File Ref.No.86241/GA - IV - J1/2016/Admn

UNIVERSITY OF CALICUT

Abstract

M.Sc Forensic Science Programme -University Teaching Department-under Choice based Credit Semester System (PG)- Syllabus-approved -implemented with effect from 2018 admissions -Approved- Orders issued

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G & A - IV - J

U.O.No. 741/2018/Admn Dated, Calicut University.P.O, 16.01.2018

Read:-1. U.O.No.GA IV/J1/1373/08 dated 01.07.2008.
2. Minutes of the meeting of Board of Studies in Forensic Science held on 29.07.2017 item No.2.
3. Minutes of the Faculty of Science held on 15.12.2017 item. No.1.
4. Minutes of the meeting of the LXXVII meeting of the Academic Council held on 23.12.2017 item No.II.D.1.
5. Orders of the Vice Chancellor in the file of 191466/GA IV/J1/2016/Admn dated 06.01.2018.

ORDER

Vide paper read first above, Choice based Credit Semester System in the teaching Departments/Schools of the University was implemented from the academic year 2008-09 onwards.

Vide paper read second above, the Board of Studies in Forensic Science has resolved to approve the syllabus for M.Sc Forensic Science.

Vide paper read third above, the meeting of Faculty of Science has resolved to approve the minutes of the meeting of the Board of Studies in Forensic Science and resolved to implement the syllabus for M.Sc Forensic Science w.e.f 2018 admission onwards.

Vide paper read fourth above, the Academic Council approved the minutes of Faculty of Science.

Vide paper read fifth above,the Vice Chancellor has accorded sanction to implement the resolution of the Academic Council.

Sanction has, therefore, been accorded for implementing the revised Syllabus of M.Sc Programme in Forensic Science under Choice based Credit Semester System regulations in the teaching Departments/Schools of the University w.e.f 2018 Admissions.

Orders are issued accordingly.

(The syllabus appended)

Ajitha P.P

Joint Registrar

To

The Controller of Examinations/ EX Branch/EGI/P.G branch/Digital wing.

Forwarded / By Order

Section Officer

UNIVERSITY OF CALICUT

CURRICULUM AND SYLLABUS

For

M.Sc. FORENSIC SCIENCE
(Choice based Credit Semester System- CCSS)

(w.e.f. 2018 Admission)

Details of the members of Board of Studies in Forensic Science (Single Board), University of Calicut

U.O.No.1507/2016/Admn dated, Calicut University P.O, 11.02.2016

Sl. No.	Name & Designation	Contact details
1.	Dr. K Prasannan	Prasadam,

	Professor & Head, Department of Forensic Medicine, Government Medical College, Calicut. **(Chairman)**	Chevayur P.O, Kozhikode-673017. Mob.:- 9961988889 E-mail:- ranjiprasannan@gmail.com
2.	Smt. Annamma John Former Assistant Director, Forensic Biology Division, Regional Forensic Science Laboratory, Thrissur	Alummootil House, Nellikkadu, Ramavarmapuram P.O, Thrissur- 680631. Mob.:- 9446092318 E-mail:- annammajohnfs@gmail.com
3.	Dr. James Vadackumchery Former Criminologist, Kerala Police	VRA III, Ashramam Road, Mannamoola, Perurkada, Thiruvananthapuram- 5. Mob.:- 9447724369 E-mail:- jvadackumchery@yahoo.com
4.	Prof. (Dr.) G. B Aravind Head of the Department of Criminology & Forensic Science, S.B.R.R Mahajan First Grade College, Mysore- 570012.	Head of the Department of Criminology & Forensic Science, S.B.R.R Mahajan First Grade College, Mysore- 570012. Mob.:- 9886089317 E- mail:-criminology-hod@mahajanafgc.com
5.	Dr. Shirley Vasu Principal, Government Medical College, Thrissur.	Principal, Government Medical College, Thrissur. Mob.:- 9349112937 E-mail:- drshirleyvasu@gmail.com
6.	Dr. P.B Gujaral District Police Surgeon, District Hospital, Palakkad- 678001.	District Police Surgeon, District Hospital, Palakkad- 678001. Mob.:- 8089552728 E-mail:- drpbgujaral@gmail.com
7.	Shri. K Mohanan Former Joint Director, Forensic Physics Division, Forensic Science Laboaratory, Thiruvananthapuram.	TC 14/560, G 8, Silent Nagar, Pothujanam Road, Kumarapuram, Medical College P.O, Thiruvananthapuram-11. Mob.:- 9446102295 E-mail:- liaisonbookhouse@gmail.com
8.	Dr. S. P Shaji Prabha Junior Scientific Officer, Chemical Examiner's Laboratory, Department of Home, Thiruvananthapuram- 695035.	Junior Scientific Officer, Chemical Examiner's Laboratory, Department of Home, Thiruvananthapuram- 695035. Mob.:- 9496252162 E-mail:- shajiprabhaa@yahoo.com
9.	Dr. Jayesh K Joseph Criminologist, Kerala Police Academy.	Criminologist, Kerala Police Academy, Ramavarmapuram- 680631. Thrissur. Mob.:- 9493352042 E-mail:- criminologistkepa@gmail.com
10.	Shri. Ranjith N.K Junior Scientific Officer, Regional Chemical Examiner's Laboratory, Department of Home, Calicut Medical College, Calicut- 673008.	Junior Scientific Officer, Regional Chemical Examiner's Laboratory, Department of Home, Calicut Medical College, Calicut- 673008. Mob.:- 9447300506 E-mail:- nkrjith@gmail.com

Forward:

1. The syllabus and curriculum of M. Sc. Forensic Science course under the Choice based Credit semester System (CCSS) going to be offered by the proposed Department of Forensic Science, University of Calicut with effect from 2018 admissions.

2. The two-year Post Graduate Programme will be in the semester pattern. There will be four semesters in the entire course, with two semesters in each year. Each semester will have 90 instructional days with a minimum of 6 hours of instructions each day under the five-day system. End-semester examinations will be held within the 90 regular instructional days. The papers in the first two semesters will constitute the Core Courses only, in the third semester both Core and Elective Courses and in the fourth semester only Elective Courses are included. The following five broad areas of elective subjects offered in this proposed Department for the time being:-

    1. Questioned Documents and Forensic Dermatoglyphics
    2. Forensic Physics and Ballistics
    3. Forensic Chemistry and Toxicology
    4. Forensic Biology, Serology and DNA Profiling
    5. Cyber Security and Cyber Forensic

3. Evaluation of all semester theory/ practical papers will be done in two parts namely by continuous internal evaluation and external evaluation.

4. This syllabus and curriculum of M. Sc. Forensic Science course shall follow the Calicut University Regulations for the Choice Based Credit Semester System (CUCCSS) (PG) for the teaching departments/ schools of the University of Calicut vide Calicut University Order No. GA1/ J1/ 1373/ 08 dated 01/07/2008.

M.Sc. FORENSIC SCIENCE (2018 admission onwards)

SUMMARY OF COURSE

Semester	Course	Course	No. of	Credits/	Marks/	Total	Total

	Type	Mode	Course	course	course	Credits	Marks
FIRST	Core	Theory	4	4	100	16	600
	Core	Practical	2	2	100	4	
SECOND	Core	Theory	4	4	100	16	600
	Core	Practical	2	2	100	4	
THIRD	Core	Theory	2	4	100	8	600
	Core	Practical	1	2	100	2	
	Elect.	Theory	2	4	100	8	
	Elect.	Practical	1	2	100	2	
FOURTH	Core	Project	1	8	200	8	600
	Elect.	Theory	2	4	100	8	
	Elect.	Practical	2	2	100	4	
Grand Total						**80**	**2400**

Total credits: Core course : Theory - 40; Practical - 10; Total - 50
Elective course : Theory - 16; Practical - 06; Total - 22
Project : 08
Grand total : 80

SEMESTER-WISE DETAILS

FIRST SEMESTER

Code No. & Course	Teaching Hours	Credits	Ext. Marks	Int. Marks	Total Marks
FSC1C01 – FUNDAMENTALS OF FORENSIC SCIENCE & CRIMINAL LAWS	80 Hrs	4	80	20	100

FSC1C02 – CRIME & CRIMINAL JUSTICE SYSTEM	80 Hrs	4	80	20	100
FSC1C03 – FORENSIC & CORRECTIONAL PSYCHOLOGY	80 Hrs	4	80	20	100
FSC1C04 – LABORATORY QUALITY MANAGEMENT, RESEARCH METHODOLOGY & STATISTICS	80 Hrs	4	80	20	100
FSC1C05 – PRACTICAL ON FSC1C01 & FSC1C02	40 PS	2	80	20	100
FSC1C06 – PRACTICAL ON FSC1C03 & FSC1C04	40 PS	2	80	20	100
Total for First Semester		**20**	**480**	**120**	**600**

C - Core course, PS – Practical Session

SECOND SEMESTER

Code No. & Course	Teaching Hours	Credits	Ext. Marks	Int. Marks	Total Marks
FSC2C07 – PHYSICAL EVIDENCE & INSTRUMENTAL TECHNIQUES-PHYSICAL	80 Hrs	4	80	20	100
FSC2C08 – DIGITAL & CYBER EVIDENCE	80 Hrs	4	80	20	100
FSC2C09 – CHEMICAL EVIDENCE & INSTRUMENTAL TECHNIQUES-CHEMICAL	80 Hrs	4	80	20	100
FSC2C10 – BIOLOGICAL EVIDENCE & INSTRUMENTAL TECHNIQUES-BIOLOGICAL	80 Hrs	4	80	20	100
FSC2C11 – PRACTICAL ON FSC2C07 & FSC2C08	40 PS	2	80	20	100
FSC2C12 – PRACTICAL ON FSC2C09 & FSC2C10	40 PS	2	80	20	100
Total for Second Semester		**20**	**480**	**120**	**600**

C - Core course, PS – Practical Session

THIRD SEMESTER

Code No. & Course	Teaching Hours	Credits	Ext. Marks	Int. Marks	Total Marks
FSC3C13 – FORENSIC PHOTOGRAPHY	80 Hrs	4	80	20	100
FSC3C14 – CRIME SCENE MANAGEMENT	80 Hrs	4	80	20	100

& RECONSTRUCTION					
FSC3E15 – QUESTIONED DOCUMENTS#	80 Hrs	4	80	20	100
FSC3E16 – FORENSIC DERMATOGLYPHICS#	80 Hrs	4	80	20	100
FSC3E17 – FORENSIC PHYSICS#	80 Hrs	4	80	20	100
FSC3E18 – FORENSIC BALLISTICS#	80 Hrs	4	80	20	100
FSC3E19 – FORENSIC CHEMISTRY#	80 Hrs	4	80	20	100
FSC3E20 – FORENSIC MEDICINE & TOXICOLOGY#	80 Hrs	4	80	20	100
FSC3E21 – FORENSIC BIOLOGY#	80 Hrs	4	80	20	100
FSC3E22 – FORENSIC SEROLOGY & DNA PROFILING#	80 Hrs	4	80	20	100
FSC3E23 – COMPUTER & SMART PHONE FORENSIC#	80 Hrs	4	80	20	100
FSC3E24 – CYBER FORENSICS & CYBER SECURITY#	80 Hrs	4	80	20	100
FSC3C25 – PRACTICAL ON FSC3C13 & FSC3C14	40 PS	2	80	20	100
FSC3E26 – PRACTICAL ON FSC3E15 & FSC3E16#	40 PS	2	80	20	100
FSC3E27 – PRACTICAL ON FSC3E17 & FSC3E18#	40 PS	2	80	20	100
FSC3E28 – PRACTICAL ON FSC3E19 & FSC3E20#	40 PS	2	80	20	100
FSC3E29 – PRACTICAL ON FSC3E21 & FSC3E22#	40 PS	2	80	20	100
FSC3E30 – PRACTICAL ON FSC3E23 & FSC3E24#	40 PS	2	80	20	100
Total for Third Semester		**20**	**480**	**120**	**600**

C - Core course; E - Elective course; PS – Practical Session

Elective Courses (Two Theory course in any of the following combinations FSC3E15 & FSC3E16; FSC3E17 & FSC3E18; FSC3E19 & FSC3E20; FSC3E21 & FSC3E22; FSC3E23 & FSC3E24 and its corresponding Practical are to be opted by the student)

FOURTH SEMESTER

Code No. & Course	Teaching Hours	Credits	Ext. Marks	Int. Marks	Total Marks
FSC4C31 – PROJECT	160 Hrs	8	160	40	200

FSC4E32 – ADVANCED FINGERPRINT DEVELOPMENT METHODS*	80 Hrs	4	80	20	100
FSC4E33 – FORGERY & IT'S FORENSIC DETECTION *	80 Hrs	4	80	20	100
FSC4E34 – FORENSIC AUDIO VIDEO ANALYSIS*	80 Hrs	4	80	20	100
FSC4E35 – ADVANCED FORENSIC BALLISTICS*	80 Hrs	4	80	20	100
FSC4E36 – EXPLOSIVES & EXPLOSION*	80 Hrs	4	80	20	100
FSC4E37 – PHARMACOLOGY & FORENSIC ANALYSIS OF DRUGS*	80 Hrs	4	80	20	100
FSC4E38 – FORENSIC- ANTHROPOLOGY, ENTOMOLOGY & ODONTOLOGY*	80 Hrs	4	80	20	100
FSC4E39 – FORENSIC- BOTANY, WILDLIFE & MICROBIAL FORENSIC*	80 Hrs	4	80	20	100
FSC4E40 – ETHICAL HACKING & RECOVERY FORENSIC*	80 Hrs	4	80	20	100
FSC4E41 – DIGITAL IMAGE PROCESSING*	80 Hrs	4	80	20	100
FSC4E42 – PRACTICAL ON FSC4E32*	40 PS	2	80	20	100
FSC4E43 – PRACTICAL ON FSC4E33*					
FSC4E44 – PRACTICAL ON FSC4E34*	40 PS	2	80	20	100
FSC4E45 – PRACTICAL ON FSC4E35*					
FSC4E46 – PRACTICAL ON FSC4E36*	40 PS	2	80	20	100
FSC4E47 – PRACTICAL ON FSC4E37*					
FSC4E48 – PRACTICAL ON FSC4E38*	40 PS	2	80	20	100
FSC4E49 – PRACTICAL ON FSC4E39*					
FSC4E50 – PRACTICAL ON FSC4E40*	40 PS	2	80	20	100
FSC4E51 – PRACTICAL ON FSC4E41*					
Total for Fourth Semester		**20**	**480**	**120**	**600**

C - Core course; E - Elective course; PS – Practical Session

*Elective Courses {Two Theory course (corresponding to the Elective courses in the 3rd Semester) in any of the following combinations FSC4E32 & FSC4E33; FSC4E34 & FSC4E35; FSC4E36 & FSC4E37; FSC4E38 & FSC4E39; FSC4E40 & FSC4E41 and its corresponding Practical are to be opted by the student}.

