7: Case studies

Study of famous criminal and civil cases in India and Abroad.

Practical's: -

1. To study the seven principles of forensic science with examples.

2. To study the different evidence collection methods with examples.
3. To study the different evidence collection materials with examples.
4. To search, collect and preserve the physical evidence recovered from the crime scene.
5. To record the crime scene by photography and videography methods of crime scene documentation.
6. To record the crime scene by Note making and Sketching methods of crime scene documentation.
7. To study the reconstruction of blood spatter patterns.
8. To study the reconstruction of glass fracture evidence.
9. To simulate the scene of crime and perform its investigation.
10. To prepare a forensic report on crime scene investigation.

Suggested Reading:

1. Henry Lee's Crime Scene Handbook: Henry C Lee
2. Forensic Biology: Shrikant H. Lade
3. Crime Scene Processing and Laboratory Work Book: Patric Jones
4. Forensic Science: An Introduction to Scientific and Investigative Techniques 3rd ed.: Stuart H. James
5. Criminalistics: An Introduction to Forensic Science, 9th edition.: Richard Saferstein
6. Computer Crime and Computer Forensic: Dr. R.K. Tiwari
7. Criminal Profiling: An Introduction to a Behavioral Evidence Analysis, 3rd edition.: Brent E. Turvey
8. Forensic Science in Criminal Investigation and Trial, 4th edition.: B.R. Sharma
9. Handbook of Forensic Psychology: Dr. Veer raghavan crime scene, sketching of crime scene, searching, collection, preservation, packing of physical evidence, documentation of crime scene, forwarding or dispatch of exhibit in to the laboratory, chain of custody, collection of standard/reference samples.
10. Crime Scene Management with Special Emphasis on National Level Crime Cases: Dr. Rukmani Krishnamurthy under publishing
11. Text Book of Medical Jurisprudence, Forensic Medicine and Toxicology: Parikh C.K.
12. The Identification of Firearms and Forensic ballistics: Barrard and Gerald
13. M. Byrd, *Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence*, CRC Press, Boca Raton (2001).
14. Richard Saferstein: Forensic science from the crime scene to the crime lab.
15. S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2nd Edition, CRC Press, Boca Raton (2005).
16. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, *Techniques of Crime Scene Investigation*, CRC Press, Boca Raton (2013).

FORENSIC PSYCHOLOGY **Credits: 3+1+1**

Unit I: Basics and History of Psychology

Introduction, Historical Perspective Psychology and Modern Psychology-, Definition, significance and scope of Psychology. Principles & Ethics of Psychology. Branches of Psychology.
Role of Psychologists: Assessment, Evaluation of Eyewitness Testimony, Errors/Problems in Eyewitness Testimony, Solutions for Increasing Eyewitness Accuracy., psychology of evidence, psychology in courtroom with special ref. to 84 IPC

Unit II: - Perspective of Criminal Behavior and Legal Proceedings

Psychological Approaches- Emotional Deprivation, Psychological Motives of Crime, Frustration, Attitudes, Peer Influence. Psychological Disorders, Social Perspective- Differential Association theory, Labeling theory, Critical theory, Control theory.
Application of Forensic Psychology in Civil & Criminal Proceedings- Assessment of Domestic Issues in Childhood and Adolescent, Assessment of Civil Competency,
Competency to stand trial, Criminal responsibility and insanity defense, Risk assessment, Evaluation of Eyewitness testimony, Personal Injury Evaluation, Evaluation of Trauma Caused by Sexual Harassment or Rape.

Unit III: - Social Psychology in The Interpersonal Aspects of Legal System

Social Influence and Legal System- Police Interrogations, Line-ups and Effect of Media, Coverage on Perception of Defendants. Social Cognition and Legal System: The Influence of Prejudice and Stereotypes On the Legal System**.**

Unit IV: - Investigative Psychology

Criminal Psychological Profiling- Nature, Definition. Ethical Guidelines for Criminal profiler. **Psychological Investigative Tools-** Mental Status Examination, **Psychological Testing: Polygraph Testing, Narco Analysis, Forensic Hypnosis, Brain Electrical Oscillation**. **Signature Profiling –** Introduction, Theory, Procedure, Interpretation of results & Limitations, Ethical issues. **Psychological Autopsy-** Manner of Death Defined, Types of Psychological Autopsies. **Modus Operandi-** Nature, Elements of Modus Operandi, Modus Operandi Risk- Low MO risk and High MO risk.

Unit V: Stress, Criminal Psychology & Police Psychology

Stress- Definition, Nature, Models of Stress- Response based model, Stimulus based model, Transactional/Interactive model. **Consequences of Stress-** Physiological, Psychological, Behavioral. Stress and Burnout, Coping with the stress, Stress Management.
Criminal Psychology – Serial Murderers, psychology of Terrorism
Police psychology- Nature, Psychological testing & selection of police officer: aptitude test, intelligence test, personality test. Stress and Policing, Types of police stress, Fitness for duty evaluation, Police suicide.

Unit VI: Crime & Delinquency and Psychology & court

Crime & Delinquency:
Psychology of crime & Delinquency, Juvenile Delinquency: Definition, Concept.
The Developmental perspectives in delinquent behaviour- Developmental theory, Coercion Developmental Model.
Risk Factors of Juvenile Delinquency- Biological Factors- Temperament, Genetic influence, Hormones and aggression, Substance abuse. **Individual Factors-** intelligence, language development, Self-regulation skills & Executive functions. **Family Factors-** Family pattern, Rejection in family, Family Conflicts, Family Relationships, Emotional Deprivation. **Social Factors-** Peer Group, Cultural Values, Media. Juvenile Psychopathy, Prevention and Control of Juvenile Delinquency.

Unit VII: Laws & cases related to Forensic Psychology:

Relation between law and Psychology, Mental Health Act, 1987 and Case Studies

Practical's:

1. To prepare a report on the relationship between mental disorders and forensic psychology.
2. To review a crime case involving serial murders. Comment on the psychological traits of the accused.
3. To cite a crime case involving a juvenile and argue for and against lowering the age for categorizing an individual as juvenile.
4. To study a criminal case in which hypnosis was used as a means to detect deception.
5. To Prepare a report on relationship between mental disorders and criminal behaviour
6. To review a crime case involving the mental disorder of schizophrenia. Comment the clause of insanity defence.

Suggested Reading:

1. Saundra K. Ciccarelli, Psychology
2. David V. Canter, Forensic Psychology for Dummies
3. Ellis, Havelock, The criminal
4. Stanton E. Samenow, Inside the Criminal Mind
5. Dennis Howitt, The Psychology of Criminal Conduct: Theory, Research and Practice
6. Ronald Roesch, Patricia A Zapf, Stephen D. Hart, Forensic Psychology and Law
7. Kevin S Douglas, Randy K.otto, Patricia Zapf, Handbook of Violence Risk Assessment
8. Helen Gavin, Criminological and Forensic Psychology

FORENSIC RELATED LAWS **Credits: 3+0+2**

Unit I: Law to Combat Crime

Classification – civil, criminal cases. Essential elements of criminal law. Constitution and hierarchy of criminal courts. Criminal Procedure Code. Bailable and Non bailable offences. Cognizable and non-cognizable offences. Compoundable and Non-compoundable offence.
Sentences which the court of Chief Judicial Magistrate may pass. Summary trials – Section 260(2). Judgements in abridged forms – Section 355.

Unit II: Indian Penal Code

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 Penal Code pertaining to offences against property Sections – 378, 383, 390, 391, 405, 415, 420, 441, 463, 489A, 497, 499, 503, 511.

Unit III: Indian Evidence Act

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.

Section 293 in the code of criminal procedure.

Unit IV: Constitution of India

Preamble, Fundamental Rights, Directive Principles of State Policy. – Articles 14, 15, 20, 21, 22, 51A.

Unit V: Acts Pertaining to Chemistry & Toxicology

Narcotic, Drugs and Psychotropic Substances Act. Drugs and Cosmetics Act. Explosive Substances Act, Poison Act. Prevention of Food Adulteration Act & rules

Unit VI: Acts pertaining to Socio Economic & Environmental Crimes

Dowry Prohibition Act, Essential Commodity Act, Prevention of Corruption Act, Wildlife Protection Act, Environment Protection Act, Untouchability Offences Act and Arms Act.

Unit VII: Cyber Laws & IPR Acts

IT Act 2000, The Patent Law, Domain Name & Trademark Act

Suggested Reading:

1. Ratanlal & Dhirajlal, The Indian Penal Code
2. Dr.J.N.Pandey, Consitutional Law of India
3. Government of India, The Constitution of India Bare Act with Amendments
4. C K Takwani, Civil Procedure with Limitation Act 1963
5. LexisNexis, The Code of Civil Procedure, 1908
6. Government of India, The Code of Criminal Procedure 1973 (CRPC) Bare Act with Amendments
7. Batuk Lal, The Law of EVIDENCE
8. Lawmann's, Information Technology Act, 2000
9. Government of India, The Narcotic Drugs and Psychotropic Substances Act 1985 (NDPS) Bare Act with Amendments
10. The Commersial Law Publishers, The ARMS Act, 1959
11. Professional book Publisher, The Explosives Act, 1884
12. Rajeev Babel, Laws relating to Intellectual Property Rights in India
13. LexisNexis, The Prevention of Food Adulteration Act, 1954
14. MAGAZINE R, DRUG AND COSMETIC ACT 1940 AND RULES 1945
15. Lawmann’s, Dowry Prohibition Act 1961
16. Commercial Law Publishers (India) Pvt. Ltd., The Environment (Protection) Act, 1986
17. Lawmann’s, Essential Commodities Act, 1955 (Act No. 10 of 1955)

FINGERPRINT SCIENCE AND OTHER IMPRESSIONS **Credits: 3+2+0**

Unit I: History of fingerprint science & Basics of fingerprint

History and development of fingerprint in India and abroad, morphology and anatomy of dermal skin, Embryology of fingerprint- morphology of volar pad and configurational areas, development of volar

pad, formation of friction ridges, Sweat glands- eccrine, sebaceous and apocrine, Definition of fingerprint, Theory and principles of fingerprint, Forensic significance of fingerprint. Case studies.

Unit II: Fingerprint classification systems

Basic classification of fingerprint- arch, loop, whorl and composite, Rules for placing core and delta, counting and tracing of ridges, ridge density, Classification of identification of fingerprint- different system of classifications (Ivon, Vucetich, Purkinje, Francis Galton, Henry 10 digit, Henry FBI extension and Battley single digit classification) and their modification till date and their utilities.

Unit III: Taking and collection of fingerprint

Types of fingerprint- rolled, plain, chance, latent, patent and plastic, Collection of latent, patent and plastic fingerprint : methods, procedure, precautions, limitations, preservation and preservation and lifting of fingerprint, Taking of fingerprint: Taking fingerprints of living person- purpose, requirements, procedures, precaution, limitation and collection, Taking finger prints of dead bodies- purpose, requirements, procedures, precaution, limitation and collection(techniques of recording fingerprints of dead bodies of different stages, viz, immediately after death and after rigor mortis, decomposed and charred bodies).

Unit IV: Detection & Development of fingerprint

Detection of fingerprint using Light sources, Development of fingerprint: Physical methods and chemical methods- silver nitrate, Ninhydrin and its analogues, physical developer etc., fuming methods- iodine fuming, cyanoacrylate fuming, soot method, hydrogen fluoride fuming and metal deposition method.

Unit V: Comparison of Fingerprints

Comparison of fingerprint: class and individual characteristics (minutia's), fundamentals of comparison- print to print, trace to record, trace to print, trace to trace, documentation of fingerprint, AFIS (Automated Fingerprint Identification System).

Unit VI: Impression Evidence I

Lip prints & Ear Prints: Introduction, Collection, preservation, Examination & their significance.

Unit VII: Impression Evidence II

Palm Prints & Foot print impressions**:** Introduction, Collection, preservation, Examination & their significance.

Practical's:

1. To record plain and rolled fingerprints and identify different types of fingerprint patterns in a given fingerprint.
2. To locate and identify type line, core and delta in a given fingerprint.
3. To carry out ridge tracing, ridge counting and ridge density of fingerprints.
4. To locate, identify, develop and preserve the fingerprint impression by using physical methods of fingerprint detection.

5. To locate, identify, develop and preserve the fingerprint impression by using chemical methods of fingerprint detection.
6. To extract the fingerprint minutiae from a given fingerprint sample.
7. To compare and opine whether two given fingerprints are or not.
8. To carry out ten-digit classification of fingerprints.
9. To carry out the forensic analysis of given lip print impression.
10. To carry out the forensic analysis of given foot print impression.

Suggested Readings

1. J.E. Cowger, Friction Ridge Skin, CRC Press, Boca Raton (1983).
2. D.A. Ashbaugh, Quantitative-Qualitative Friction Ridge Analysis, CRC Press, Boca Raton (2000).
3. C. Champod, C. Lennard, P. Margot an M. Stoilovic, Fingerprints and other Ridge Skin Impressions, CRC Press, Boca Raton (2004).
4. Lee and Gaensleen's, Advances in Fingerprint Technology, 3rd Edition, R.S. Ramotowski (Ed.), CRC Press, Boca Raton (2013).

INSTRUMENTAL METHODS OF ANALYSIS **Credits: 3+2+0**

Unit I: Microscopy I

Fundamental & principles and Applications of Microscopes, Different types of Microscopes-Simple Microscope, Compound Microscope, Stereo Microscope, Comparison Microscope

Unit II: Microscopy II

Principles of Microscopes – Phase contrast, Polarizing, Fluorescent microscope, IR microscope, SEM and TEM

Unit III: Spectroscopic Techniques I

Basic Fundamentals, Different types of Spectroscopy-EMR, UV-VIS, IR, Fourier-transform and Fourier-transform infrared Spectroscopy atomic absorption Spectroscopy, Atomic Emission Spectroscopy - Principles and Forensic Application

Unit IV: Spectroscopic Techniques II

Basic Fundamentals of Raman spectroscopy**,** Photo-thermal spectroscopy, XRD, XRF, NMR, Mass Spectroscopy – Principles & Forensic Application

Unit V: Chromatographic Techniques I

Introduction of Chromatography, Basics of separation of molecules, Types of chromatography, Working principles of Paper chromatography, Thin Layer Chromatography, Column chromatography.

Unit VI: Chromatographic Techniques II

Principles and Applications of chromatographic techniques - Ion exchange chromatography, Gas Chromatography, Gas Liquid Chromatography, High Performance Liquid Chromatography, High Performance Thin Layer Chromatography**.**

Unit VII: Centrifugation and Electrophoresis

Basic fundamentals of molecular separation methodologies and parts of centrifuge – Bench top centrifugation, micro centrifugation, Low speed centrifugation, Ultra centrifugation, Gas centrifugation. Fundamentals of electrophoresis – Agarose gel electrophoresis, Poly acrylamide Gel electrophoresis.

Practical's:

1. To determine the concentration of a coloured compound by calorimetry analysis.
2. To carry out thin layer chromatography of ink samples.
3. To carry out separation of organic compounds by paper chromatography.
4. To identify drug samples using UV-Visible spectroscopy.
5. To perform Agarose Gel Electrophoresis by using any forensic sample
6. To Separate the Molecules by using Ultra centrifugation
7. To identify the Blood cells by using Microscope.
8. To perform the protein analysis by using Poly Acrylamide Gel Electrophoresis.
9. To determine the chlorophyll by using UV-Visible spectroscopy.
10. To determine the caffeine and benzoic acid in soft drinks by using FT-IR.

Suggested Readings

1. Barbara Stuart, Forensic Analytical Techniques
2. Dr. K. R. Mahadik, INSTRUMENTAL METHODS OF ANALYSIS
3. Dr. G.R. Chatwal, Instrumental Methods of Chemical Analysis
4. Books LLC, Wiki Series, Laboratory Techniques: Polymerase Chain Reaction, Gel Electrophoresis, Distillation, Microscopy, Immunoperoxidase
5. Imran Latif Patel, Biochemical and Biophysical Techniques

FORENSIC CHEMISTRY **Credits: 3+2+0**

Unit I: Petroleum and Petroleum Products

Distillation and fractionation of petroleum. Commercial uses of different petroleum fractions.
Analysis of petroleum products.
Analysis of traces of petroleum products in forensic exhibits.
Comparison of petroleum products. Adulteration of petroleum products.

Unit II: Arson

Chemistry of fire. Conditions for fire. Fire scene patterns. Location of point of ignition. Recognition of type of fire. Searching the fire scene. Collection and preservation of arson evidence.
Analysis of fire debris. Analysis of ignitable liquid residue. Post-flashover burning.
Scientific investigation and evaluation of clue materials. Information from smoke staining.

Unit III: Explosives

Introduction, Classification of explosives – low explosives and high explosives. Homemade explosives. Military explosives. Blasting agents.
Synthesis and characteristics of picric acid, TNT, PETN and RDX. Explosion process. Blast waves.
Bomb scene management. Searching the scene of explosion. Mechanism of explosion. Post blast residue collection and analysis.
Blast injuries.

Unit IV: Narcotic Drugs & Psychotropic Substances

Definition of narcotics, drugs and psychotropic substances. Broad classification – Narcotics, stimulants, depressants and hallucinogens. General characteristics and common example of each classification. Natural, synthetic and semi-synthetic narcotics, drugs and psychotropic substances. Designer drugs. Tolerance, addiction and withdrawal symptoms of narcotics, drugs and psychotropic substances Crime scene search for narcotics, drugs and psychotropic substances – searching a suspect, searching a dwelling, searching a vehicle. Testing of narcotics, drugs and psychotropic substances. Presumptive and screening tests for narcotics, drugs and psychotropic substances. Microcrystalline testing of drugs of abuse

Unit V: Analysis of Beverages

Introduction, Alcoholic and non-alcoholic beverages and their composition, Definition of alcohol and illicit liquor. Alcohol and prohibition, Consequences of drunken driving, Breath analysis, blood alcohol analysis by GC-HS.
Analysis of Beverages- Analysis of alcoholic beverages as per BIS and PFA Act, Detection and determination of ethanol, furfural, organic acids, aldehydes, chloral hydrate, methanol and ethylene glycol in liquors.

Unit VI: Detection of Food Adulteration

Food adulteration: Introduction, Prevention of food adulteration, analysis of samples taken under food adulteration act

Unit VII: Case Studies

Famous case studies related to forensic chemistry.

Practical's:

1. To carry out analysis of gasoline.
2. To carry out analysis of diesel.
3. To carry out analysis of kerosene.
4. To prepare a case report on a case involving arson.
5. To carry out analysis of explosive substances.
6. To separate explosive substances using thin layer chromatography.
7. To prepare a case report on bomb scene management.
8. To carry out analysis of Narcotics & Psychotropic substances.
9. Analysis of Alcoholic and Non Alcoholic Beverages.
10. Analysis of food samples for adulteration.