Semester wise allotment of instructional hours per week

Course/ Activity	Hours allotted per Week				
	First Semester	Second Semester	Third Semester	Fourth Semester	Total
Core Theory	4 hrs X 4 courses = 16 hrs	4 hrs X 4 courses = 16 hrs	4 hrs X 2 courses = 8 hrs	--	40 hrs
Core Practical	2 Practical X 2 courses = 12 hrs	2 Practical X 2 courses = 12 hrs	2 Practical X 1 courses = 6 hrs	--	30 hrs
Elective Theory	--	--	4 hrs X 2 courses = 8 hrs	4 hrs X 2 courses = 8 hrs	16 hrs
Elective Practical	--	--	2 Practical X 1 course = 6 hrs	2 Practical X 1 course = 6 hrs	12 hrs
Seminar/ Assignment	2 hrs	2 hrs	2 hrs	2 hrs	8 hrs
Project/ Dissertation	--	--	--	14 hrs	14 hrs
Total hrs per Week	**30 hrs**	**30 hrs**	**30 hrs**	**30 hrs**	

FIRST SEMESTER

FSC1C 01 FUNDAMENTALS OF FORENSIC SCIENCE & CRIMINAL LAWS

Module I: Introduction to Forensic Science (16 hrs)

Introduction, Need, Scope, Concepts and Significance of Forensic Science, History and Development of Forensic Science, Laws and Basic principles of Forensic Science, Branches of forensic science, Forensic Science Laboratory: Organisation & services (FSL,CFSL,GEsQD, FPB etc). Administration, Central & State Forensic Science Laboratories in India, Forensic Science Laboratory Services in India, Standard Laboratory services, Evidence intake, analytical sections other laboratory services. Administrative issues with Forensic Science Laboratories; Accountability, Access to Laboratory services. The forensic scientist: Education & training of forensic scientists. Mobile FSL- Role & Functioning. Forensic science in international perspectives, including set up of INTERPOL, FBI etc.

Module II: Evidences (24 hrs)

Definition, types (testimonial and real evidence) (oral & circumstantial), Transfer & Persistence, contamination, Identity, class and Individualisation. Known and questioned items, Relationship and context, comparison of evidence, controls, Analysis of evidence: Controls, Analysis of evidence: Some preliminary considerations. Admissibility of scientific evidence and importance of physical evidences, Collection, preservation, packing and forwarding of different types of evidences (Fingerprint, hair, fibre, glass, soil, Questioned documents, impression evidences, etc.) to the FSL. Frye case and Daubert standard.

Module III: Criminal Major Acts (16 hrs)

Indian Penal Code: sections-23, 24, 25,39,44,52,76-79,84-86, 232 - 235, 246, 247, 279, 287, 304A, 337, 338, 425, 427, 440. Criminal Procedure Code: sections-2, 6-35, 41-60, 61-90,154-176, 293, 294. Indian Evidence Act: sections- 3, 24-30, 45, 60 - 65, 73, 74, 135-138, 141. Expert testimony.

Module IV: Indian Constitution and Minor Acts (12 hrs)

Constitution of India- Preamble, Fundamental Rights, Directive Principles of State Policy. – Articles 14, 15, 20, 21, 22, 51A.NDPS Act, Food and Adulteration Act, Drugs and Cosmetic Act, Arms Act, Explosives Act (Sections: 4, 17)., Information Technology Act 2000 (Sections: 2r, 2t, 3, 4, 7, 13, 79).

Module V: Social legislations, Local and Special Laws (12 hrs)

Legislation for the Amelioration of social problems- Prevention of Atrocities Act 1989, Protection of Civil Rights Act, 1976. Legislations relating to the welfare of women- Dowry prohibition Act 1961, Immoral Traffic (Prevention) Act–1956, Prevention of Domestic Violence Act, 2005. The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal), 2013. Legislations relating to the welfare of children- The Protection of Children from Sexual Offences Act (POCSO Act) 2012, Juvenile Justice (Care and Protection of

Children) Act, 2015. Legislations relating to the welfare of weaker sections and other minor acts. Local and Special Laws: KAAPA, 2007 etc. Objectives of Economic Legislations such as FERA, COFEPOSA, Prevention of Corruption Act.

Recommended Reading:

1. Houck, M.M & Siegel, J.A; Fundamentals of Forensic Science, Acadamic Press, London, 2006.
2. Sharma, B.R; Forensic Science in Criminal Investigation & Trials, Universal Publishing Co., New Delhi, 2003
3. Nanda B.B and Tewari, R.K; Forensic Science in India- A vision for the Twenty First Century, Select Publisher, New Delhi, 2001.
4. James, S.H and Nordby, J.J; Forensic Science- An Introduction to Scientific and Investigative Techniques, CRC Press, USA, 2003.
5. Saferstein; Criminalistics- An Introduction of Forensic Science, Prentice Hall Inc, USA,2007.
6. Barry, A.J. Fisher; Techniques of Crime Scene Investigation, 7th Ed, CRC Press, NewYork, 2003.
7. H.L. Blitzer and J.Jacobia; Forensic Digital Imaging and Photography, Academic Press, London, 2002
8. Mordby, J. & Reckoning, D; The Art of Forensic Detection, CRC Press NewYork, 2003.
9. Robertson and Vignaux; Interpreting Evidence, John Wiley, New York, 1995.
10. Swansan, C.R, Terrbles, L & Taylor,R.W; Police Administration, Prentice Hall, USA, 1998.
11. Gross.H; Criminal Investigation- A Practical Textbook for Magistrates, Police Officers, and Lawyers; Universal Law Publishing Co., New Delhi, 2000.
12. Lyman, M.D; Criminal Investigation – The Art & the Science, Prentice Hall, New Jersey, 2002.
13. O'Hara CE & Osterburg, JW; An Introduction to Criminalistics., Indiana University. Press, London, 1972.
14. Swansson,C.R, Chamelin, N.C, & Territ, L; Criminal Investigator, McGrawhill, New York, 2000.
15. The Indian Evidence Act,(1872), Amendment Act (2002); Universal Law Publishing Co., 2003.
16. The Code of Criminal Procedure (1973) Amendment Act, (2001); Universal Law Publishing Co., 2002.
17. Rattan Lal & Dhiraj Lal; The Indian Penal Code, 28th Ed. Wadhwa & Co. Nagpur, 2002.
18. D.A. Bronstein, Law for the Expert Witness, CRC Press, Boca Raton (1999).
19. Vipa P. Sarthi, Law of Evidence, 6th Edition, Eastern Book Co., Lucknow (2006).
20. A.S. Pillia, Criminal Law, 6th Edition, N.M. Tripathi Pvt Ltd., Mumbai (1983).
21. R.C. Nigam, Law of Crimes in India, Volume I, Asia Publishing House, New Delhi (1965).
22. (Chief Justice) M. Monir, Law of Evidence, 6th Edition, Universal Law Publishing Co. Pvt. Ltd., New Delhi (2002).

FSC1C 02 CRIME & CRIMINAL JUSTICE SYSTEM

Module I: Crime Typologies (15 hrs)

Types of Crime (White collar, Blue collar, Black Collar, Organised, Terrorism, etc.) Offences: Criminal Offences, Nature and types, Juvenile Delinquency- Factors responsible. Juvenile Justice Act, Role of Correctional Institutions, Child Abuse- Physical Abuse, Emotional Abuse, Sexual Abuse, Child Neglect, Crime against Women, Crime against Elderly, Youth and Crime. Alcoholism and Drug Addiction.

Module II: Sociology of Crime (15 hrs)

Sociological contentions about the Causes of Crime (Correlates of crime)- Social, Cultural, Economic, Psychological, Geographical, Immigration etc. The theory of social and environmental determinism, "born-criminals", "criminoids", etc.

Module III: Criminology & Victimology (20 hrs)

Criminology- Advanced study of Crime, Criminal, Criminal Action and Criminal Behaviour, Schools of Criminology, Theories of Criminology (Differential Association theory, Self concept and containment theory, Labeling theory, Barrier theory, etc.), Punitive Aspects (Theories of punishment), Probation & Parole, Correctional Institutions. Victimology- Victim, Science of Victimology, Role of Victim in Crime, Victim-Offender relationship, Types of Victims, Effects on the victim post-crime (the feeling of insecurity, mental harassment, feeling victimized throughout life, quest for justice), Justice system to the aid of the Victim, relief and compensatory aids, therapies, etc.

Module IV: Criminal Justice System in India (15 hrs)

Structural and functional process. Prosecution: Structure and Authority, Framing of Charges, Collection of Evidence and witnesses, Courts: Structure and types- Criminal courts, Juvenile Courts, Family Courts, 'Lok Adalat' and Human Right Courts. Role of Police in Crime Investigation, Accountability of Police to Law, People and Society, Interrogation & Interviewing of the criminals; methods used by the police in getting information from the criminal; the ethical issues related to the same. Custodial Death, Police and Human Rights.

Module V: Legal Aspects (15 hrs)

Bailable and Non-bailable offenses, Dying Declaration, dying deposition, Summon, Warrants, Sub-poena, perjury, Cognizable and non-cognizable offenses, FIR, Complaint, Inquest, Inquiry, Search and Seizure, Types of Witnesses (eye witness, hear-say witness, Hostile witness, etc.), leading question, medical certificate, medicolegal report, etc. Punishments- Theories, capital punishments, Imprisonment, Monetary Punishment.

Recommended Reading:

1. Swansan, C.R, Terrbles, L & Taylor,R.W; Police Administration, Prentice Hall, USA, 1998.
2. Gross.H; Criminal Investigation- A Practical Textbook for Magistrates, Police Officers,

and Lawyers; Universal Law Publishing Co., New Delhi, 2000.
3. Sharma, B.R. : Forensic Science in Criminal Investigaion and Trials, Central Law Agency, Allahabad, 1974.
4. Nanda B.B and Tewari, R.k. Forensic Science in India- A vision for the Twenty First Century, Select publisher, N. Delhi, 2001.
5. Brendan Maguire & Polly F. Radosh, (1999), *Introduction to Criminology*, Wadsworth Publishing Company, Boston, U.S.A.
6. Reid Sue Titus, (2006). *Crime and Criminology*. Mc Graw Hill Publishers.
7. Edwin H. Sutherland and Donald R. Cressey (1974), *Principles of Criminology*, Lippincott, Philadelphia.
8. Williams, F.P. and McShane, M.D. (2004) *Criminological Theory*. Upper Saddle River, NJ: Prentice Hall.
9. John E.Conklin, J.E., (1981), *Criminology*, Macmillan, London.
10. Swansan, CR, Terrbles, L& Taylor,R.W.;. Police Administration, Prentice Hall, USA, 1998. Diaz, S.M., (1976), *New Dimensions to the Police Role and Functions in India,* Published by the National Police Academy, Hyderabad.
11. Krishna Mohan Mathur, (1994), *Indian Police, Role and Challenges*, Gyan Publishing House, New Delhi.
12. Morley, W.H., (1958), *Administration of Justice in India*, New Delhi, Metropolitan.
13. Nehad Ashraf, (1992), *Police and Policing in India*, Common Wealth Publishers, New Delhi.
14. Rosenbaum, Dennis P., Arthur J. Lurigio, and Robert C. Davis (1998). *The Prevention of Crime: Social and Situational Strategies*. Wadsworth Publishing. Belmont CA.