Suggested Readings

1. J.D. DeHaan, Kirk's Fire Investigation, 3rd Edition, Prentice Hall, New Jersey (1991).
2. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, The Foundation Press, Inc., New York (1995).
3. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
4. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).
5. S. Ballou, M. Houck, J.A. Siegel, C.A. Crouse, J.J. Lentini and S. Palenik in Forensic Science, D.H. Ubelaker (Ed.), Wiley-Blackwell, Chichester (2013).

FORENSIC DOCUMENT EXAMINATION **Credits: 3+2+0**

Unit I: Basics of Document Examination

Definition, Types of documents, Essentials to produce document, scope of forensic document examination, document expert, Handling of Documents.

Unit II: Handwriting & Signature

Principles of handwriting, Comparison of handwriting. Development of individuality in handwriting. Natural variations and Factors affecting handwriting, Class and individual characteristics. Standards for comparison of handwriting. Signature Examination.

Unit III: Detection and Decipherment of Forgeries

Definition, Types of forgery, Handwriting & Signature forgeries, Alterations in documents, including erasures, additions, deletions, over-writings and obliterations.

Unit IV: Examination of Questioned Documents

Preliminary examination of document. Examination of Printed documents, Type written documents & Xeroxed documents. Examination of Indented writings, Invisible writings & Charred documents. Examination of anonymous letters.

Unit V: Examination of Security Documents

Definition, Types of security documents, Examination of counterfeit Indian currency notes, passports, plastic cards and stamp papers.

Unit VI: Determination of Relative Age of Documents

Determination of relative age of writing and signatures, determination of relative age by examination of signatures/rubber stamp impression in chronological order.
Determination of relative age of document by - Examination of writing paper and ink, Examination of sequence of intersecting strokes, Addition of text with ink or typescript, Anachronistic features and their importance.

Unit VII: Tools and techniques used in document examinations

Tools and techniques needed for forensic documents examination – Stereomicroscope, Projectina Nirvis, Video Spectral Comparator, Electrostatic Detection Apparatus, TLC and Paper chromatography.

Practical's:

1. To opine whether given signature samples are written by the same author or not.
2. To extract the handwriting features including class and individual from the given handwriting samples.
3. To opine whether given handwriting samples are written by the same author or not.
4. To identify and examine the exhibits for secret writing.
5. To extract and identify the security features in the Indian Currency Notes.
6. To extract and identify the security features in the debit card and credit card.
7. To extract and identify the security features in the Indian passport.
8. To extract and identify the security features in the stamp papers.
9. To identify and compare the given typewritten document.
10. To identify and compare the given photocopied document.

Suggested Readings

1. O. Hilton, Scientific Examination of Questioned Documents, CRC Press, Boca Raton (1982).
2. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, Foundation Press, New York (1995).
3. R.N. Morris, Forensic Handwriting Identification: Fundamental Concepts and Principles, Academic Press, London (2000).
4. E. David, The Scientific Examination of Documents – Methods and Techniques, 2nd Edition, Taylor & Francis, Hants (1997).

FORENSIC BIOLOGY, SEROLOGY & DNA FINGERPRINTING Credits: 3+2+0

Unit I: Biological Evidence

Nature and importance of biological evidence. 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.
Diatoms and their forensic significance. Palynology and limnology.

Unit II: Forensic Microbiology

Introduction of Microbiology, Types of microbes, Microbial organisms of forensic significance. Role of Microbial DNA in Crime Scene Investigation, Biological warfare Agents, Microbial Bioterrorism.

Unit III: Introduction to Serology

Overview of basic Immunology, Cellular antigens, Antibodies. Blood and its components, Body Fluids, Types of Body fluids, Composition, Functions and Circulation of Body Fluids. Collection and preservation of body fluids.

Unit IV: Forensic Examination of Body fluids

Determination of blood groups. Antigens and antibodies. Forensic characterization of bloodstains. Typing of dried stains. Morphology of spermatozoa. Tests for identification of semen, saliva, sweat, urine, vaginal secretions, faecal matter. Individualization on the basis of semen examination. Forensic significance of body fluids.

Unit V: Blood stain pattern and Genetic marker analysis

Fundamentals of Bloodstain characteristics. Impact bloodstain patterns. Cast-off bloodstain patterns. Projected bloodstain patterns. Contact bloodstain patterns. Blood trails. Bloodstain drying times. Crime scene reconstruction with the aid of bloodstain pattern analysis.

Unit VI: Basics of DNA & DNA Fingerprinting

Structure of DNA and RNA, Overview of DNA replication, transcription and translation. History of DNA fingerprinting. Introduction to mitochondrial DNA and its forensic importance. Procedure for collection and preservation of biological sample for DNA analysis.

Unit VII: DNA Typing & Forensic Significance

Introduction to Polymerase Chain Reaction and its applications. Genes and DNA markers in forensic DNA analysis - STR, VNTR, SNP.
Techniques of DNA isolation and its quantitation. Introduction to RFLP.
Overview of modern trends in DNA Fingerprinting. Sexual assault investigations and Parentage Testing.

Practical's:

1. To examine hair morphology and determine the species to which the hair belongs.
2. To examine human hair for cortex and medulla.
3. To carry out microscopic examination of pollen grains.
4. To carry out microscopic examination of diatoms.
5. To cite a crime case in which diatoms have served as forensic evidence.
6. To prepare a case report on forensic entomology.
7. Isolation of DNA from human Blood sample
8. Agarose Gel Electrophoresis for DNA examination
9. Blood Grouping from human blood
10. Forensic Analysis methods for body fluids

Suggested Readings

1. R. Saferstein, Forensic Science Handbook, Vol. VIII, Prentice Hall, New Jersey (2016).
2. G.T. Duncan and M.I. Tracey, Serology and DNA typing in, Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
3. S. Chowdhuri, Forensic Biology, BPRD, New Delhi (2000).
4. W.G. Eckert and S.H. James, Interpretation of Bloodstain Evidence at Crime Scenes, CRC Press, Boca Raton (1998).
5. J.M. Butler, Forensic DNA Typing, Elsevier, Burlington (2005).
6. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).

7. K. Inman and N. Rudin, An Introduction to Forensic DNA Analysis, CRC Press, Boca Raton (1997).
8. The examination and Typing of Blood Stains in the crime laboratory – B J Culliford, U. S. Dept. of Justice, Washington D. C.
9. Blood Group Serology – Boorman KE, Dodd BE and LOncoln PJ, Chuchill Livingstone Inc. New York.
10. Laboratory Procedure Manual - Forensic Serology (2005), Directorate of Forensic Sciences, MHA, New Delhi.
11. Laboratory Procedure Manual – DNA Profiling (2005), Directorate of Forensic Sciences, MHA, New Delhi.
12. Molecular Biology of the Cell, 6th Edition (2014) – Bruce Alberts, et al., Garland Sciences, ISBN: 978-0815341055
13. Forensic DNA Typing, Second Edition: Biology, Technology, and Genetics of STR Markers 2nd Edition (2005) - John M. Butler, Academic Press, ISBN:0121479528

FORENSIC BALLISTICS **Credit: 3+2+0**

Unit I: Firearms

History and development of firearms. Classification of firearms. Weapon types and their operation. Firing mechanisms of different firearms.

Unit II: Internal ballistics

Definition, ignition of propellants, shape and size of propellants, manner of burning, and various factors affecting the internal ballistics: lock time, ignition time, barrel time, erosion, corrosion and gas cutting.

Unit III: External Ballistics

Vacuum trajectory, effect of air resistance on trajectory, base drag, drop, drift, yaw, shape of projectile and stability, trajectory computation, ballistics coefficient and limiting velocity, Measurements of trajectory parameters, introduction to automated system of trajectory computation and automated management of ballistic data.

Unit IV: Terminal Ballistics

Effect of projectile on hitting the target: function of bullet shape, striking velocity, striking angle and nature of target, tumbling of bullets, effect of instability of bullet, effect of intermediate targets, influence of range. Ricochet and its effects, stopping power.

Unit V: Ammunition

Types of ammunition. Constructional features and characteristics of different types of cartridges and bullets. Primers and priming compounds. Projectiles. Headstamp markings on ammunitions. Different types of marks produced during firing process on cartridge – firing pin marks, breech face marks, chamber marks, extractor and ejector marks.

Unit VI: Examination of Firearm Evidence

Matching of bullets and cartridge cases in regular firearms. Identification of bullets, pellets and wads fired from improvised, country made firearms. Automated method of bullet and cartridge case comparison. Determination of range of fire and time of fire.
Mechanisms of formation of gunshot residues. Methods of analysis of gunshot residues from shooting hands and targets, with special reference to clothing.

Unit VII: Firearms Injuries

Identification and nature of firearms injuries. Reconstruction with respect to accident, suicide, murder and self-defence.

Practical's:

1. To describe, with the aid of diagrams, the firing mechanisms of Pistol.
2. To describe, with the aid of diagrams, the firing mechanisms of Revolver.
3. To describe, with the aid of diagrams, the firing mechanisms of Air Gun.
4. To describe, with the aid of diagrams, the firing mechanisms of AK-47 Rifle.
5. To describe, with the aid of diagrams, the assembling and disassembling of different types of firearms.
6. To describe, with the aid of diagrams, the internal structure of different types of bullets.
7. To describe, with the aid of diagrams, the difference between Pin fire, Rimfire and Centrefire ammunition.
8. To carry out the comparison of fired bullets.
9. To carry out the comparison of fired cartridge cases.
10. To differentiate, with the aid of diagrams, contact wounds, close range wound and distant wounds.