FSC1C 03 FORENSIC & CORRECTIONAL PSYCHOLOGY

Module I: Forensic Psychology (16 hrs)

Historical perspective, scenario in India, functions and role of forensic psychologist. Assessment and Evaluation in Forensic Psychology: Forensic Assessment, Tests used in Forensic Psychology Assessment: Intelligence Tests, Achievement and Aptitude Tests, Personality Tests, MMPI Test, Rorschach Test, Thematic Apperception Test, Neuropsychological tests, Mens rea, diminished capacity, competency evaluation, Forensic Behavioural Analysis, Forensic Psychologists as an Expert. Psychopathology & Abnormal Behaviour, Theories of Offending, Gender & Crime, Ethnicity & Crime. Effect of Media. Terrorism & the related psychological aspects. Psychometric Assessment tools used in Forensic Psychology, Nature of Crime (Organized, Disorganized, Planned, Spontaneous), Crime Scene Analysis, Psychological Autopsy, Stages and Types of Offender Profiling. Behavioural Analysis, Serial Killers, Signature, Modus Operandi. Portrait Parle. Psycholoical profiling of juvenile offenders.

Module II: Elements of Forensic Psychiatry (16 hrs)

Forensic Psychiatry: Introduction to different mental illnesses; neurosis (depression, mood disorder, Insanity, Psychosis, Delusion, delirium, schizophrenia), Impulsive control stress disorder, Anti-social personality disorder, psychopathy, Post traumatic stress disorder and post

partum stress disorder. Substance Abuse. Association between mental disorder and crime. Mc Naughten rule, diminshed responsibility, testamentary capacity.

Module III: Interviewing Techniques (18 hrs)

Importance of Investigative Interviewing, Influence of Psychology, P.E.A.C.E Model of Interviewing, Cognitive Interviewing, Ethical Interviewing, Other Interview Techniques. Interrogation and the related Techniques, Brain Electrical Oscillation Signature Profiling (BEOS), Voice-Stress Analysis/ Layered Voice Analysis, reliability, Limitations, NHRC Guidelines, Admissibility on the Court, Case Studies.

Module IV: Interrogation Techniques (18 hrs)

Polygraph/Lie Detector Test: Objectives, theoretical basis, stages of examination (Pre-test, In-test, post-test), Questioning techniques, Stimulation tests, Limitations, Admissibility in the court of law, NHRC guidelines, case studies, etc. Brain Fingerprinting/Brain-Mapping: Principle**,** Importance**,** History, process, brain waves (P300, delta, theta, gamma, alpha), reliability, case studies, admissibility, etc. Narco-analysis: Principle, History, drugs used, procedure, reliability, admissibility, limitations, Indian scenario, case studies, etc.

Module V: Legal & Correctional Aspects (12 hrs)

The mentally ill in court, Competency to stand trial Mental Health Act, 1987: (Object, Relevant Definitions, Central & State authority, Reception Orders, Human Rights of Mentally ill persons, Penalties & Case-Studies), Indian Penal Code, 1860 : Relevant general exceptions. Rehabilitation & Correctional Treatment of Offender(s) / Victim(s), Techniques, Strategies and Types of Treatments.

Recommended Reading:

1. 'Criminology' by Larry Siegel
2. 'Introduction to Forensic Psychology' by Bruce Arrigo
3. 'Forensic & Criminal Psychology' by Dennis Howitt.
4. 'Abnormal Psychology' by Halgin&Whitbourne.
5. 'Abnormal Psychology', by Robert C. Carson, James N. Butcher, Susan Mineka, Jill M. Hooley thirteenth Edition, Thirteenth Edition.
6. 'Encyclopedia of Forensic Science' by Jay A. Siegel, PekkaJ. Saukko, Geoffey C. Knupfer, Volume-1 to Volume-5.
7. 'Mental Disorders and Treatment' by Katherine Marsland.
8. 'Handbook of Forensic Psychology' by Prof. Dr.VimalaVeeraraghavan.
9. 'Handbook of Polygraph Testing' by Murray Kleine.
10. 'Brain Mapping-The Methods' by Arthur W. Toga & John C. Mazziotta, Second Edition.
11. 'Criminal Profiling and Introduction to Behavioural Evidence Analysis' by Brent Turve, Second Edition.
12. Krishnamurthy, R., Introduction to Forensic Science in Crime Investigation, 2011, Selective & Scientific Books, New Delhi.
13. 'Forensic Psychology' by Graham Towel& David Crighton

14. Serial Crime, Theoretical & Practical issues in Behavioural Profiling, Petherick, Woodworth Publication.
15. 'Introduction to Forensic Psychology', by Bruce Arrigo.
16. Diagnostic & Statistical Manual-IV TR, American Psychological Association
17. DSM-IV Mental Disorders Diagnostics, Etiology and Treatment, by Michaen, Allan.
18. 'Psychological Testing' by Anne Anastasi, Susana Urbina, Seventh Edition.
19. 'Psychological Testing' by Robert J. Gregory, Fourth Edition.
20. 'Mental Health Act' 1987.

FSC1C 04 LABORATORY QUALITY MANAGEMENT, RESEARCH METHODOLOGY & STATISTICS

Module I: Standards for analysis (12 hrs)

Basic standards – Need of standards is analytical sciences – Basic chemical standards – Analytical standards – Reference materials – high purity substances – Certified reference materials – working or secondary standards – matrix effect in standards – Biological standards – Biochemical standards – Microbial cell lines and standards.

Module II: Quality Management and Laboratory Accreditation (20 hrs)

Introduction – Quality - Quality system – Quality plan – Inspection and testing – Test records – Control of inspection Handling, storage, packaging, preservation and delivery of the material – Control of quality records – Internal quality audits – Quality assurance– Training. Laboratory Accreditation – ISO 9000 and ISO 14000 and 17000 series of standards – Accreditation Boards – NABL guidelines for accreditation in India. Proficiency testing system – Internal quality control – Inter and intra laboratory testing programmes – Designing and running the proficiency testing programmes – Confidentiality. Advantages of accreditation.

Module III: Laboratory Management and Safety (14 hrs)

Administration of Laboratories – Types of laboratories – Connection between filed work and laboratory – Educational requirements of laboratory personnel – Routine laboratory work – Research and development – Internal organization of a laboratory. Architectural requirements – Laboratory design – Floor area furniture design – Auxiliary services – Receipt of reports and remnants – Record management – Requirement of equipment, glassware, chemicals and other material – Purchase procedure – Disposal of wastes – Security of the premises. Laboratory Information Management system (LIMS) classification of LIMS functions – Sub-division by functional area – Definition of LIMS – Strategic design of LIMS – System development life cycle – Review of the laboratory – Project proposal – Definition of system requirements – specifications – commercial or Bespoke LIMS – Evaluation – Purchase and installation – Demonstration – Validation – user training and implementation. Laboratory safety – planning – written safety plan – Safety policies – Safety resources – operations Hazards of chemicals, solvents, poisons and explosives – storage facilities – Biological hazards - Pressure vessels and then handling – Electrical safety – Fume cup boards- Exhausts system – Protective equipment-Emergency care and medical facilities.

Module IV: Research Methodology (23 hrs)

Identification and criteria of selecting a research problem (Hypothesis), Formulation of objectives, research plan, and its components. literature search/review, Sampling- Principles, methods, types of sampling, rationale for using a particular sampling method. Population and sample size, sampling procedures (random and non random), sampling statistics, sampling and physical state, homogenization of samples, sample size and hazards in sampling. Methods of Resear MFS-Survey, experimental, Ex-post facto, case study methods, and content analysis, etc. Tools of Data Collection - Observation, interview schedule, questionnaire, semantic differential. Impact factors of journals.

Module V: Statistics (23 hrs)

Introduction, Descriptive Statistics: Frequency distribution, class intervals, graphical presentation: bar diagram, histogram, pie chart; Measures of Central Tendency; measures of dispersion, Mean and standard deviation: Distribution of random errors, reliability of results, tests of significance, confidence interval, Paired t-test, Correlation and linear regression, the number of replicate determination, analysis of variance, the value of statistics in forensic science. Correlation, Methods of correlation, skewness and Kurtosis variance, Types of correlation (Pearson r & Rho) (+/-); Tests of significance. Parametric and nonparametric statistics; level of significance (Chi-square, t test, F test, Z test), the various nonparametric tests with one sample, two samples and k-samples, Kruskall-Wallis ANOVA. Regression Analysis, Multi-factorial Analysis, etc. Introduction to probability theory and distributions.

Recommended Reading:

1. Woodget, B. W. and Cooper, D.: *Sample and Standards*, ACOL Series, Wiley 1987.
2. Dux, J. P., *Hand Book of Quality Assurance for Analytical Chemistry Laboratory*, Van Nostrand, 1986.
3. Duncan, W. L.: *Total Quality: Key Terms and Concepts*, 1995.
4. Shah, D. H.: *QA Manual*, Business Horizons, 2000.
5. Kumar, K.: *Quality Management*, ABD Pub., 2000.
6. Ross, J.: *Total Quality Management*, Vanity Book, Intl., 1995.
7. Seiler, J. P., *Good Laboratory practice*, Springer, 2000.
8. Diwan, P.,: *Quality in Totality,* Manager's Guide to TQM and ISO 9000, Deepti & Deepti Pub., 2000.
9. Gyani, G. J.,:*Training Manual on ISO 9000; 2000 and TQM*, Raj Pub., 1999
10. Olson, M. H. and Davis, G. B.: *Management Information Systems*, McGraw Hill, 1998.
11. Specific Guidelines for Accreditation of Forensic Science Laboratories, DST, 1998.
12. Guide for Safety in The Chemical Laboratory: Manufacturing Chemist's Association, 1972.
13. Steere N. V.(Ed.): *Hand Book of Laboratory Safety*, CRC, 1967.
14. Tilstone, W. J. and Lothridge, K.: Crime Laboratory Management, Taylor and Francis, 2004.
15. Clair, J. S: *Crime Laboratory Management, Academic Press*, 2003.
16. Miller, J. C. and Miller, J. N.: Statistics for Analytical Chemistry, Ellis Horwood, 1988.Fisher, R. A.: Statistical Methods for Research Workers, John Wiley, 1954.
17. Sokal, R. R. and Rolf, F. J.: Biometry – Principles and Practices of Statistics in Biological Research, Freeman, 1981.
18. Bhaskar Rao T.: Methods of Biostatistics, Paras, 2001.

19. Rama Krishnan P., Biostatistics, Saras, 1995.
20. Rao,V.K., Biostatistics– A Manual of Statistical methods for use in Health, Nutrition and Anthropology, Jaypee Medical Pub., 1996.
21. Woodget, B. W. and Cooper, D.: Sample and Standards, ACOL Series, Wiley, 1987.
22. Dux, J. P., Hand Book of Quality Assurance for Analytical Chemistry Laboratory, Van Nostrand, 1986.

FSC1C 05 PRACTICAL

1. Descriptive study of organizational structure of a forensic science laboratory (FSL & CFSL).
2. To review the sections of forensic science at INTERPOL and compare with those in Central Forensic Science Laboratories in India. Include suggestions for improvements if any.
3. To compare the code of conduct prescribed by different establishments for forensic scientists.
4. To study the annual reports of National Crime Records Bureau and depict the data on different type of crime cases by way of smart art/templates.
5. To write report on different type of crime cases.
6. To review how the Central Fingerprint Bureau, New Delhi, coordinates the working of State Fingerprint Bureaus.
7. To study a crime case in which an accused was punished on charge of murder under Section 302.
8. To study a crime case in which an accused was punished on charge of rape under Section 375.
9. To cite example of a case in which the opinion of an expert was called for under Section 45 of the Indian Evidence Act.
10. Visit to Police Station/ Correctional Institution.
11. Format of Medico legal report (dying declaration, injuries report).
12. Post-mortem report Interpretation.
13. Format of FIR in various cases.
14. Study the theories of crime.
15. Criminal profiling.
16. Portrait Parle.

FSC1C 06 PRACTICAL

1. Reaction time
2. Steadiness test
3. Distraction of attention
4. Retroactive and proactive inhibition
5. Chunking on recall
6. Emotional intelligence test
7. Social intelligence test
8. Spiritual intelligence test
9. Weshler’s Adult Intelligence Scale (WAIS)
10. Weshler’s Intelligence Scale for Children (WISC)

11. Sociopathy/ Psychopathy Check List
12. Suicidal Ideation test
13. Big five personality test
14. Antisocial Personality Disorder test
15. Externalizing Behaviour test
16. Rorschach Ink Bolt test (Demo only)
17. Thematic Apperception test (Demo only)
18. Word Association test
19. Demonstration/Working of Polygraph: Testing of Individuals
20. Narco analysis- Demo/working/principle/framing questionnaire
21. Brain mapping- Demo/working/principle/Interpretation of results
22. Computation of measures of central tendency and dispersion in anthropometric data of school children.
23. Simulation of binomial and Poisson distributions.
24. Estimation of the mean number of children per family from selected populations.
25. Designing of an experiment for the comparison of efficacy of a few diets on different types of animals by the method of ANOVA.
26. Regression analysis and correlation analysis of a data of heights and weights of a group of students.
27. Data Analysis by SPSS.
28. Construct frequency curve, frequency polygon, bar diagram, histogram and pie diagram using suitable data.
29. Formulate a hypothesis of any scientific observation made by you.