Suggested Readings

1. B.J. Heard, Handbook of Firearms and Ballistics, Wiley and Sons, Chichester (1997).
2. W.F. Rowe, Firearms identification, Forensic Science Handbook, Vol. 2, R. Saferstein (Ed.), Prentice Hall, New Jersey (1988).
3. A.J. Schwoeble and D.L. Exline, Current Methods in Forensic Gunshot Residue Analysis, CRC Press, Boca Raton (2000).
4. E. Elaad in Encyclopedia of Forensic Science, Volume 2, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).

FORENSIC PHYSICS **Credit: 3+2+0**

Unit 1: Introduction & Examination of Trace Evidences:

Physical properties of materials: temperature, weight and mass, density, refractive index and their forensic importance.
Soil: Significance of soil evidence, Variations in soil, Collection and preservation of soil evidence, Forensic examination of soil.
Fibre: Types, Identification and comparison of manufactured fibres (Microscopic examination, Dye composition, Chemical composition, Other properties for examination), Significance of match, Collection and preservation of fibre evidence. Forensic examination of cloth and cloth fibres.
Paint: Composition of paint, Classification of common paints, Pigment Volume concentration number,

Microscopic examination of paint, Analytical tools used in paint comparison, significance of paint evidence, collection and preservation of paint evidence. Forensic examination of paint.

Unit 2: Examination of Glass **& Plastic Evidences**:

Composition of glass, Comparison of glass fragments, Measuring and comparing density and refractive index of glass, classification of glass samples, Glass fractures, Collection and preservation of glass evidence.
Plastic: Classification of plastics according to thermal and mechanical property, Plastics in common use.

Unit 3: Footwear Impressions:

Casting 3-D Footwear Impressions: Introduction to casting, Importance of casting, Benefits of casts over photographs, casting materials, Methods of casting with dental stone, Casting footwear impressions in snow.
Treatment of 2-D Footwear Impressions: Lifting 2-D footwear impressions, Lifting impressions electro statically and electrostatic lifting devices, Gelatine and adhesive lifting, Other lifting materials and choices, Powdering impressions, Deformable impressions, Impressions on carpets, cushions, grass and skin.
Enhancement of Footwear Impressions: Specialized lighting and photographic methods, Chemical enhancement, Other enhancement techniques.

Unit 4: Causes and Investigation of Vehicular Accidents:

Road Terminologies: Cut, Final Grade, Surface, Existing Grade, Fill, Sub grade, Base, Traffic lane, Travelled way, Shoulders, Roadbed, Roadway, Roadway ditch, Ditch slope, Back slope, Fill slope, Interceptor ditch, Slope ratio, Central line, Crown, Super elevation, Road dividers. Road signs, symbols and traffic control mechanisms.
Vehicular accidents: Primary causes of road accident, Types of road accident, sources of information, eye witnesses, Tire and other marks, Pedestrian impacts and vehicle speed, vehicle condition, vehicle speed and damage, types of skid marks, curved scuffmarks, speed estimation from skid/scuffmarks. Time and distance, reaction time and peripheral vision of a driver, Photography and plans, Brake system and Steering failure, Motor vehicle examination.
Rail Accidents: Investigation of rail crash: Criminal and safety investigation, Investigation principles, Best Practices: rail company tests, inspection of driving cab, examination of electrical/electronic/technological system and their failure. Necessary equipments required for forensic examination.
Forensic investigation of Aeroplane accident.

Unit 5: Fundamentals of Speech Recognition:

Forensic Speaker Identification: Introduction and scope of forensic speaker identification, speaker identification vs. Speaker verification. Human vocal tract, production and description of speech sound, acoustic characteristics of speech signal, introduction to phonetics and its importance in forensic speaker identification, International Phonetics Alphabets (IPA) and its symbolic representation.
Methods of speaker identification, open and close set, sound spectrograph and its analysis, analysis of vowel and consonant sound.
Voice evidence: collection of voice samples, examination and formation of opinion in terms of probability scale, presenting evidence in court of law in view of forensic speaker identification.

Recent advancements: Automated speaker identification: text dependent and text independent approach. Tools used for speaker identification.

Unit 6: Tools and Tool Mark analysis:

Common Hand Tools-Levers (screw drivers, crow bars, pry bars, nail pullers, pinch bars, moulding bar, wrecking bar), Hand saw (Rip saw, cross cutting saw, bow saw, teeth saw, compass saw, dip cut, coping saw, wall board saw, bow saw, hacksaw, chisel teeth saw, coarse cut carpenter saw), Striking Tools (Hammers, Hatches and Axes), Grasping Tools (Wrenches, Vise - grips, Pliers), Cutting Tools (Metal snips, wire cutters, bolt and cable cutters), Crimping Tools, Knives, Scissors and shears, Chisels and punches, Drill bits.
Tool Marks: Marks made by hand tools (Impression / compression marks, dent, saw marks, drill marks and holes, punctures, point to point blade cut marks, scratch and scour marks. Collection and documentation of tool marks. Restoration of erased marks

Unit 7: Automobiles, Appliances and their Failure:

Automobiles- Vehicles manufactured in India, Components of automobile, Chassis, body, chassis frame, general assemblies of chassis and their functions, Various identification numbers, Head lights, Tail lights and Indicators, Types of automobiles, Technical terms- wheel base, thread width, turning radius, ground clearance, variants. Safety standards for cars, Suspension system, Steering system, Brake system and testing of brakes, Tyre and rims, Two stroke and four stroke engines and their comparison. Appliances and Equipment Failure- Kitchen and House hold appliances like- stoves, Refrigerators, Washers / Driers, Coffee makers, Fans and Heaters, Television and VCRs. HVAC Systems like- Furnace humidifiers and Furnaces, Air conditioner, Fire places and water heaters, Pumps, generators and motors, Boilers, welding failure, swimming pool failure.

Practical's:

1. To perform the physical matching of glass.
2. To determine the sequence of strokes on glass.
3. To perform the physical matching of paint chips.
4. To perform the microscopic examination of different types of fibers.
5. To perform the microscopic examination of different types of soil.
6. To preserve 3-Dimensional print of Footwear by casting method.
7. To determine the speed of a vehicle by analysing vehicular skid marks.
8. To carry out the comparison of questioned and standard voice samples.
9. To carry out the comparison and identification of different types of tool marks.
10. To study the causes of appliances and equipment failure.

Suggested Readings

1. Criminalistics – An Introduction to Forensic Science by Richard Saferstein.
2. Fundamentals of Speech Recognition by Lawrence Rabiner and Biing- Hwang Juang.
3. The Physics of Speech by D. B. Fry
4. Applied Speech and Audio Processing by Ian Mcloughlin
5. Color Atlas of Forensic Toolmark Identification by Nicholas Petraco.
6. Basic of Automobile Engineering by C. P. Nakra.
7. Automobile Engineering Vol- I and II by K. M. Gupta.

8. Automotive Mechanics by Joseph Heitner.
9. Encyclopedia of Science and Technology, Vol-2 Tata Mc Graw-Hill.
10. Auto Design by R. B. Gupta.
11. Forensic Engineering Fundamentals by Harold Franck and Darren Frank.

FORENSIC TOXICOLOGY **Credits: 3+2+0**

Unit 1: Basics of Toxicology

Introduction to toxicology, different branches of toxicology, concepts of forensic toxicology. Scope and application forensic toxicology. Significance of toxicological findings. Techniques used in toxicology. Toxicological analysis and chemical intoxication tests. Post-mortem Toxicology. Human performance toxicology. Dose-response relationship. Lethal dose 50 and effective dose 50.

Unit 2: Collection & Preservation of Toxicological Evidences

Collection and preservation of viscera, blood and urine for various poison cases.

Unit 3: Plant Poison:

Classification, Fatal Dose, fatal Period, Sign & symptoms, Post-mortem Appearance, Medico legal Importance, Treatment & Analysis- Screening & Instrumental.

Unit 4: Animal Poison

Classification, Fatal Dose, fatal Period, Sign & symptoms, Post-mortem Appearance, Medico legal Importance, Treatment & Analysis- Screening & Instrumental.

Unit 5: Metallic Poisons

Classification, Fatal Dose, fatal Period, Sign & symptoms, Post-mortem Appearance, Medico legal Importance, Treatment & Analysis- Screening & Instrumental.

Unit 6: Acidic & Alkali poisons

Classification, Fatal Dose, fatal Period, Sign & symptoms, Post-mortem Appearance, Medico legal Importance, Treatment & Analysis- Screening & Instrumental.

Unit 7: Neutral Poisons

Classification, Fatal Dose, fatal Period, Sign & symptoms, Post-mortem Appearance, Medico legal Importance, Treatment & Analysis- Screening & Instrumental

Practical's:

1. Perform the colour test for the given acidic drug/poison.
2. Perform the TLC for the given acidic drug/poison.
3. Perform the UV-Visible analysis of drug/poison.
4. Perform the FT-IR analysis of drug/poison.

5. Perform the colour test for the given basic drug/poison.
6. Perform the TLC for the given basic drug/poison.
7. Perform the colour test for the given plant poison.
8. Perform the TLC for the given plant poison.
9. Identify the given metallic poison.
10. Analysis of the given neutral poison.

.

Suggested Readings

1. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
2. F.G. Hofmann, A Handbook on Drug and Alcohol Abuse, 2nd Edition, Oxford University Press, New York (1983).
3. S.B. Karch, The Pathology of Drug Abuse, CRC Press, Boca Raton (1996).

A. Poklis, Forensic toxicology in, Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).

4. A.W. Jones, Enforcement of drink-driving laws by use of per se legal alcohol limits: Blood and/or breath concentration as evidence of impairment, Alcohol, Drug and Driving, **4**, 99 (1988).
5. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).

FORENSIC MEDICINE **Credits: 3+1+1**

Unit 1: Introduction to Forensic Medicine

Fundamental aspects and scope of forensic medicine. Approaching the crime scene of death. Obtaining first-hand information from the caller. Rendering medical assistance to the victim, if alive. Protecting life. Recording dying declaration. Identifying witnesses and, if possible, suspect.

Unit 2: Autopsy

Definition, Types, Forensic Importance of autopsy, Death– Types, Cause of Death and Manner of death, Medico-legal aspects of death.

Unit 3: Exhumation

Definition, Importance, Protocols for Exhumation and Examination

Unit 4: Injuries

Types and classification of injuries. Ante mortem and post mortem injuries. Determination of Age of injuries. Artificial injuries.

Unit 5: Forensic Entomology:

Basics of Forensic Entomology, insects of forensic importance, Collection of entomological evidences during death investigations, determining time since death.

Unit 6: Forensic Anthropology

Introduction to forensic anthropology. Study of human skeleton. Identification of human bones. Determination of age, sex, stature from skeletal remains.

Unit 7: Forensic Odontology

Development, scope and role of forensic odontology in mass disaster. Types of teeth and their comparative anatomy. Estimation of age from teeth.
Bite marks- Collection, preservation and photography of bite marks evidence. Forensic Importance of bite marks.

Practical's:

1. To design a questionnaire for the first responder to the death scene.
2. To study the human skeletal system and bones of anthropological significance.
3. Determination of age from skull.
4. Determination of sex/gender from skull.
5. Determination of age from teeth.
6. Processing and analysis of bite marks.
7. Determination of sex/ gender from pelvis
8. Determination of stature from a given long bone.
9. To study the life cycle of flies of forensic importance.
10. To determine the type of weapon by studying the injury.

Suggested Readings

1. M.Y. Iscan and S.R. Loth, The scope of forensic anthropology in, Introduction to Forensic Sciences, 2nd Ed., W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
2. D. Ubelaker and H. Scammell, Bones, M. Evans & Co., New York (2000).
3. S.Rhine, Bone Voyage: A Journey in Forensic Anthropology, University of Mexico Press, Mexico (1998).
4. K. Smyth, the Cause of Death, Van Nostrand and Company, New York (1982).
5. M. Bernstein, Forensic odontology in, Introduction to Forensic Sciences, 2nd Ed., W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
6. J. Dix, Handbook for Death Scene Investigations, CRC Press, Boca Raton (1999).
7. H.B. Baldwin and C.P. May in, Encyclopedia in Forensic Science, Volume 1, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).
8. V.J. Geberth, Practical Homicide Investigation, CRC Press, Boca Raton (2006).
9. T. Bevel and R.M. Gardner, Bloodstain Pattern Analysis, 3rd Edition, CRC Press, Boca Raton (2008).
10. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).

DIGITAL & CYBER FORENSICS **Credit: 3+2+0**

Unit I: Computer Organization & Architecture

Introduction, Central Processing Unit, Internal Communications, Machine Cycle, The Bus, Instruction set, Random Access Memory, Read only Memory, Storage System, Magnetic Storage System, Magneto Optical System, Solid-state storage devices, Storage evaluation criteria.
Input Devices: Keyboard, pointing devices, scanning devices, Optical Recognition devices, Digital Camera, Voice Recognition System, Data Acquisition Sensor, Media Input Devices, Display Monitors, Printers, Impact Printers, Non-impact Printers, Plotters, Voice Output Systems, Projectors, Terminals.
Output Devices: Media Input Devices, Display Monitors, Printers, Impact Printers, Non-impact Printers, Plotters, Voice Output Systems, Projectors, Terminals.

Unit II: Computer Codes

Introduction, Decimal System, Binary System, Hexadecimal System, Octal System, 4-bit Binary Coded Decimal (BCD) Systems, 16-bit Unicode, Conversion of numbers.
Computer Arithmetic: Introduction, Binary Addition, Binary Multiplication, Binary Subtraction, Binary Division, Signed/Unsigned numbers, Complements of Binary Numbers, Binary Subtraction using compliments, Representing Numbers, Integer Arithmetic, Floating Point Arithmetic, Errors in Arithmetic, Laws of Arithmetic.

Unit III: Introduction to Cyber Forensics

Introduction, Information technology, The Cyberspace, Traditional Crimes Go Hi-Tech, Digital forms of Conventional Crimes, Digital Crime & Cybercrime, Computer Forensic.
The Internet Crimes
Modus operandi Used for Committing Internet Crimes, Different types of Internet Crimes, Cyber Laundering, Cyber Terrorism, Cyber Warfare, Prevention of Internet Crimes.
Computer Crimes:
Classification of Computer Crimes, Computer Virus, Different types of Viruses, Computer worm, Trojan Horse, Trap Door, Super Zapping, Logic-bomb, Salami Logic, Characteristics of Computer Crimes, Characteristics of Computer Criminals, Common Targets of Computer Criminals.

Unit IV: Basics of Networking

Basics of Networking-Types of topologies, LAN, MAN, WAN, SAN, CAN etc. Types of internet connections (Dialup, DSL, Cable, broadband, leased line, satellite, Wi-Fi, 3G-4G) ISP, IP grouping.
Network Security Measures: Basics Security Concepts, Safeguards Against the Computer Security Breaches, Secure Socket Layer Protocol.
Vulnerability of Computer Network: Objective of Network Security, Classification of Computer Attacks, Common tools of Computer Attacks, Technical Reasons for the Vulnerabilities, Vulnerability Assessment, Sources of Computer Attacks.

Unit V: Computer Networking

What is computer network, Communication Protocols, The Internet, Routers, Wireless Application Protocol. Internet Technology, Electronic Commerce, Electronic Payment Systems, The Electronic or Digital Cash Virtual Private Networks (VPN).
Digital Signatures:
Signatures in Paper-based Society, Transfer of Computer-based Documents, Authentication of Computer Based Documents, Digital Signatures.

Cryptography: Cryptography, Use of Hash Function, Digital Signature Generation, Certification of Public Keys, need for trusted Intermediary, Certification Authority, Issues in Asymmetric Cryptography, Steganography.

Unit VI: Computer Forensics

Computer Forensics, Cardinal Rules of Computer Forensics, Characteristics of Computer Forensics Scientist, Information Storage in a Computer, Existence of evidence in Different Formulas.
Digital Analysis of Digital Evidence: Analysis Procedures, Data Validation Using MD5 Hash, Requirements for Forensic Imaging Tools, Commercial Forensic Imaging software's, Forensic Examination of Storage Media, Status of Computer Forensics in India.
Cyber Forensic Tools and Utilities: Introduction, examining a Breadth of Products Cyber Forensic, Tools Good, Better, Best: What's the Right Incident Response, Tool for Your Organization, Tool Review Forensic Toolkit, Encase, Mobil edit, F-RAT, FTK, Cyber check suites, etc. Specifications for Forensic Tool Tested.

Unit VII: Investigation of Computer Crimes

The Characteristics Issues, the challenges, The Process of Investigation & Detection of Crime, Collection of Evidence from the Scene of Crime, Handling of Digital Evidence, Preserving the Digital Evidence, Examination of Digital evidence.
The Cyber Laws: Need to Regulate the Internet, Country Specific Cyber Laws, The Indian Information Technology Act-2000, Salient Features of IT Act 2000, Legal Recognition of Legal Records, Legal Recognition of Digital Signatures, and Measures to Adapt Electronic governance, Computer Virus, Inadequacies in the IT Act 2000.
National & International Coordination to handle Cyber Crimes:
Need for International Co-ordination, The Present Structure to handle Computer Crimes, The Proposed Global Approach to Handle Computer crimes.

Practical's:

1. To Study Computer Hardware Components,
2. To study Internal & External ports of Computer
3. To study the Input devices of Computer, to study the Output devices of Computer.
4. To Study working of Ethernet (LAN cables), to Study the types of cables.
5. To Study Understanding LAN-client/server, user creation, password protection.
6. To study the Computer Network Security, to study Use of Hash Function.
7. To Study the use of Steganography.
8. To Study the Vulnerability of Computer Network.
9. To Study the communication Protocols layer by using cmd.
10. To detect deletions, obliterations and modifications of files using encase software.
11. To identify the IP address of the sender of e-mails.
12. To identify Encrypted files, to identify Hidden files.

Suggested Reading:

1. Joakim Kavrestad, Basics of Digital Forensics: Theory, Methods, and Real-Life Applications, 1st Ed.2018Edition.

2. Joakim Kavrestad, Basics of Digital Forensics: Theory, Methods, and Real-Life Applications, 1st Ed.2018Edition.
3. A Practical Guide to Computer Forensics Investigation by Released December 2014 Publisher(s): Pearson IT Certification ISBN: 9780132756174

II. ELECTIVE COURSE (DISCIPLINE SPECIFIC)

CRIMINALISTICS **Credit: 3+1+0**

Unit I: Crime Scene

Definition, Types- Primary, Secondary & Tertiary. Crime scene safety: Golden rules, Types of hazards- Biological & Chemical. General precautions- Personal protective equipment. Processing of Crime Scene- Where, What & How to search. Searching Techniques

Unit II: Searching Methods

Strip/ Lane Method, Spiral, Wheel/Radial, Zone, Methods, etc.