SECOND SEMESTER

FSC2C 07 PHYSICAL EVIDENCE & INSTRUMENTAL TECHNIQUES- PHYSICAL

Module I: Prints evidence (13 hrs)

Development of Fingerprint science in India, Friction ridges- Friction ridges pattern visualization techniques, Taking of finger prints from living & dead persons, preserving prints for analysis, principles of friction Ridge analysis, Classifying Fingerprints, Comparison of finger prints, Identification, How long do friction ridge prints last?. Lip Prints, Ear Prints, Bite marks-Nature, Location, Types, Classification, Development, Lifting, Evaluation, Analysis, Minutiae Identification and comparison with reference/control sample(s), Forensic Significance.

Module II: Documents (13 hrs)

Forensic Document Examination and its scope & importance; Classification of documents; Care, handling, preservation of documents; Observation tests and their application in handwriting examination; Preliminary examination of documents; examination of paper & inks, Process of comparison of handwriting; Principle of handwriting examination; Importance of natural variations and disguise in hand writing examination; Latest technological developments in the field of document examination with reference to office automation; Quality Assurance in document Examination; Document Expert in trial courts.

Module III: Firearms and tool marks (13 hrs)

Firearms, Types of Firearms, Firearm Barrels, Anatomy of Ammunition, What happens when ammunition is discharged? cartridge cases and bullet comparison, Collection of firearms evidence, Safety and operations testing, Firearm Databases and Automated search system, Distance of firing Determination, shot pattern, Gunpowder Residues, Primer Residues, Serial Character Restoration. Tool marks, various types of tool marks, Tool mark comparison.

Module IV: Impression and other Physical Evidence (13 hrs)

Types of Impression Evidence, Significance of Impression Evidence, Footwear Impressions (General Characteristic), Footwear Impressions at the Crime Scene, Casting three Dimensional Footwear impressions, Lifting imprints, Comparison of footwear impressions, Tire Impressions Evidence, skid mark, Serial numbers restoration. Fibres: Types of fibres– (Natural, Artificial), forensic aspects of fibre examination. Paints: Types of paints- (Household, Automotive, etc.), Binders and their composition, layers, macroscopic and microscopic examination. Soil: Formation and types of soil, composition and colour of soil, particle size distribution, turbidity test, microscopic examination, density gradient analysis, ignition loss, elemental analysis. Glass: Types of glass and their composition, Forensic examination of glass fractures under different conditions, determination of direction of impact: cone 3-R rule. Forensic Examination of cables, cut wires, locks, keys, real and imitation, jewellery, Ropes, ligature, tungsten filaments, seals (postal, metallic), fuse, fuse wire, stone, brick, debris, construction materials, iron rods, cloth pieces, knot examination, duplicate labels-container identification. Principles & Techniques: specific gravity, density, refractive index, microscopic examination, physical matching, mechanical fit, elemental analysis, etc.

Module V: Microscopy and Spectroscopy (28 hrs)

Resolving powers of different microscopes, Visualization of cells and subcellular components by light microscopy, Microscopy and detection of molecules in living cells, Phase contrast, Immunofluorescence and Confocal microscopy, Electron microscopy: Scanning and Transmission (SEM and TEM), Freeze-etch and freeze-fracture methods for Electron Microscope, Cytophotometry, Micrometry, Different fixation and staining techniques, Cryotechnique. Spectroscopy, electromagnetic spectrum, sources of radiation, their utility and limitations. Conventional sources for UV, visible and infrared rays, sources for shorter wavelength radiations (X-ray tubes), radioactivity, Laser (He, Ne Argon, ion, dye lasers, semi conductor lasers) a source of radiation, interaction of radiation with matter:- reflection, absorption, transmission, fluorescence, phosphorescence and their forensic applications, radiation filters. Detection of radiations; photographic detectors, thermal detectors, photoelectric detectors etc. Atomic spectra, energy levels, quantum numbers and designation of states, selection rules, qualitative discussions of atomic spectra. Fluorescence and phosphorescence spectrometry: Types of sources, structural factors, instrumentation, comparison of luminescence and UV-visible absorption methods. Atomic absorption spectrometry: Instrumentation and techniques, interference in AAS, background correction methods, quantitative analysis. Atomic emission spectrometry: Instrumentation and techniques, arc/spark emission, ICP-AES, comparison ICP v/s AAS methods, quantitative analysis, applications. Elements of X-ray spectrometry, fluorescence, energy dispersive X-ray analysis (EDX), wavelength dispersive X-ray analysis (WDX), X-ray diffraction, augur effect. IR spectroscopy- correlation of infrared spectra with molecular structure, Fourier transform infrared (FTIR) and Raman spectroscopy, fluorescence and phosphorescence spectrophotometry,

Recommended Reading:

1. Caddy, B; Forensic Examination of Glass and Paint Analysis and Interpretation, CRC Press, New York, 2001.
2. Shaw, D; Physics in the Prevention and Detection of Crime, Contem Phys. Vol.17, 1976.
3. Saferstein, R; Forensic Science Handbook. Vol. I,II, (Ed.), Prentice Hall, New Jersey, 1988.
4. Working Procedure Manual; Physics BPR&D Publication, 2000.
5. Sharma, B.R; Forensic Science in Criminal Investigation and Trials (3rd Ed.), Universal Law Publishing Co., New Delhi, 2001.
6. Working Procedure Manual- Physics, BPR&D Publication. 2000
7. Hess, K.P; Textile Fibers and their Use, 6th Edn, Oxford and IBH Publishing Co., 1974.
8. Robinson, J.W; Atomic Spectroscopy, 2nd Ed. Revised & Expanded, Marcel Dekkar, Inc, New York, 1996.
9. Workman, J; Art Springsteen; Applied Spectroscopy- A compact reference for Practitioners, Academic Press, London, 1997.
10. Subrahmanyam, N. & Lal B; A text Book of Optics, S. Chand & Company, New Delhi, 2004.
11. Willard, H.H. Lynne L. Merrett, J. Dean, A. Frank, A. Settle. J; Instrumental Methods of Analysis, 7th Edn. CBS pub. & Distributors, New Delhi, 1986.
12. Khandpur, R.S; Handbook of Analytical Instruments, Tata McGraw Hill Pub. Co. New

Delhi, 2004.
13. Thomson, K.C. & Renolds, R.J; Atomic Absorption Fluorescence & Flame Emission Spectroscopy, A Practical Approach, 2nd Edn. Charles Griffith & Company, New South Wales, 1978.
14. Dudley, H. Williams & Fleming, I; Spectroscopic Methods in Organic Chemistry, 4th Edn, Tata McGraw- Hill Publishing Company, New Delhi, 1994.

FSC2C 08 DIGITAL AND CYBER EVIDENCE

Module I: Computer System Architecture (14 hrs)

CPU, Multiprocessing, Operating System Components, Memory Types, Virtual Memory, Input and Output Devices. File Systems- Types and components. Computer Booting Process, Computer Memory – Volatile and Non-Volatile Memory. Basic Input and Output System (BIOS), and System Applications. Types of Storage Media – Hard Drive, SSD, Optical Devices.

Module II: Digital Forensics (18 hrs)

Principles of Digital Forensics, Collection of Evidence- Single System, Networked System and Remote System. Digital Forensic Software and Hardware tools – Proprietary and Open Source Tools. Imaging and Analysis of Storage Media – Tools and Techniques. Computer Facilitated Crimes and Reasons of Attacks, Rules of Digital Forensic, Standard Operating Procedure (SOP) of Digital Crime Scene. Incidence Response tools and techniques. Search and Seizure of Volatile and Non-Volatile Data. Imaging and Hashing Digital Evidence, Analyzing and Recovering Deleted files and folders.

Module III: Introduction to Network and Communication Technology (18 hrs)

Overview of OSI Model and TCP/IP Protocol. Network Address and NAT, Monitoring Network Activities, Searching for Evidence from the Network. Live Packet Capturing and Analysis. Routers and Routing Protocols, Routing Table Poisoning, Denial of Service Attack (DOS), Distributed Denial of Service Attack (DDOS) and Wireless Attacks.

Module IV: Web Browsers and Email (15 hrs)

Web Browsers, Cookies, Favourites or Bookmarks, Cache, Session Data and Plugins. Email: Types of Email and Protocols. Analysing the Header details and tracking the email, Spoofed Mails.

Module V: Smart Phones (15 hrs)

Types of Smart Phones and the Operating Systems, Collection and Preservation of Mobile Phone and PDA, Analyzing Mobile Phone Evidence, Rooting and Jail Braking. Virtual Machine and Cloud Technology Forensics.

Suggested Reading:

1. Harlan Carvey; Windows Forensic Analysis Toolkit, Syngress, 2012.
2. Anthony Reyes, Jack Wiles; The Best Damm Cybercrime and Digital Forensics Book, Syngress, USA, 2007.
3. Aaron Philipp, David Cowen, Chris Davis; Hacking Exposed Computer Forensics Second Edition, McGrawHill, USA, 2010.
4. Cory Altheide, Harlan Carvey; Digital Forensics with Open Source Tools, Syngress, USA, 2011.
5. Andrew Hoog; Android Forensics Investigation, Analysis and Mobile Security for Google Android, Syngress, USA, 2011.
6. Hakima Chaouchi, Maryline Laurent-Maknavicius; Wireless and Mobile Network Security, Wiley, 2007.
7. Dan Kusnetzky; Virtualization: A Manager's Guide, O'Reilly, 2011.

FSC2C 09 CHEMICAL EVIDENCE & INSTRUMENTAL TECHNIQUES- CHEMICAL

Module I: Introduction (10 hrs)

Types of cases/exhibits, preliminary screening, presumptive test (colour and spot test), inorganic analysis, micro-chemical methods of analysis, Examination procedures involving standard methods and instrumental techniques, analysis of beverages: alcoholic and nonalcoholic, country made liquor, illicit liquor and medicinal preparations containing alcohol and drugs as constituents, drugs of abuse: introduction, classification of drugs of abuse, drugs of abuse in sports, narcotics drugs and psychotropic substances, designers drugs and their forensic examination, Drugs and Cosmetic Act, Excise Act, NDPS Act.

Unit II: Poisons and Drugs (16 hrs)

Definition, dosage, administration of poisons, Classification of poisons, action of poisons & factors modifying its action. collection and preservation of toxicological exhibits in fatal and survival cases, signs and symptoms of poisoning, mode of action and its effect on vital functions, medico-legal and post mortem examination report/finding studies, specific analysis plan/ approach to toxicological examination of poisoning samples. The role of drug recognition expert, Drugs of Abuse, Signs and symptoms of addiction, Interpreting drug findings, Functions and roles of toxicologists in a forensic science lab. Significance of toxicological findings.

Module III: Arson and Explosives (10 hrs)

Fire, chemistry and physics of fire behaviour, elements of life cycle of fire, types of fire, Room fire sequence, direction of fire, incendiary devices, fire extinguishers, Analysis of fire/arson crime scene, establishing the origin of fire, patterns and surface effects of char, Accidental fire causes, crime scene investigation & management of evidences on a fire/arson crime scene. Nature, Classification, Composition and characteristics of Explosive, pyrotechnics, IEDs, Commonly used Explosive devices, Explosion process and effects, types of hazard, effect of blast wave on structures, human etc. Crime scene management in explosive cases, post-blast residue collection, Reconstruction of sequence of events, Evaluation and assessment of scene of explosion,

systematic examination of explosives and explosion residues in the laboratory using chemical and instrumental techniques in the laboratory and interpretation of results, Explosives Act.

Module IV: Other Chemical Evidences (16 hrs)

Adulterants in food and food products, cement, petroleum products, pharmaceutical products, medicines, beverages. Techniques used in toxicology. Extraction, Isolation and clean-up procedures from biological samples: using conventional as well as modern techniques such as solid phase micro-extraction techniques, separation of poisons and drugs using chromatographic and electrophoretic techniques, identification and estimation of poisons and drugs using chromatographic and Spectrophotometric and other instrumental methods, significance of analytical studies with respect to Forensic examination.

Module V: Biochemical, Radiochemical and Nuclear techniques (28 hrs)

Biological and biochemical techniques: General principles of Biological/ Bio-chemical Analysis, pH and buffers, Physiological solution, cell and tissue culture, Cell fractionation, Biological variations etc. Centrifugation Techniques, Immuno-chemical Technique, General principles, Production of antibodies, Precipitin reaction, Gel immune-diffusion, Immunoelectrophoresis, complement fixation, Radio Immuno Assay (RIA), Enzyme-linked Immuno Sorbent Assay (ELISA), Fluorescence immune assay. Chromatographic Techniques, Electrophoretic Technique: General principles, Factors affecting electrophoresis, Low voltage thin sheet electrophoresis, High voltage electrophoresis, Sodium dodecylsulphate (SDS) polyacrylamide gel electrophoresis, Isoelectric focusing (IEF), Isoelectrophoresis, Preparative electrophoresis, Horizontal and Vertical Electrophoresis.Radiochemical techniques: Basic principles and theory, introduction about nuclear reactions and radiations, neutron sources, neutron activation analysis (NAA) ,Thermal analysis methods: Basic principles and theory, differential scanning colorimetry and differential analysis, thermogravimetry. Nuclear Magnetic Resonance spectroscopy: Basic principles, theory and instrum, Mass Spectrometry, GCMS, LCMS, Secondary Mass Spectrometry, Laser Mass spectrometry, Fast Atom bombardment and liquid secondary Ion Mass spectrometry, High performance liquid chromatrography, Electrospray Ionization mass spectrometry.