Unit III: **Crime Scene Photography and Videography**

Introduction, History -cardinal rules, Basic principles– Macro & Micro Photography- Forensic photogrammetry Variations of Photography- Mid range, Close-up, Aerial and overall. Photography – EMR photographic techniques – SWGIT – Photo images as evidences – Documentation of Crime Scene Photography – Forensic Videography.

Unit IV: Sketching of Crime Scene

Rough Sketch & Fine Sketch- Rectangular Coordinate Method, Polar Method, Baseline Method, Triangulation Method etc. optical methods of mapping, 3D laser Scanning.

Unit V: **Physical Evidence**

Definition, Importance, Types – Biological, Chemical, Digital Evidence and their handling- Identification of Physical Evidence - Trace Evidence. Type of information to be elicited from various types of Physical Evidence. General precautions while collecting Physical Evidence– Evidence collection equipments, techniques. Chain of Custody of Physical Evidence.

Unit VI: Collection and Packaging

Packing Materials of Physical Evidence, Importance of Packing and Packing Materials. Sealing, Marking, and labelling of various physical evidence, Letter of Advice, Precautions while Transporting physical evidence. General precautions - Types of Preservatives for various Physical Evidence- Biological, Chemical and Digital Evidence, etc.

Unit VII: **Crime Scene Reconstruction**

Definition – Nature and Importance - Types of Crime Scene Reconstructions - Role of pattern analysis in reconstruction - Blood stain pattern, Glass fracture pattern, Fire burn or smoke patterns, Gait Pattern, Tyre impression patterns etc. Sequence of events – Recording, Documentation required for Crime Scene Reconstruction. etc.

Practical's:

1. To understand the basic concepts of processing a crime scene.
2. To analyse the crime scene using different search methods.
3. Photography and videography of the crime scene.
4. Handling, Lifting and Packing of physical evidence.
5. Sealing, Labelling and Preservation of different physical evidence.
6. To prepare rough and final sketch of the crime scene.
7. Collection and packaging of different evidences from the scene of crime.
8. Mapping techniques of crime scene- Baseline, Rectangular, Triangulation and Polar techniques.
9. To reconstruct a crime scene (outdoor and indoor).
10. To prepare a report on evaluation of crime scene.

Suggested Readings

1. M. Byrd, Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence, CRC Press, Boca Raton (2001).
2. T.J. Gardener and T.M. Anderson, Criminal Evidence, 4th Ed., Wadsworth, Belmont (2001).
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.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).
5. Criminalistics – An introduction to Forensic science 5th edition –Saferstein
6. Forensic Digital Photo Imaging – PatrickJones.

FORENSIC NANOTECHNOLGY **Credit: 3+1+0**

Module 1: Introduction of Nanotechnology

History of Nanoscience and nanotechnology, definition of nanoscience, nanomaterials, nanotechnology, Classification of nanomaterials, Properties of nanomaterials, Crystal symmetries, crystal directions, crystal planes, band structure. Recent advancements in the field of nanotechnology. Future of nanotechnology.

Module 2: **Synthesis Techniques of Nanomaterials**

Methods of preparation- Top-down approaches (Mechanical milling, Electrospinning, Lithography, Sputtering, The arc discharge method and Laser ablation) and Bottom-up approaches (Chemical vapor deposition (CVD), Solvothermal and hydrothermal methods, The sol–gel method, Soft and hard templating methods and Reverse micelle methods).

Module 3: Characterization Techniques

X-Ray diffraction and Scherrer method, scanning electron microscopy, transmission electron microscopy, scanning probe microscopy, atomic force microscopy, piezo-response microscopy, X-ray

photoelectron spectroscopy, XANES and XAFS, angle resolved photoemission spectroscopy, diffuse reflectance spectra, photoluminescence spectra, Raman spectroscopy.

Module 4: Nano technology in developing Latent Fingerprints

Introduction to latent fingerprints. Study of various traditional powders used for the development of latent fingerprint. Study of different types of nanomaterials used for the development of latent fingerprint.

Module 5: Nano technology in the Analysis of Drugs and Pesticides

Introduction to drugs and pesticides, Drugs and Pesticides crucial for forensic investigation, Nano Chips, Nano Sensors, Nano Probes for detection of drugs and pesticides. Different types of nanomaterials used for the detection of drugs and pesticides.

Module 6: Nano technology in the Analysis of explosives

Introduction to explosives, Explosives crucial for forensic investigation, Nano Chips, Nano Sensors, Nano Probes for detection of explosives. Different types of nanomaterials used for the detection of explosives.

Module 7: Other applications of nanotechnology

Industrial applications, agricultural applications, automobile applications, medicinal applications, pharmaceutical applications and other related applications.

Practical's:

1. Greener and chemical synthesis of various nanomaterials by top-down approaches.
2. Greener and chemical synthesis of various nanomaterials by bottom-up approaches.
3. Characterization of nanomaterials by SEM and TEM with EDS.
4. Characterization of nanomaterials by XRD and XRF.
5. Characterization of nanomaterials by UV-visible spectroscopy.
6. Characterization of nanomaterials by TG, DTA and DSC.
7. Dielectric and magnetic study of nanomaterials by using LCR meter and VSM respectively.
8. To develop the latent fingerprint by using nanomaterials.
9. To identify the drug and pesticide by using nanomaterials.
10. To identify the explosives by using nanomaterials.

Suggested Readings

1. Nano science and nano technology by M.S Ramachandra Rao, Shubra Singh, Wiley publishers.

2. Introduction to Nano Technology by Charles P. Poole, Jr., Frank J.Owens, Wiley publishers.
3. Introduction of Forensic Nanotechnology as Future Armour (Nanothechnology Science and Technology), Ritesh Kumar Shukla, Nova Science Publishers Inc., ISBN-10 : 1536160407.
4. Nanotechnology by Jermy J Ramsden, Elsevier publishers
5. Nano Materials- A.K.Bandyopadhyay/ New Age Introdu.
6. Nano Essentials- T.Pradeep/TMH.
7. Nanotechnology the Science of Small by M.A Shah, K.A Shah, Wiley Publishers.
8. Principles of Nanotechnology by Phani Kumar, Scitech.

FORENSIC ACCOUNTING AND FRAUD EXAMINATION **Credit: 3+0+1**

Unit 1: Introduction to Account

Basic concept on account: accounting process, recording of transactions, financial statements etc.,

Unit 2: Introduction to Fraud

Introduction to Fraud, brief history of fraud, types of fraud: employee fraud and financial statement fraud.

Unit 3: Introduction to Forensic Accounting

Forensic accounting, application of forensic accounting, Importance of Forensic Accounting, Role of Forensic Accountant.

Unit 4: Fraud Investigation

Sources of information, Investigation of Frauds - bank and financial institutions fraud, insurance fraud, cheque and credit card fraud, payroll fraud.

Unit 5: Forensic Auditing

Introduction to forensic auditing, types of auditing, importance of auditing.

Unit 6: Tools and Techniques

Tools and Techniques required for investigation of fraud cases.

Unit 7: Case studies

Famous Case studies

Suggested Readings

1. Stephen Pedneault, Forensic Accounting and Fraud Investigation for Non-Experts.
2. Sandeep Baldava, Forensic Investigations and Fraud Reporting in India: Practical insights to Predict, Prevent, Detect and Investigate Frauds.
3. Daniel Calivinson-ashley, Forensic Accounting and Fraud Investigation: A Guide to the Profession.

4. Mary-Jo Kranacher, Forensic Accounting and Fraud Examination.
5. Tommie W. Singleton, Fraud Auditing and Forensic Accounting (Wiley Corporate F&A).

MOBILE FORENSICS **Credit: 3+1+0**

Unit 1: Introduction and Basics of Cell Phone Forensics:

A brief history of the development of mobile phone technology; The history of mobile phone forensics; The mobile phone forensics process; PDA Forensics; Digital Evidence Handling for Cell Phones and SIM Cards; SIM Card Cloning; Call History Recovery; Deleted SMS Recovery; Evidence in Mobile Phone Systems; Mobile Storage Media; Forensic analysis of mobile phone internal memory; Digital Camera Forensics; Advanced Cell (Mobile) Phone Forensics; Mobile phone forensics case studies; Tools used in Mobile and SIM Card Forensics.

Unit 2: Introduction and Basics of Smartphones Forensics:

Smartphones: Specialty of smartphone forensic procedures, Different classes of data acquisition process (and tools) and the tradeoff, Additional forensic artifacts, such as contact list, call logs, SMS messages, Platform specific issues and forensic methodologies: Android vs. iOS; Use of forensic tools, for example: Flasher Box.

Unit 3: Mobile Issues and Development Strategies:

Physical Security, Strong authentication with poor keyboards, Safe browsing environment, Secure Operating Systems, Application Isolation, Virus, Worms, Trojans, Spyware and malware, Insecure Device drivers.

Unit 4: Android Security:

Developing and debugging on android–Androids Securable IPC mechanisms–Androids Security Model–Android Permissions Review–Content Providers–Mass storage - Android Security tools.

Unit 5: iOS Security:

iOS security overview-pairing, back up, configuration, introducing app security, blocking access, key bags & keychains, Sandboxing, Encrypting Devices, Organizational controls. Mobile device Management.

Unit 6: Vulnerabilities, Threats of Mobile Devices and Countermeasures-

Understanding Attack vectors, Overview of various Mobile Malwares, Network Attacks, Mobile malware defenses: Advantages and disadvantages, protect against Mobile Malware, protect against identity theft, protect against Mobile DoS (Denial of Service Attacks), Protect against Bluetooth attacks.

Unit 7: Legal Issues and Courtroom Skills

Mobile Security Penetration Testing tools, Mobile platform attack tools and utilities – browser extensions– networking tools – Web application tools. Mobile malware – Important post malware – Threat Scenarios – mitigating mobile malware – For developers and platform vendors.

Practical's:

1. Digital Evidence Handling for Cell Phones.
2. Digital Evidence Handling for SIM Cards
3. SIM Card Cloning
4. Call History Recovery
5. Deleted SMS Recovery
6. Evidence in Mobile Phone Systems
7. Mobile Storage Media
8. Forensic analysis of mobile phone internal memory
9. Vulnerabilities, Threats of Mobile Devices.
10. Advanced Cell (Android & IOS Mobile) Phone Forensics.
11. Mobile phone forensics case studies.
12. Mobile Security Penetration Testing and SIM Card Forensics using Tools.

Suggested Readings

1. Mobile Application Security by Himanshu Dwivedi,1st Edition, McGraw-Hill Education, February 5,2010.
2. Wireless and Mobile Device Security by Jim Doherty, 1st Edition, Jones and Barlett Publication, 2014.
3. Learning iOS security, Allister Banks, Charles S Edge, packet Open source.
4. Mobile Security: How to Secure, Privatize, and Recover your devices by Timothy Speed, Darla Nykamp, Mary Heiser, Joseph Anderson, Jaya Nampalli, reprint edition, Packt Publication, 2013.
5. Mobile Device Security: A comprehensive guide to securing your Information in a Moving World by Stephen Fried, illustrated edition, Taylor & Francis Publication, 2010.

MULTIMEDIA FORNSICS **Credit: 3+1+0**

Unit 1: Introduction to Multimedia:

Multimedia Hardware & Software, Multimedia operating systems & communication systems.

Unit 2: Introduction to Digital and Multimedia Forensics:

Introduction to multimedia forensics, need of multimedia forensics, challenges faced by multimedia forensic experts, tools used by multimedia forensic scientist, development in the field of multimedia

forensics.

Unit 3: Basics concepts of photography, speech acoustics and videography:

Basics of Image, types of images, digital image representation, phases of image processing, audio format, common video format, forensic videography.

Unit 4: Audio fundamentals and representations:

Digitization of sound, frequency and bandwidth, decibel system, data rate, audio file format, Sound synthesis, MIDI, wavetable, Compression and transmission of audio on Internet, Adding sound to your multimedia project, Audio software and hardware.

Unit 5: Image fundamentals and representations:

Colour Science, Colour, Colour Models, Colour palettes, Dithering, 2D Graphics, Image Compression and File Formats: GIF, JPEG, JPEG 2000, PNG, TIFF, EXIF, PS, PDF, Basic Image Processing [Can Use Photoshop], Use of image editing software, White balance correction, Dynamic range correction, Gamma correction, Photo Retouching.

Unit 6: Video and Animation

Video Basics, How Video Works, Broadcast Video Standards, Analog video, Digital video, Video Recording and Tape formats, Shooting and Editing Video (Use Adobe Premier for editing), Video Compression and File Formats. Video compression based on motion compensation, MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21.

Unit 7: Animation:

Animation: Cell Animation, Computer Animation, Morphing.

Practical's:

1. To study Multimedia Hardware system
2. To study the Multimedia basic software tools
3. Capture Audio from a Microphone (PC)
4. To cut clips from any VCD
5. To crop a picture using Crop tool
6. HOT SPOT REMOVAL using Clone Stamp Tool.
7. To study the working of Macromedia Flash MX
8. To study the basic features of Windows XP movie Maker

Suggested Readings

1. Tay Vaughan, Multimedia: Making it Work (with CD), 9th Edition, McGraw Hill Education
2. Multimedia: An Introduction, Villamil & Molina, PHI.
3. Sound & Video, Lozano. Multimedia, PHI
4. Ranjan Parekh, Principles of Multimedia, 2nd Edition, McGraw Hill Education, 2013
5. Multimedia on the Pc, Sinclair, BPB

QUALITY CONTROL & QUALITY ASSURANCE Credit: 3+0+1

Unit 1: Introduction to Quality Control & Quality Assurance

Introduction, Scope, Need and General Requirements for Standardization of Forensic Science Laboratory.

Unit 2: Quality Management

Testing and Calibration Procedures, Total Quality Assurance, Quality Control, Quality Planning.

Unit 3: Laboratory Management Procedure

Lab Information Management System, Validation of Equipment and Safety Protocols.

Unit 4: Quality Audit

Definition, Types of Audit - Internal Audit and External Audit, Need of Audit, Importance of Audit and Forensic Significance.

Unit 5: Accreditation & Certificate

NABL - Introduction & Relevant Provisions

Unit 6: Accreditation & Certificate

ISO - Introduction & Relevant Provisions

Unit 7: Accreditation & Certificate

IEC & BIS - Introduction & Relevant Provisions

Suggested Readings

1. Sean Doyle, Quality Management in Forensic Science.

FORENSIC PHOTOGRAPHY Credit: 3+1+0

Unit 1: History of forensic photography

History of photography in criminal investigations, Forensic working groups on photography and Infamous cases.

Unit 2: Basics of light and optics

Light Temperature, Sources of light, Light intensity, Light angles and Optics.

Unit 3: Camera Peripherals & functions

Camera body, Lenses & lens care, Filters, Hot shoe, Camera/equipment handling and Media storage.

Unit 4 Crime Scene Photography

Aerial Photography, Overall photography, Mid-Range Photography and Close-up Photography.

Unit 5 Evidence Photography

Physical Evidence Photography, Biological Evidence Photography, Chemical & Toxicological Evidence Photography, Fingerprint Evidence Photography, Document Evidence Photography, Digital Evidence Photography and Corpse Photography.

Unit 6 Special Photography

UV Photography, Fluorescent Photography, IR Photography, Underwater Photography and Surveillance Photography.

Unit 7 Court Presentation

Report Writing and Expert Testimony.

Practical's:

1. To perform crime scene photography by Overall Photography method.
2. To perform crime scene photography by Mid-Range Photography method.
3. To perform crime scene photography by Close-up Photography method.
4. To perform evidence photography by Close-up method.
5. To perform crime scene photography by Special Photography method.

Suggested Readings

1. Nick Marsh, Forensic Photography: A Practitioner's Guide.
2. Keith Mancini, Fundamentals of Forensic Photography: Practical Techniques for Evidence Documentation on Location and in the Laboratory (Applications in Scientific Photography).
3. David R. Redsicker, The Practical Methodology of Forensic Photography (Practical Aspects of Criminal and Forensic Investigations).
4. Edward M. Robinson, Crime Scene Photography.
5. Sanford Weiss, Handbook of Forensic Photography.

BIOMETRY **Credit 3+0+1**

Unit 1: Fundamental Aspects of Biometry

Definition, Biometric vs traditional techniques. Classification of biometric systems – physiological and Behavioural. Merits and demerits of physiological and Behavioural biometrics. Multimodal biometrics.

Unit 2: Key Biometric Process

Key biometric processes – enrolment, identification and verification. Positive and negative identification. Performance measures used in biometric systems – FAR, FRR, GAR, FTA, FTE and ATV.

Unit 3: Physiological Biometrics 1

Fingerprints, palm prints, geometry of hand; components, working principles, strength and weakness.

Unit 4: Physiological Biometrics 2

Iris, Retina and Face geometry; components, working principles, strength and weakness

Unit 5: Behavioural Biometrics 1

Handwriting, signatures, keystrokes, gait and voice; components, working principles, strength and weakness.

Unit 6: Behavioural Biometrics 2

Gait, voice; components, working principles, strength and weakness

Unit 7: Standards in Biometrics

Assessing the privacy risks of biometric, need for standards, different biometric standards.

Suggested Readings

1. Massimo Tistarelli, Handbook of Biometrics for Forensic Science.
2. Archana Singh, Biometrics & It's Uses: 3 (Forensic Science).
3. Monique Mann and Gregor Urbas Marcus Smith, Biometrics, Crime and Security.
4. S. Nanavati, M. Thieme and R. Nanavati, Biometrics, Wiley India Pvt. Ltd. (2002).
5. P. Reid, Biometrics for Network Security, New Delhi (2004).
6. J.R. Vacca, Biometric Technologies and Verification Systems, Butterworth-Heinemann, Oxford (2007).

WILDLIFE FORENSICS **Credit 3+1+0**

Unit 1: Fundamentals in Ecology

Basic concepts and structure of ecosystems: abiotic and biotic components; climatic and edaphic regimes; nutrients and minerals; producers, consumers and decomposers. Communities, populations, groups and individuals. Functioning of ecosystem: energy flow and nutrient cycles, Systems approach to ecological functioning. History of evolutionary thought; natural selection and speciation; evolutionarily significant units. Species concepts; biological, phylogenetic, evolutionary and ecological species concepts. Macroevolution, coevolution and mutualism.

Unit 2: Forestry and Natural Resource Conservation

Philosophies of science, conservation and sustainable development. Concept of conservation with special reference to forest and wildlife management, conservation verses preservation. Introduction to forestry, principles of forest management, forest and wildlife as natural resources. Conservation movement in India, socio-economic and political realities, 2 different phases of the conservation and how it has impacted people at large. Concept of stakeholders. International conservation bodies; IUCN UNDP, FAO, WWF.