Recommended Reading:

1. Niesink, RJM; Toxicology- Principles and Applications, CRC Press,1996
2. Modi, JP, Textbook of Medical Jurisprudence & Toxicology, N.M. Tripathi Pub,2001
3. Chadha, PV; Handbook of Forensic Medicine & Toxicology, Jaypee Brothers, New Delhi,2004
4. Parikh, C.K; Text Book of Medical Jurisprudence, Forensic Medicine & Toxicology, CBS Pub. New Delhi,1999
5. Morrison R.T and Boyd R. N;Organic Chemistry 6th Ed Prentice Hall, 2003
6. Laboratory Procedure Manual : Petroleum Products, Directorate of Forensic Science, MHA, Govt. of India, 2005
7. Working Procedure Manual on Chemistry ; Directorate of Forensic Science MHA Govt. of India
8. Bureau of Indian Standard Specifications related to Alcohols and Petroleum Products.
9. Welcher F; Standard Methods of Chemical Analysis, 6th Ed.Van Nostrand Reinhold, New York, 1969
10. Watson C. A; Official and Standardised Methods of Analysis, Royal Society of Chemistry, UK,1994.
11. Central Excise Act ; Universal Law Publication.
12. Essential Commodity Act, 1955

13. Feigl, F; Spot Test in Inorganic Analysis, Elsevier Publ. New Delhi, 2005.
14. Clark E.G.C; Isolation and Identification of drugs, Academic Press, London, 1986.
15. Sunshine I: Handbook of Analytical Toxicology, CRC Press, Costa Rica, 1969.

FSC2C 10 BIOLOGICAL EVIDENCE & INSTRUMENTAL TECHNIQUES- BIOLOGICAL

Module I: Body Fluids (13 hrs)

Composition, formation and function of body fluids. Collection and preservation of biological fluids. Types and distribution of body fluids (semen, synovial fluid, gastrointestinal secretions, tear, milk, faeces, saliva, aqueous humour, Vaginal fluid, epithelial cells, etc.) Blood and its variants: Blood composition , Blood group antigens the classification of blood cell antigens, Forensic significance of ABO blood group , Hb blood group, Rh blood group, Kell blood group, Duffy blood group, Kidd blood group, Diego blood group, MNS blood group, etc. origin, grouping, etc.

Module II: Hair and different Botanical evidences of forensic significance (13 hrs)

Forensic hair examinations, introduction: Growth of hairs, Microanatomy, human v/s non human hairs, body area determination, ancestral estimation, damage, disease and treatments, comparison of human hairs, DNA and hairs, case studies. Leaves, seeds, pollens, Paper and Paper Pulp identification, Microscopic and biochemical examination of pulp material etc. Diatoms: Isolation of diatoms from various body organs, long bones and their forensic significance in drowning cases. Entomological evidence.

Module III: Forensic Medicine (13 hrs)

Introduction: Cause and manner of death, medico legal examination, Postmortem examination- the external or visual examination, other evidence collected, determining time since death, Laboratory Analysis, consultations. Anthropology and Odontology, Introduction: The human skeleton, Collecting Human remains, analysis of skeleton materials, facial reproductions, Interpretations, case studies.

Module IV: DNA evidence (13 hrs)

Sources of DNA, extraction/ isolation of DNA from stains, tissues, hair, nails, buccal swabs, blood, semen and other samples. FTA cards for isolation of DNA. DNA typing systems – length polymorphisms, short tandem repeats and single nucleotide polymorphisms. Introduction to DNA profiling.

Module V: Cell Biology, Physiology and Biotechnology (28 hrs)

Cell structure, Membrane structure, lipids, proteins and carbohydrates in cell membranes. Role of cell membrane in transport of material into and out of the cell. Cell organelles, cytoskeleton, projections from cell membrane. The nucleus. Chromosomes. Basic structure of DNA and RNA. Synthesis of proteins, karyotyping, cell division. Chromosomal sex and sex chromatin. Abnormal cell growth and tumours. Introduction to body function: External and internal environment, homeostasis. Negative and positive feedback mechanism. Essential body function- procuring and

ingestion of food, respiration, excretion of waste products. Need for movement. Mode of communication within the body. Importance of electrolytes, acids and alkalis, carbohydrates, proteins and fats in the body. Basic concept of anatomy and physiology of digestive, respiratory, skeleton, nervous, excretory and reproductive system etc. Lamellar bone, woven bone, cancellous bone. Structure of compact bone, periosteum, formation of bone, development of a typical long bone, fracture healing. History, Scope and importance of biotechnology. Cloning and expression vectors**.** Blotting and Hybridization techniques- Southern, Northern and Western blotting techniques, Dot and Slot blots, Molecular probes and hybridization. Polymerase Chain Reaction (PCR)- Basic PCR and its modifications: Inverse PCR, Anchored PCR, PCR for mutagenesis, Asymmetric PCR, Real time PCR and its applications, RACE, Applications of PCR in biotechnology and genetic engineering. Cloning in bacteria and eukaryotes- Construction and screening of genomic and cDNA libraries. Gene silencing techniques, Transgenic animals and Gene knockouts. Knockout vectors, Knockout mouse. Animal Tissue Culture, Hybridoma and Monoclonal antibodies- Organ Culture, Cell cultures, Culture media, Initiation of cell cultures, Evolution of cell lines, Large scale culture of cell lines: Monolayer and suspension cultures, Hybridoma technology and the production of monoclonal antibodies, Antibody engineering using genetic manipulations, Alternatives to hybridoma technology, Production of human and humanized antibodies, Uses of monoclonal antibodies.

Recommended Reading:

1. Mclay, W.D.S; Clinical forensic medicine, Cambridge University Press, London, 1990.
2. Shepherd, R; Simpson's forensic medicine, Oxford University press, London, 2003.
3. Mant, A.K; Taylor's priniciples & practice of medical jurisprudence, Wingking Tong company ltd., Hong Kong, 2003
4. Maio, D.J. & Maio V.J; Forensic pathology, CRC press, Costa Rica, 1993.
5. Wecht, C.H; Legal medicine annual, Academic Press Publisher, Massachussets, 1970.
6. Polson C.H; Essentials of forensic medicine, Pergamon press, London, 1973.
7. Lahiri, S.K; Elements of medical jurisprudence , Prabasi press, Calcutta, 1973.
8. Flzinga, R.J; Fundamentals of Entomology, Prentice hall of India pvt ltd, New Delhi, 1978.
9. Smith, D.G.V; A manual of Forensic Entomology, Ithaca New York Camstock Univ. Press, New York, 1986.
10. Byrd, J.H. & Castner, J.L; Forensic Entomology, The utility of Anthropods in legal Investigation, CRC Press, New York, 2000.
11. Harvey, Warren; Dental identification and forensic, Henry Kimption Publishers, (1976).
12. Singh, Inderbir; Human Osteology, Jayee Brothers, (2004).
13. Joseph, J; Human Osteology, Jaypee Brothers, (1996).
14. Marion, Krogman Wilton; Human skeleton in forensic medicine, Charles C Thomas, (1986).
15. Singh, Inderbir; Textbook of human osteology, Jaypee Brothers, (2002).
16. P.L. Williams & R. Warwick; Gray' Anatomy, Churchill Livingston, London,(1980).
17. Krogman, W.M.. The Human Skeleton in Forensic Medicine, Chalres C Thomas, Springfield, (1973).
18. K.J. Reich; Forensic Osteology: Advances in the identification of Human remains, Charles C Thomas, (1998).
19. William M. Bass;Human Osteology: A Laboratory and Field Manual, Missouri Archaeological Society (1995).
20. Reddy,V.R; Dental Anthropology, Inter-India Publication, New Delhi, 1985.
21. Kroeber; Anthropology, Oxford & IBH Publishing Company, New Delhi, 1972.

22. Pickering, R. & Bachman D; The use of Forensic Anthropology, CRC Press, Costa Rica, 2009.
23. Bose, N K; Anthropology, Narayana Press, Denmark, 1972.
24. James, R; Forensic examination of hair, Taylor & Francis, 2ND Ed. London, 1999.
25. Shubhra, G; Introduction to forensic examination, Selective Scientific Books, New Delhi, 2008.
26. Michael, W. Haney, H.A. & Freas, L.E; The Forensic Anthropology Laboratory, CRC Press, 2008.
27. Brown, T; Gene cloning and DNA analysis: An Introduction , 5th ed. Blackwell publishing, London, 2006 .
28. Butler, J; Advanced Topics in Forensic DNA Typing: Methodology, 1st Ed., Academic Press, London, 2009.
29. Easteal, S. McLeod, N. & Reed, K; DNA Profiling: Principles, Pitfalls and Potential, Harwood Academic Publishers, New Jersey, 1991.
30. Primorac, D.& Schanfield, M; Forensic DNA Applications: An Interdisciplinary Perspective, CRC Press, New York, 2014.
31. Rudin, N. & Inman, K; An Introduction to Forensic DNA Analysis, Second Ed.,CRC press, New York, 2001.
32. Spencer, C; Genetic testimony: a guide to forensic DNA profiling, Pearson, New Delhi, 2004.
33. Eveleth, P.B. & Tanner, J.M; Worldwide Variation in Human Growth, Cambridge University Press, London, 1976.

FSC2 C11 PRACTICAL

1. Demonstration of working principle of Light, Phase contrast and Fluorescence microscope,
   Camera Lucida and Photomicrographic equipment, HPLC.
2. Determination of pH of biological fluids using pH meter.
3. Collection, Packing and Forwarding of Physical evidence/ Trace evidence/ Sources of Digital evidence.
4. Examination of broken pieces of glass bangles to determine the source correspondence. Determination of specific gravity of glass pieces.
5. Microscopic and spectrophotometric examination of textile fabrics.
6. Physical matching of Cloth piece and/or rope piece and /or garments.
7. Determination of particle size distribution in soil samples using sieve test.
8. Examination of physical properties of paint evidences.
9. Restoration techniques of tool mark impressions.
10. Restoration of erased identification marks.
11. Determination of refractive indices of glass & liquids.
12. Physico-chemical analysis of paint samples.
13. Comparison of tool marks.
14. Linkage of evidence cartridge cases with suspected firearms-examination under comparison Microscope.
15. Linkage of evidence bullets with suspected firearms- examination under comparison Microscope.

16. Plotting of gun-shot injuries on body diagrams.
17. FTIR analysis of propellant loaded in shotgun, rifle and handgun cartridges
18. Soil comparison by density gradient method.
19. Identification of storage media and its authentication.
20. Collection of digital evidences using different softwares.
21. Collection and Preservation of Volatile data from the standalone computer
22. Recovering the deleted files and folders.
23. Network data collection and preservation.
24. Malware analysis.
25. Imaging the Seized storage media with different imaging format.
26. Analyzing the image file for hidden files and folders including slack space.
27. Collecting Registry, Event logs and Executable files details using Forensic Tools.
28. Capture and Analysis the TCP packet from the LAN.
29. Analysis the browser detail of Internet Explorer and Header details of email.

FSC2 C12 PRACTICAL

1. Qualitative analysis of explosives and explosive residue by color test and TLC.
2. Detection and identification of pesticide in a given formulation by color test.
3. Analysis of dyes by UV-visible spectrometer.
4. To perform Colour test and UV-Visible Spectrophotometry of pesticide, insecticides.
5. UV-Visible Spectroscopic analysis of Drugs.
6. Estimation of DNA by diphenyl amine method/ UV absorption
7. Estimation of RNA by orcinol method/ UV absorption
8. Estimation of Protein by Lowry's method
9. Isolation of plasmid DNA from bacterial culture
10. Isolation of genomic DNA
11. Isolation of RNA from Yeast.
12. Separation of DNA by electrophoresis
13. Southern blotting, Northern blotting, Western blotting.
14. Dot and Slot blotting
15. Determination of species of origin of blood, semen and saliva.
16. ABO grouping of bloodstains by absorption elution, absorption inhibition and mixed agglutination techniques.
17. Preparation of lectins and testing their activities against body fluids and tissues.
18. Microscopic examination of hair.
19. Examination of morphological characteristics of human and animal hair.
20. Species, race, sex determination from hair.
21. Examination of fibre (cotton, silk, wool, jute, rayon, nylon, asbestos etc.)
22. Identification and comparison of diatoms.
23. Examination of faecal matter and faecal stains.
24. Histopathological examination of tissues.
25. Preliminary examinations of blood, semen, saliva, vomit etc.

THIRD SEMESTER

FSC3 C13 FORENSIC PHOTOGRAPHY

Module I: Forensic Photography (20 hrs)

Introduction, Photographic instruments, fundamentals of light and vision, light source, geometry and photometry of image formation, types of camera, features, camera movement, and Optical filters. Specialized photography - UV, IR, transmitted light and side light photography, close-up, midrange and bird-eye view photography, trick photography, contact photography. Digital photography, software for digital photography, file formats for digital photographs – jpg, gif, bmp, tiff, mpeg, etc. Radiography, Photomicrography, microphotography, photography using scientific equipment, juxtapose charts and demonstrative photographs, photographs as secondary evidence, case studies.

Module II: Types of Photography (20 hrs)

History and Development of Photography. Basic principles and techniques of Black & White and colour photography, Photography in indoor and outdoor scene of crime; aerial photography, Aperture and focus adjustment. Significance of Photography in Forensic Science. Photo prints: Developing techniques and methods of photography, Different kinds of developers and fixers, modern developments in photography, linkage of cameras and film negatives.

Module III: Surveillance Photography (20 hrs)

Surveillance Photography: its methods, techniques and tactics. Surveillance photography – Cameras and accessions for surveillance photography moving surveillance on foot, 2-person foot surveillance moving, surveillance with vehicles, fixed surveillance, Use of photography in reconstructing the scene of crime and its presentation in the court of law. Image magnification, U. V. and I. R. illumination, Art factual evidences (Bloodstain, fingerprint, imprints, and micro evidences).

Module IV: Digital Photography (20 hrs)

Digital water marking and digital imaging, photogrammetric, Videography/ highspeed Videography, crime scene and laboratory photography. Photography of objects- Close up, normal, telephoto and processing. Aerial Photography. Remote sensing & Geo-mapping. Document and finger print photography. Photography in identification of docile and hostile human objects, etc. Digital photography, how digital camera works and basics of digital imaging. 3-D Photography/Videography, videography/high speed videography, High-speed photography, legal aspects of visual evidence, Admissibility in the court.

Recommended Reading:

1. Blitzer, H.L and Jacob, J; Forensic Digital Imaging and Photography, Academic Press, 2002
2. Henry Horeustein; Colour Photography -A working Manual, Little Brown Co.Boston (1995).

3. B.H.E. Jacobson, Ray GG Attridge; The Manual of Photography, Focal Press, London (1988).
4. Jahne B; Digital Image Processing, Heidelberg Springer(1996).
5. Workinson J; Art of Digital Video, Oxford Focal Press (1994).
6. Upton Kobre, Brill; Photography, Pearson Education, Inc (2006).
7. H.L. Blitzer and J.Jacobia; Forensic Digital Imaging and Photography, Academic Press (2002)
8. David R.Redsicker; The Practical Methodology of Forensic Photography- 2nd Ed. CRC Press LLC (2001)
9. R.E. Jacobson, S.F.Ray, G.G.Attridge, The Manual of Photography- Photographic and Digital Imaging, N.R. Oxford.

FSC3C 14 CRIME SCENE INVESTIGATION, MANAGEMENT & RECONSTRUCTION

Module I: Crime Scene Investigation (CSI) (24 hrs)

Types of Crime Scenes (Indoor, Outdoor, Mobile, Water), Various Crime Scenes (Homicide, Suicide, Murder, Accidental, HBT, Hit and Run, Hanging, Drowning, Shooting etc.). Various types of Evidences (Physical, Biological, Chemical). Various Crime Scene Search methods. Locating, Prioritize Collection of Evidence , Collect, Preserve, Inventory, Package, Transport, and Submit Evidence. Crime Scene Documentation (Sketching, Photography, Videography and Notes-taking). Safety, Sources & Forms of dangerous materials: Inhalation, skin contact, Ingestion, Injection. Universal precautions, personal protective equipments, transporting hazardous materials.

Module II: Crime Scene Management (CSM) (15 hrs)

Introduction & Components of CSM: Information, Manpower, Technology & Equipment and Logistics Management. Role of various experts at crime scene. Security, safety and preservation of crime scene. Contamination control. Scene Survey and initial documentation. Co-ordination amongst various agencies involved in investigation. Co-ordination of Interstate investigation agencies. Evidence recovery log. Chain of custody. Forwarding & Authorization letters and relevant paper work. National & International scenario on Crime Scene Investigation (CSI) and Crime Scene Management (CSM). Report Writing and Evidence Evaluation: Components of reports and Report formats in Crime Scene and Laboratory findings.

Module III: Crime Scene Reconstruction (CSR) (15 hrs)

Steps involved (Recognition of evidence, Documentation of evidence, Collection of evidence, Evaluation of evidence, Hypothesis, Testing, Reconstruction), various crime scenes and scenarios (like Hit and Run, Accidents, Hanging, Shooting, Burglary, etc.). Role of Logic in CSR. Writing a Reconstruction report. Correlation of crime scene analysis with behavioural analysis. Cases of Special Importance pertaining to forensic examination Digital Aids in Reconstruction (3-D Photography/Videography, Computer aided Reconstruction).

Module IV: Blood Spatter Analysis **(15 hrs)**

Historical perspective, Introduction, terminologies, biological and physical properties of human blood, droplet dynamics- in-flight and on-impact, directionality, point of convergence and point of origin, Spatter Types, Altered bloodstain patterns, Artifactual bloodstain patterns, Documentation, Evaluation & importance of Bloodstain evidences, Legal aspects of BPA, Manual and Computer-assisted reconstruction of BPA. Dealing with risks associated with blood-borne pathogens.

Module V: Report Writing & Court Room Presentation **(11 hrs)**

Report Writing and Evidence Evaluation: Components of reports and Report formats in Crime Scene and Laboratory findings. Constitutional validity of Forensic Evidence, Expert Testimony: Admissibility in court of law, Pre-Court preparations & Court appearance, Interpretation of Reports, Presentation in the court, Common witness, Expert witness, Expert Testimony: The role of the expert-witness; acceptance of evidence in the court; mental disorder and acceptance of evidence in court; child witness in the court, Examination-in-chief, Direct examination and cross – examination by prosecution and defense.

Recommended Reading:

1. Houck, M.M & Siegel, J.A; Fundamentals of Forensic Science, Acadamic Press, London, 2006.
2. Mordby, J. & Reckoning, D; The Art of Forensic Detection, CRC Press NewYork, 2003.
3. David R.Redsicker; The Practical Methodology of Forensic Photography- 2nd Ed. CRC Press, New York, 2001.
4. R.E.Jacobson, S.F.Ray, G.G.Attridge; The Manual of Photography- Photographic and
5. Digital Imaging , N.R. Oxford.
6. Sharma, B.R; Forensic Science in Criminal Investigation & Trials, Universal Publishing Co., New Delhi, 2003.
7. Barry, A.J. Fisher; Techniques of Crime Scene Investigation, 7th Ed, CRC Press, NewYork, 2003.
8. Nanda B.B and Tewari, R.K; Forensic Science in India- A vision for the Twenty First Century, Select Publisher, New Delhi, 2001.
9. James, S.H and Nordby, J.J; Forensic Science- An Introduction to Scientific and Investigative Techniques, CRC Press, USA, 2003.
10. Saferstein; Criminalistics- An Introduction of Forensic Science, Prentice Hall Inc, USA,2007.

FSC3 E15 QUESTIONED DOCUMENTS

Module I: Various writing features (20 hrs)

Terminology and definitions, observation tests and their applications, general characteristics of handwriting and their estimation, individual characteristics of handwriting and their estimation. Natural variations in handwriting, disguise in writing, principle of handwriting identification, comparison of like with like, process of comparison – suitability of standards for comparison. Simon New Comb theory of probability, Examination of vernacular scripts, effect of mother tongue on foreign language, effect of age, illness, posture, emotions and writing instrument on handwriting. Classification of Documents- Preliminary examination of documents- various points to be considered during examination, examination of alphabets and numerals, case studies. Working and handling of Stereo Zoom Microscopes, Comparison Microscope, Video Spectral Comparator, Electrostatic Detection Apparatus, UV – Vis, TLC.

Module II: Ink analysis (14 hrs)

Historical development- Dating of fountain pen ink, ballpoint and Non ball point ink, Ink analysis and forensic document examination, coordination with handwriting comparison and latent print processing, Ink chemistry- recognition of ink source, chemical composition of Ink. Preliminary method of analysis- Introduction, Pen line microscopy, Ink colour assessment, microscopic specular reflectance, Video spectral analysis, Laser induced fluorescence, Infrared luminescence. Forensic comparison and identification of writing ink by TLC. Instrumental analysis of Ink, Ink dating- aging process, first date of production method, Ink tag method, relative age comparison method, determination of age of ink by statistical analysis of densitometry data.

Module III: Examination of Writing Material (20 hrs)

Luminescence, Fluorescence, Phosphorescence, types of paper and Inks, techniques used in the analysis of paper & inks- raw materials, ingredients, and tagging materials etc. including NAA techniques. Examination of mechanical impressions - examination of indentation marks, secret writings, examination of rubber stamp and seal impressions, embossed impressions. Determination of sequence of intersecting strokes – all types, examination of creases and folds, determination of sequence of writings over creases & folds. Reconstruction and examination of torn documents, stabilization and examination of charred documents, case studies.

Module IV: Final examination and report writing (15 hrs)

Final examination and report writing - opinion writing and writing of reasons for opinion, importance of no opinion / qualified opinion, marking of photographs and their presentation, preparation of juxtapose charts in support of reasons, case studies. Debonair of expert and preparation for presentation of evidence in trial courts, examination-in-chief, cross examination by defence and cross examination by expert, Daubert guidelines and various court rulings. Limitations of forensic document expert, moot Courts. Quality management in Document Laboratories, safety management in document laboratories, NABL guidelines for accreditation of document laboratories.

Module V: Indian Laws related to Questioned Documents (11 hrs)

Scope and application in crime investigation, various Indian laws with reference to IPC – 34, 120B, 302, 304, 304A, 306, 324, 409, 415, 416, 417, 418, 419, 420, 463,467,468, 470, 471, 489(A to E), Indian Evidence Act – Sec 3, 45, 47, 73 and 114.

Recommended Reading:

1. Ordway Hilton; Scientific Examination of Questioned Documents. Revised Edition, Elsevier, NY (1982).
2. Albert S. Osborn; Questioned Documents, 2nd Ed., universal Law Pub., Delhi (1998).
3. Albert S Osborn; The Problem of Proof, 2nd Ed., Universal Law Pub. Delhi (1998).
4. Charles C. Thomas; I.S.Q.D. Identification System for Questioned Documents, Billy Prior Bates Springfield, Illinois, USA (1971).
5. Wilson R. Harrison; Suspect Documents Their Scientific Examination, Universal Law Pub. Delhi Indian Reprint (2001).
6. Hard less H.R; Disputed Documents. Handwriting and Thumb – Print Identification, profusely illustrated, Law Book, Allahabad (1988).
7. Morris Ron N; Forensic Handwriting Identification, Acad Press, London (2001).
8. Kurtz Sheila; Graphotypes a new Plant on Handwriting Analysis, Crown Pub. Inc., USA (1983).
9. Lerinson Jay; Questioned Documents, Acad Press, London (2001) Vacca John R; Computer Forensics- Computer crime scene Investigation, Firewall Medial, An imprint of Laxmi Pub(2002).
10. Casey Eoghan; Handbook of computer crime Investigation, Forensic Tools & Technology-Academic Press (2002).
11. Ellen Davin; Questioned Documents – Scientific Examination, Taylor & Francis, Washington (1997).
12. Roy A Huber, AM Headrick, Handwriting Identification-Facts & Fundamental, CRC Press (1999).
13. Andrea Mc Nichol, Jeffrey A Nelson; Handwriting Analysis Putting it to work for you, Jaico Books, Delhi (1994).
14. Morris (2000); Forensic Handwriting Identification (fundamental concepts & Principals).
15. Madinger J & Zalopany AR; (1999) -Money Laundering- CRC Press.
16. Manning CA;(1999) -Financial Investigation & Forensic Accounting- CRC Press.
17. Brewster F.; Contested Documents and Forgeries," The Eastern Law House, Kolkata.
18. Quirke AJ; Forged Anonymous & Suspect Documents- 1930, Reorge Rontledge & Sons Ltd, London.
19. Katherine M Kappenhaver, CDE-Forensic Document Examination-Humana Press.
20. Jan Seaman Kelly & Brian S Lindblom-Scientific Examination of Questioned Documents-Taylor Francis Group London and New York.

FSC3 E16 FORENSIC DERMATOGLYPHICS

Module I: Fingerprints and Palm prints (30 hrs)

History and development of Dermatoglyphics, Fingerprint: Nature, Location, Classification, Types, Patterns of Fingerprints, Poroscopy & Edgeoscopy, Classification of Fingerprints: Henry's Classification, Single Digit Classification, Extended Henry's System, Types of Fingerprints (Latent, Patent and Plastic), Invisible Finger marks development methods (Powder methods, Fuming methods, Chemical Methods, etc.) Recent techniques (Digital Imaging & Enhancement, Laser & other radiation based techniques, Preservation and photography of fingerprints on various surfaces. Ridge counting, Ridge tracing, Minutiae Identification & Matching. Palm Prints: Nature, Location, Types, Classification, Development, Lifting, Evaluation, Analysis, Forensic Significance.

Module II: Footwear Impressions and Gait pattern analysis (15 hrs)

Footwear Impressions-Introduction-Forms of footwear impressions-Information from footwear impressions-Location and recovery of footwear impressions-Enhancement methods-Preparation of Exemplars-The examination process-Case histories. Gait pattern.

Module III: Tire impressions (15 hrs)

Introduction-Original equipment tires, Replacement tires and tire construction-Tread nomenclature and sidewall information-Tread wear indicators-Retreated tires-Tire reference material and databases-Tire track evidence and recovery-Known tires and exemplars-Tire impressions examination process-Case histories.