Unit 3: Mammalogy, Ornithology and Ichthyology

History of mammalogy. Evolution of mammals and morphology. Adaptations in mammals; hibernation, torpor, aestivation, locomotion and water regulation. Body size variation in mammals and its influence

on life history, metabolic rate, weight constraints, feeding behaviour, niche width and reproduction. Avian systematics and classification of Indian birds. Biogeographic patterns in Indian avifauna and their affinities. Emphasis on montane avifauna; Himalayas, Western & Eastern Ghats; Island avifauna, waterfowl, desert avifauna; birds of cultivation and degraded habitats. Classification and evolution of major groups of fishes in India. Ichthyogeography and diversity of freshwater fishes of India.

Unit 4: Conservation Biology

Introduction to conservation biology, values of biodiversity and conservation ethics, Patterns and process of biodiversity, losses and threats to biodiversity. Biological consequences of habitat fragmentation, covering barriers and isolation, crowding effect, local and regional extinctions, edge effects, changes in species composition and problem of climate change. Population genetics and conservation; community and ecosystem level conservation.

Unit 5: Conservation Genetics and Wildlife Forensics

Introduction to Mendelian Genetics- Mendal's Laws; Genetic Code- Characteristics and feature of genetic code; DNA Sequencing, Genotyping; Allelic variation; Interpretation of genetic data; Application of genetics for wildlife conservation; Loss of genetic diversity, Resolving taxonomic uncertainties; Wildlife Forensics- Overview, various forensic protocols for species identification, Molecular markers used in wildlife forensics; Wildlife forensics based on DNA analysis and morphometry; Wildlife crime case studies.

Unit 6: Conservation Breeding and Wildlife Utilisation

Captive breeding and Propagation: Founder population, rehabilitation, education, utilization, gene banks, Ex-situ and in-situ linkages, conservation breeding Management Plans, Role of scientific institution and NGOs in Conservation Breeding Programme. Principles: Understanding biological requirements of species; design of facilities, food, hygiene, disease control, breeding. Propagation of threatened plants. Case studies on Conservation Breeding Programme of endangered wild animals.

Unit 7: Animal Physiology and Nutritional Ecology

Feeding ecology of herbivores, carnivores, insectivores and omnivores – food selection, quantity, quality (nutritional value), seasonal variations, relations to food to animal condition. Predator-prey interactions. Eco-physiology with special reference to adaptations to water and temperature. Importance of minerals to animal health, growth and reproduction.

Practical's:

1. Collection and Storage of Animal samples (Blood, Scat, Tissue)
2. Isolation of genomic DNA from Animal blood samples
3. Isolation of Mitochondrial DNA from Animal samples
4. Construction of Phylogeny towards evolutionary relationship between species
5. Analysis of protein structure using RASMOL
6. Sequencing comparison using BLAST
7. Extraction of Protein from various biological samples

Suggested Readings

1. Jane E. Huffman, Wildlife Forensics: Methods and Applications.

2. John E. Cooper, Wildlife Forensic Investigation: Principles and Practice.
3. Jan Bundschuh, Wildlife Forensic Investigation, Principles and Practice.
4. Laurel A. Neme Ph.D., Animal Investigators: How the World's First Wildlife Forensics Lab is Solving Crimes and Saving Endangered Species.

III. ABILITY ENHANCEMENT COURSE

A. Ability Enhancement Compulsory Course: One each in semester I and II

CUTM1673 ENGLISH **Credits: 2**

Objective:

- To expose the students to a variety of self-instructional, learner-friendly modes of language learning.
- To enable them to learn better pronunciation through stress on word accent, intonation, and rhythm.
- To maintain good linguistic -through accuracy in grammar, pronunciation and vocabulary.

Learning Outcome:

Upon successful completion of this course, the student will be able to:

- Ability to communicate fluently in different business situation
- Effective oral and written communication
- Appropriate word usage with correct pronunciation
- Clarity of word stress and intonation.

Course Outline

Unit-I: Communication Skill **Credits: 2**

Communication: Definition, concept
Channels of Communication: Sender, receiver, channel, message, encoding, decoding, context, feedback
Verbal & Non-Verbal Communication: Spoken & written-advantages & disadvantages, Bias free English,
Formal & informal style.

Unit-II: Communicative Grammar

Time, Tense & Aspect
Verbs of state & events
Modality Active & Passive voice Antonyms, Synonyms, Homonyms, one word substitutions & correction of errors

Unit-III: Sounds of English

Length of vowels:
Long vowels as in the words feel, food, shoot, card etc.
Short vowels as in the words pen, sun, cut, shut, etc.
Consonants
Stress pattern
Intonation: Rising & Falling.

Text Book:

1. Effective technical communication by M.A.Rizvi

Reference Books:
1. Communicative English & Business Communication by R.K.Panda, J.Khuntia, M.Pati, Alok Publication.
2. Communicative Grammar of English Geoffery Leech

CUTM1010 ENVIRONMENTAL SCIENCE **Credits: 2**

Objective:

- To understand the concept of multi-disciplinary nature of Environmental Science where different aspects are dealt with a holistic approach.
- Students will develop a sense of community responsibility by becoming aware of environmental issues in the larger social context.
- One must be environmentally educated.

Learning Outcome:

Upon successful completion of this course, students will be able to:

- Understand the natural environment and its relationships with human activities.
- Characterize and analyze human impacts on the environment.
- Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems.
- Design and evaluate strategies, technologies and methods for sustainable management of environmental systems and for the remediation or restoration of degraded environments.

Course Outline

Unit 1

Environment and its multidisciplinary nature of environmental science; Need for public awareness

Unit 2

Renewable and non -renewable resources–forest, water, mineral, land, food and energy resources; Structure and function of ecosystems of forest, grass land, desert and aquatic types.

Unit 3

Biodiversity and its conservation: Biodiversity at global, national and local levels; Threats to biodiversity - Habitat loss; wild life poaching and man - wildlife conflicts

Unit 4

IUCN: Rear, Endangered and endemic species; conservation measures. Causes, effects and control measures of pollution, air, water and noise pollution; Nuclear hazards

Unit 5

Solid-waste management–Causes, effects and control measures; Management of disasters due to natural causes of floods, earthquakes, cyclones and landslides.

Unit 6

Social issues and the environment; Sustainable environment, Water conservation measures; Rain water harvesting; Resettlement and rehabilitation of people; Climate change and global warming; Acid rain; Ozone layer depletion; water land reclamation; Consumerism and waste products

Unit 7

Features of Environment Protection Act, Air pollution and Control of Pollution Acts; Water Pollution and its Control Act. Effects of Pollution explosion on environment and public health; Need for value education to Protect environment and resources.

Suggested Readings

1. Anubhav Kaushik & C.P. Kaushik: Environmental Studies-New Age International Publishers.
2. Benny Joseph: Environmental Studies-Tata Mac Graw Hill
3. E. Bharucha: Text book of Environmental Studies for under graduate courses– Universities Press. (Book prepared by UGC Committee).

B. Skill Enhancement Course

Life Skill Development **Credit 0**

CUEA 4046 Human Values and Professional Ethics **Credit 0**

Course Objectives

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they ‘really want to be’ in their life and profession
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life

Course Outcomes

On completion of this course, the students will be able to

1. Understand the significance of value inputs in a classroom and start applying them in their life and profession
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.

3. Understand the value of harmonious relationship based on trust and respect in their life and profession
4. Understand the role of a human being in ensuring harmony in society and nature.
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

Unit 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Understanding the need, basic guidelines, content and process for Value Education
Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration
Continuous Happiness and Prosperity- A look at basic Human Aspirations
Right understanding, Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority
Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
Method to fulfil the above human aspirations: understanding and living in harmony at various levels

Unit 2: Understanding Harmony in the Human Being - Harmony in Myself

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha
Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
Understanding the characteristics and activities of 'I' and harmony in 'I'
Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail
Programs to ensure Sanyam and Swasthya

Unit 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Understanding harmony in the Family- the basic unit of human interaction
Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*; Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship
Understanding the meaning of *Vishwas*; Difference between intention and competence
Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship
Understanding the harmony in the society (society being an extension of family): *Samadhan*, *Samridhi*, *Abhay*, *Sah-astitva* as comprehensive Human Goals
Visualizing a universal harmonious order in society- Undivided Society (*AkhandSamaj*), Universal Order (*SarvabhaumVyawastha*)- from family to world family!

Unit 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

Understanding the harmony in the Nature
Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space
Holistic perception of harmony at all levels of existence

Unit 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values
Definitiveness of Ethical Human Conduct
Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
Competence in Professional Ethics:
a) Ability to utilize the professional competence for augmenting universal human order,
b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models
Case studies of typical holistic technologies, management models and production systems
Strategy for transition from the present state to Universal Human Order:
a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
b) At the level of society: as mutually enriching institutions and organizations

Unit 6: Case Study

Ethical Lives- Mahatma Gandhi, Nelson Mandela, Swami Vivekananda, Mother Teresa, Dr. APJ Abdul Kalam.

Unit 7: Mind, Body and Soul

Positive Spirit, Body, Mind and Soul, Attachment and Detachment, Spiritual Quotient.

Suggested Readings

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
3. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
4. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
6. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
7. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
8. A N Tripathy, 2003, Human Values, New Age International Publishers.
9. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
10. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
11. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
12. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
13. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.