Module IV: Imprints (20 hrs)

Lip Prints-Introduction-History-Scope-Application in crime detection. Ear Prints-Introduction-History-Morphology of ear – Ear prints location-Producing standards from suspects-Identification and comparison. Bite marks-Introduction-Significance-Judicial Acceptance-Description of prototypical bite marks-Evidence collection on victim and suspects-Identification and comparison-Case histories.

Recommended Reading:

1. Bridges, B.C; Criminal Investigation, Practical Fingerprinting, Thumb Impression, Handwriting expert Testimony, Opinion Evidence., Univ. Book Agency, Allhabad,2000
2. Mehta, M.K; Indentification of Thumb impression & cross examination of Fingerprints, N.M. Tripathi Pub. Bombay, 1980.
3. Chatterjee, S.K; Speculation in Fingerprint Identification, Jantralekha printing Works, Kolkata, 1981.
4. Cowger James F; Friction Ridge Skin- Comparison & Identification of Fingerprints, CRC Press, NY, 1993
5. Cossidy, M.J; Footwear Identification, Royal Canadian, Mounted Police, 1980.
6. Iannavelli, A.V; Ear Identification, Forensic Identification Series, Paramount,1989.
7. Henry, C.L. & Ganesslen, R.E; Advances in Fingerprint Technology, CRC Press, London,1991.

FSC3 E17 FORENSIC PHYSICS

Module I: Soil and Paint (15 hrs)

Types and composition of soil, sample preparation, removal of contaminants, colour, molecular particle size distribution, turbidity test, pH measurements, microscopic examination, density gradient analysis, ignition-loss test, elemental analysis, interpretation of soil evidence. Types of paint and their composition, macroscopic and microscopic analysis of paint pigments, pigment distribution, micro-chemical analysis- solubility test, pyrolysis gas chromatography, TLC, colorimetric analysis, IR spectroscopy and X-ray diffraction, elemental analysis, mass spectrometer, interpretation of paint evidence.

Module II: Cement (14 hrs)

Cement: Types of cement and their composition, sampling of cement evidence material, determination of adulterants in cement, bromoform test, fineness test, loss on ignition test of cement; Physical and instrumental methods of cement analysis: determination of compressive strength, setting times, initial and final setting time, standard consistency, chemical methods of cement analysis, x-ray powder diffraction- identification of adulterated cement and adulterants.
Cement mortar and Cement concrete: Sampling and methods of analysis.

Module III: Fibre and Glass (20 hrs)

Types of fibres, forensic aspects of fibre examination- fluorescence, optical properties, refractive index, birefringence, dye analysis. Physical fit and chemical testing. TLC, IR-micro spectroscopy, Py-MS. Difference between natural and man-made fibres. Types of glass and their composition- soda-lime, boro-silicate, safety glass, laminated, light-sensitive, tampered/ toughened, wire glass, coloured glass. Matching and comparison. Forensic examinations of glass fractures- rib marks, hackle marks, cone fracture, wavy, backward fragmentation, concentric and radial fractures. Colour, fluorescence, physical measurements, refractive index, density gradient, becke-line, specific gravity examination and elemental analysis of glass evidence.

Module IV: Tool marks (16 hrs)

Types of tool marks- compression marks, striated marks, combination of compression and striated marks, repeated marks, class characteristics and individual characteristics, tracing and lifting of marks, Photographic examination of tool marks and cut marks on clothes and walls etc. Restoration of erased / obliterated marks- Method of making-cast, punch, engrave; methods of obliteration, method of restoration- etching (etchings for different metals), magnetic, electrolytic etc., recording of restored marks – restoration of marks on wood, leather, polymer etc.

Module V: Traffic Accidents and Examination (15 hrs)

Road evidence, road engineering and design, identification and interpretation of road obstructions, defects, marks and damage, tyre marks, skid marks. Vehicle examination: Automobile common component and failure analysis, damage assessment, tyres –types speed and load rating, inflation and failures, brakes –types and brake systems, door lock and speed recording devices, safety restraint system – theory and examination of seat-belt child-seat and air-bag, vehicular fires. Speed analysis: vehicle and road kinematics, coefficient of friction and drag factor, methods of

determining drag factor, influence on braking distance. Speed determination: skid marks measurement, speed from vehicle yaw, speed calculation on different road surfaces, falls, flips and vault speeds, special speed problem. Hit and run investigation- examination of suspect vehicle, collection of evidence & control samples, inter-comparison of analytical result of physical evidence. Reconstruction of accident: overview of reconstruction software and techniques, computer aided design techniques, vehicle specification databases, momentum and energy analysis program, collision simulators, photogrammetry software. Motorcycle accident investigation: types of motor cycle, dynamics rake and turning, acceleration and breaks, mechanical consideration and slide to stop speed determination.

Recommended Reading:

1. Caddy, B; Forensic Examination of Glass and Paint Analysis and Interpretation, CRC Press, New York, 2001.
2. Shaw, D; Physics in the Prevention and Detection of Crime, Contem Phys. Vol.17, 1976.
3. Saferstein, R; Forensic Science Handbook. Vol. I,II, (Ed.), Prentice Hall, New Jersey, 1988.
4. Working Procedure Manual; Physics. BPR&D Publication, 2000.
5. Sharma, B.R; Forensic Science in Criminal Investigation and Trials (3rd Ed.), Universal Law Publishing Co., New Delhi, 2001.
6. Working Procedure Manual- Physics, BPR&D Publication. 2000
7. Hess, K.P; Textile Fibers and their Use, 6th Edn, Oxford and IBH Publishing Co., 1974.
8. Robinson, J.W; Atomic Spectroscopy, 2nd Ed. Revised & Expanded, Marcel Dekkar, Inc, New York, 1996.
9. Workman, J; Art Springsteen; Applied Spectroscopy- A compact reference for Practitioners, Academic Press, London, 1997.
10. Subrahmanyam, N. & Lal B; A text Book of Optics, S. Chand & Company, New Delhi, 2004.
11. Willard, H.H. Lynne L. Merrett, J. Dean, A. Frank, A. Settle. J; Instrumental Methods of Analysis, 7th Edn. CBS pub. & Distributors, New Delhi, 1986.
12. Khandpur, R.S; Handbook of Analytical Instruments, Tata McGraw Hill Pub. Co. New Delhi, 2004.
13. Thomson, K.C. & Renolds, R.J; Atomic Absorption Fluorescence & Flame Emission Spectroscopy, A Practical Approach, 2nd Edn. Charles Griffith & Company, New South Wales, 1978.
14. Dudley, H. Williams & Fleming, I; Spectroscopic Methods in Organic Chemistry, 4th Edn, Tata McGraw- Hill Publishing Company, New Delhi, 1994.
15. Kenneth S. Obenski et. al.; Motorcycle Accident Reconstruction and Litigation, Lawyers & Judges Pub. Company. (2011)
16. Lynn B. Fricke.; Traffic Crash Reconstruction, Northwestern University Center for Public Safety. (2010)
17. R. W. Rivers.; Basic Physics: Notes for Traffic Crash Investigators and Reconstructionists: An Introduction for Some, a Review for Others, Charles C. Thomas Pub Ltd (2004).
18. R. W. Rivers; Evidence in Traffic Crash Investigation and Reconstruction: Identification, Interpretation and Analysis of Evidence, and the Traffic Crash Investigation and Reconstruction, Charles C. Thomas Pub Ltd. (2006).
19. R.W. Rivers and Frederick G. Hochgraf; Traffic Accident Investigators' Lamp Analysis Manual, Charles C. Thomas Pub Ltd. (2001).

20. R.W. Rivers; Technical Traffic Crash Investigators' Handbook: (Level 3): A Technical Reference, Training, Investigation and Reconstruction Manual, Charles C. Thomas Pub Ltd. (2010).
21. R.W. Rivers; Traffic Crash Investigators' Manual: A Levels 1 and 2 Reference, Training and Investigation Manual, 3rd Ed Charles C. Thomas. (2011).
22. Thomas Watters; Traffic Crash Analysis: Court Preparation Manual, Dream Catcher Publishing. (1999).
23. Tony L. Becker; Lamp Examination for Traffic Collision Investigators, Institute of Police Technology and Management. (1995).

FSC3 E18 FORENSIC BALLISTICS

Module I: History of Firearms (14 hrs)

History and background of Firearms, their classification and characteristics, various components of small arms, smooth bore and rifled firearm, different systems and their functions, rifling – various class characteristics, types of rifling and methods to produce rifling. Trigger and firing mechanism, cartridge-firing mechanism. Projectile velocity determination, Theory of recoil, methods for measurement of recoil. Techniques of dismantling/assembling of firearm.

Module II: Types of ammunitions (18 hrs)

Types of ammunitions- classification and constructional features of different types of cartridges, types of primers and priming composition, propellants and their compositions, velocity and pressure characteristics under different conditions, various types of bullets and compositional aspects, latest trends in their manufacturing and design, smooth bore firearm projectile, identification of origin, improvised ammunition and safety. Identification of origin, improvised/ country-made/ imitative firearms and their constructional features.

Module III: Internal and External Ballistics (16 hrs)

Definition, ignition of propellants, shape and size of propellants, manner of burning, various factors affecting the internal ballistics: lock time, ignition time, barrel time, erosion, corrosion and gas cutting, equation of motion of projectile, principal problems of exterior ballistics, vacuum trajectory, effect of air resistance on trajectory, base drag, yaw, shape of projectile and stability, trajectory computation, ballistics coefficient and limiting velocity, Ballistics tables, measurements of trajectory parameters, introduction to automated system of trajectory computation and automated management of ballistics data.

Module IV: Terminal Ballistics (16 hrs)

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, Cavitation – temporary and permanent cavities, Ricochet and its effects, stopping power, Wound Ballistics; Threshold velocity for penetration of skin/flesh/bones, preparation of gel block, penetration of projectiles in gel block and other targets, nature of wounds of entry, exit, initial track with various ranges and velocities with various types of projectiles, explosive wounds, evaluation of injuries caused due to shot-gun, rifle, handguns and country

made firearms, methods of measurements of wound ballistics parameters, post-mortem and anti-mortem firearm injuries.

Unit V: Examination and identification (16 hrs)

Firearms, ammunition and their components identification and examination, different types of marks produced during firing process on cartridge-firing pin marks, breech face marks, chamber marks, extractor and ejector marks and on bullet number/direction of lands and grooves, striation marks on lands and grooves, identification of various parts of firearms, techniques for obtaining test material from various types of weapons and their linkage with fired ammunition, class and individual characteristics, determination of range of fire- burning, scorching, blackening, tattooing and metal fouling, shots dispersion and GSR distribution, stereo & comparison microscopy, automatic bullet and cartridge comparison system. GSR analysis: Mechanism of formation of GSR, source and collection, spot test, chemical test, identification of shooter and instrumental methods of GSR Analysis.

Recommended Reading:

1. Sharma, B.R.; Firearms in Criminal Investigation & Trials, 4th Ed, Universal Law Publishing Co Pvt Ltd, New Delhi, 2011.
2. Mathews, J.H; Firearms Identification, Vol I, II and III, Charles C. Thomas, USA, 1977.
3. Hatcher, Jury and Weller; Firearms Investigation, Identification and Evidence, Stackpole Books, Harrisburg, Pennsylvania,1997.
4. Heard, B.J; Handbook of Firearms and Ballistics, John Wiley, England, 1997.
5. Warlow, T.A.; Firearms, The Law and Forensic Ballistics, Taylor and Francis, London,1996.
6. Schooeble, A.J. and Exline, L.D; Current methods in Forensic Gunshot Residue Analysis, CRC Press, New York, 2000.
7. Wilber; Ballistic Science for the Law Enforcement Officer, Charles C. Thomas, USA, 1977
8. Carlucci, D.E & Jacobson, S.S; Ballistics, CRC Press, London, 2008.
9. Sellier, K.G; Wound Ballistics and the Scientific Background, Elsevier Pub. Co., London, 1994.
10. Jauhari M; Identification of Firearms, Ammunition, & Firearms Injuries, BPR&D, New Delhi.
11. Ordog, G.J; Management of Gunshot wounds, Elsevier Pub. Co., New York, 1983.
12. Schooeble, A.J. and Exline, L.D; Current methods in Forensic Gunshot Residue Analysis, CRC Press, NewYork, 2000.
13. Beyer, J.C; Wound Ballistics, US. Printing Office, Washington, 1962.
14. Wilber; Ballistic Science for the Law Enforcement Officer, Charles C. Thomas, USA, 1977.
15. Di Maio, JM; Gunshot Wounds, CRC Press, New York, 1999.

FSC3 E19 FORENSIC CHEMISTRY

Module I: Introduction to Biochemistry (30 hrs)

Structure of atoms, molecules and chemical bonds. Water: its effect on dissolved bio molecules- Water as an ideal biological solvent: Hydrogen bonds; Ionisation of water. Weak acids and weak bases; Equilibrium constant; pH and pH scale. Problems involving the determination of pH and pKa .Buffers and buffer action. Phosphate and bicarbonate buffer system in biological system. Structure and Reactions Carbohydrates and Lipids - Structure of Monosaccharides, Disaccharides, Oligosaccharides and polysaccharides (chitin, bacterial cell wall and glycogen). Lipids- Structure and Reactions- Classification of lipids, classification of fatty acids. Physical and chemical properties of lipids. Structure, Classification and Reactions of Amino acids - Structure of different amino acids in proteins. Classification of proteins. Physical and chemical properties of amino acids: Zwitter ions. Isoelectric point. Reactions of carboxyl group, amino group and side chains. Colour reactions of amino acids and proteins. Peptide bonds. Metabolism of Amino acids, Synthesis of amino acids, Degradation of amino acids, Transamination, decarboxylation and deamination reactions in the biological system. Structure and classification of Proteins and Nucleic acids- Structure of proteins. Classification of proteins, Glycoprotein and proteoglycans. Sequencing of proteins. Nucleic acids- Structure of nucleic acids: Structure of DNA and RNA. Biosynthesis of nucleic acids, Degradation of nucleic acids. Sequencing of DNA. Classification and structure of vitamins, Functions of vitamin.

Module II: Petroleum Products (12 hrs)

Petroleum Products, Adulterants, Detection of adulterants of gasoline, diesel and engine oils. Analysis of residues in forensic exhibits, Analysis of recycled engine oils, Analysis of dyes of petrol and kerosene, engine oils, Gas chromatography analysis of petrol, kerosene, diesel and other solvents for detection of adulteration by Flash point, boiling point, ignition method and distillation method.

Module III: Fertilizers, Pesticides and Other Chemicals (18 hrs)

Introduction to fertilizer, different type of fertilizers and classification, substandard and sub-standard adulterated fertilizers, common adulterants. Chemical and instrumental methods of analysis of fertilizers. Quantitative and qualitative forensic analysis of organic and inorganic Industrial products, chemical fertilizers, pesticides, insecticides, metallic and non metallic products, consumer items such as gold, silver, tobacco, tea, sugars, salts, acids and alkalis etc. Analysis of Beverages & Prohibited Substances: Introduction of alcohol (ethyl alcohol, methyl alcohol) and illicit liquor, Extraction methods of alcohol (Distillation), Proof spirit, absorption, metabolism, de-toxification and excretion of alcohol, Analysis of alcohol by color tests, TLC, GC, GC-MS, Consequences of drunken driving, breath analysis by Breath Analyzer, Detection of alcohol in blood and urine, Alcohol and prohibition. 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 by colour tests, TLC, GC and GC-MS methods and Case Studies.

Module IV: Arson (8 hrs)

Fire, chemistry and physics of fire behaviour, elements of life cycle of fire, types of fire, Room fire sequence, direction of fire, incendiary devices, fire extinguishers, Analysis of fire/arson

crime scene, establishing the origin of fire, patterns and surface effects of char, Accidental fire causes, crime scene investigation & management of evidences on a fire/arson crime scene.

Unit V: Narcotics and Psychotropic substances (12 hrs)

Classification and types of Narcotics (cannabis, cocaine, opium etc.) and Psychotropic Substances (stimulants, hallucinogens, depressants, sedatives etc): Nature, extraction from viscera, blood, vomit etc. Fatal dose, fatal period, signs and symptoms, post mortem findings, medico legal significance and detection (preliminary and confirmatory tests). Drugs and Cosmetic Act, NDPS Act, Control Substance Act. Dyes: Different type of dyes, role of dyes in crime investigation, food colours (edible and non-edible dyes), dyes used in cosmetic and pharmaceutical. Chemical analysis and instrumental methods of analysis of dyes. Analysis of trace evidence: cosmetics, dyes, Trap related evidence materials, fibers, oils, fats, greases, industrial dusts, chemicals and plant material. Pigments: Introductions, white pigments, Manufacturing process and properties of blue pigment, red pigment, green pigment, yellow pigment. Illicit Drugs: Illicit drug types, search of clandestine laboratory, precursors and their analysis, estimation of morphine in opium and heroin in smack, analysis of drugs in biological samples and their importance: Hair, urine, blood, viscera, methods of extraction of drugs/consultation of drugs, limitations of chemical analysis of drugs, report writing and interpretation of drugs.

Recommended Reading:

1. Alberts, B. Bray, D. Lewis, J., Raff, M. Roberts, K. And Watson, J. D. (1994). Molecular Biology of the Cell. Garland, NY.
2. Berg, J. M., Tymoczko, J. L. And Stryer, L. (2006) Biochemistry, W.H. Freeman and Co., New York.
3. Cohn R. M. And Roth K. S. (1996). Biochemistry and Disease, Williams And Wilkins, A Waverly Company.
4. Delvin, T. W. (2000). A Text Book of Biochemistry with Clinical Correlations, Wiley-Liss, NY.
5. Deb, A. C. (2004). Fundamentals of Biochemistry. New Central Book Agency (P) Ltd. New Delhi.
6. Elliott, W. H. And Elliott, C. (2003). Biochemistry and Molecular Biology. Oxford University Press, Oxford,UK.
7. Niesink, RJM; Toxicology- Principles and Applications, CRC Press,1996
8. Modi, JP, Textbook of Medical Jurisprudence & Toxicology, N.M. Tripathi Pub,2001
9. Chadha, PV; Handbook of Forensic Medicine & Toxicology, Jaypee Brothers, New Delhi,2004
10. Parikh, C.K; Text Book of Medical Jurisprudence, Forensic Medicine & Toxicology, CBS Pub. New Delhi,1999
11. Morrison R.T and Boyd R. N;Organic Chemistry 6th Ed Prentice Hall, 2003
12. Laboratory Procedure Manual : Petroleum Products, Directorate of Forensic Science, MHA, Govt. of India, 2005
13. Working Procedure Manual on Chemistry ; Directorate of Forensic Science MHA Govt. of India
14. Bureau of Indian Standard Specifications related to Alcohols and Petroleum Products.
15. Welcher F; Standard Methods of Chemical Analysis, 6th Ed.Van Nostrand Reinhold, New

York, 1969
16. Watson C. A; Official and Standardized Methods of Analysis, Royal Society of Chemistry, UK, 1994.
17. Central Excise Act; Universal Law Publication.
18. Essential Commodity Act, 1955
19. Feigl, F; Spot Test in Inorganic Analysis, Elsevier Publ. New Delhi, 2005.

FSC3 E20 FORENSIC MEDICINE AND TOXICOLOGY

Module I: Thanatology and Forensic Pathology (20 hrs)

Signs of death and changes after death. Somatic death, molecular death, early changes after death - Algor mortis, rigor mortis, cadaveric spasm, heat stiffening, cold stiffening, changes in blood, chemical changes in cerebrospinal fluid, changes in vitreous humour, post mortem lividity, fluidity of blood. Late changes- putrefaction- external and internal changes. Adipocere, mummification, gastric content and bladder content and time of death from growth of hair and nails. Destruction of body and tissues by maggots and other insects, rodents, fish and crabs, moulds. Sudden death, post-mortem demonstration of myocardial infarction. Medico legal aspects of death- Asphyxia, syncope, coma, death by starvation, drowning, hanging and strangulation. Causes and mechanism of traumatic death, manner of death. Classification of traumatic deaths. Identification & Examination of Decomposed/Mutilated Bodies & Fragmentary Remains. Medico-legal Aspects of Death. Deaths by poisoning, Signs and symptoms of poisoning- Acute & Chronic, Asphyxial Deaths (Hanging, Strangulation, Throttling, Suffocation, Drowning, Bansdola). Identification of possible causes of death. Medico-legal Aspects. Sexual Offences (Perversions, Natural, Unnatural). Abortion, Infanticide. Traffic Accident Death (Vehicular, Railway, Aircraft)., Impotence and Sterility, Artificial insemination, test-tube baby, surrogate motherhood, Virginity, Criminal Abortion Medico-legal aspects of female feticide, legitimacy, medico-legal aspect of sterilization, Sexual Offences- Natural & Unnatural (buccal coitus, sodomy, tribadism, bestiality, etc.), Report Writing and Interpretation, etc.

Module II: Mechanical Injuries (15 hrs)

Abrasions, Bruises, Lacerations, Incised wounds, Stab wounds, Firearm injuries, Defence injuries, fabricated injuries. Traffic accident injuries: vehicular injuries, railway injuries and aircraft injuries. Thermal injuries: Burn and scalds, Lightning, Electricity, Explosions. Chemical trauma. Injuries- Accidental, self-inflicted, or inflicted by others. Ante -mortem and post-mortem, artificial injuries and aging of injuries. Fractures, Dislocations Secondary causes of death Regional injuries- wound of the scalp- incised, contusions, lacerations, firearm injuries. Fractures of the skull from direct & indirect impact, injuries of the brain, face, eyes, nose, ears, lip, teeth and alveoli, neck, spine and spinal cord, chest, rib, sternum, ribs, lungs, heart, blood vessels, diaphragm, oesophagus, abdomen, stomach, liver, intestine, pancreas, spleen, kidneys, adrenals urinary bladder, rectum external genitalia, muscles, bones and joints.

Module III: Poisons (24 hrs)

Classification and Types of Poisons: Metallic, Inorganic, Organic, Volatile, Animal, Plant, Insecticides, Pesticides, etc. their nature, Use, Administration, Fatal dose, fatal period, Symptoms, some common Antidotes Post-mortem findings, Collection and preservation of viscera and other samples. Isolation and different methods of extraction:- Different methods of extraction for poisons from viscera: Solvent extraction, distillation /steam distillation, micro diffusion, dialysis,

dry ashing, wet digestion, modified star-otto method, ammonium sulphate method, residue levels, toxic levels and therapeutic levels, fatal levels of commonly encountered poisons in blood, urine and tissues. Extraction of poisons from blood, urine, stomach washes and vomits, food material and toxicological analysis of decomposed materials. Interpretation of toxicological finding and preparation of reports, limitation of method and trouble shooting in toxicological analysis, disposal of analysis samples, some interesting and their importance in view of specific approach in examination. Volatile Poisons:- Nature, use, administrations, symptoms, post-mortem findings, fatal dose, fatal period, isolation, detection, qualitative and quantitative estimation of: Acetone, Ether, Oxalic Acid, Phenols, Camphor, Chloral Hydrate, Chloroform, Acetaldehyde Methyl alcohol, ethyl alcohol, illicit liquor, country-made liquor, etc. Analysis by colour tests, chromatographic techniques (TLC, FTIR, NMR, GC, GC-MS, etc.). Non-Volatile Organic Poisons: Cl**a**ssification and types (alkaloids, sedatives, stimulants, hallucinogens, sominiferous, spinal, cardiac etc.): Nature, extraction from viscera, blood, vomit etc. Fatal dose, fatal period, signs and symptoms, post mortem findings, medico legal significance and detection (preliminary and confirmatory tests). Asphyxiants (carbonmonoxide, carbondioxide, hyrdrogensulphide, nitrous oxides, war gases, etc.)

Module IV: Metallic, Non-metallic and Food Poisons (15 hrs)

Metallic poisons: Nature, use, administrations, symptoms, post-mortem findings, fatal dose, fatal period, isolation, detection, qualitative and quantitative estimation of metallic poisons including: Lead, Copper, Mercury, Arsenic, Barium, Selenium, Magnesium, Aluminium etc. Non-metallic poisons including: chlroine, bromine, iodine, phosphorus etc. Nature, use, administrations, symptoms, post-mortem findings, fatal dose, fatal period, isolation, detection, qualitative and quantitative estimation. Analysis by colour tests, AAS, FTIR etc. Food Poisons: Introduction, Food poisoning due to chemical, bacterial and fungal, Sign and symptoms of food poisoning, collection and preservation of evidence material, extraction and isolation, from food material, Biological material, detection and identification by colour test and instrumental techniques. Food Adulteration: Food Adulteration Act, Various adulterants in household and food products, their detection.

Module V: Plant and Animal Poisons (6 hrs)

Plant Poisons: Classification and types (Dhatura, *Abrus precatorious*, Nerium oleander, *Calotropis giganti*a, *Gloriosa superba*, Ergot, Mushroom etc.) of Plant Poisons: Nature, extraction from viscera, blood, vomit etc. Fatal dose, fatal period, signs and symptoms, post mortem findings, detection (preliminary and confirmatory tests) and medico legal significance. Animal Poisons: Classification and types (neurotoxin, myotoxin, cantharides, vasculotoxin, spider, snakes, scorpion, etc.) of Animal Poisons: Nature, extraction from viscera, blood, vomit etc. Fatal dose, fatal period, signs and symptoms, post mortem findings, detection (preliminary and confirmatory tests) and medico legal significance.

Recommended Reading:

1. B.V.Subrahmanyam; Modi's Medical jurisprudence, Lexis Nexis butterworth, (1988)
2. WDS. Mclay; Clinical forensic medicine, Greenwich medical media, (1990)
3. Nandy; Principals of forensic medicine, New central book agency, (1995)
4. R.Shepherd; Simpson's forensic medicine, Oxford University press,(2003)

5. A.K.Mant; Taylor's priniciples & practice of medical jurisprudence, Wingking Tong co. Ltd., (2003)
6. D.J.Maio & V.J. Maio; Forensic pathology, CRC press, (1993)
7. C.H.Wecht; Legal medicine annual , ACC Press, (1970)
8. C.H. Polson; Essentials of forensic medicine, Pergamon press, (1973)
9. R. Mortiz & R.C. Morris; Handbook of legal medicine, C.V. Mosby company, (1975)
10. S.K. Lahiri; Elements of medical jurisprudence , Prabasi press, (1973)
11. I.Gordon & H.A.Shapiro; Forensic medicine, Longman group Ltd., (1982)

FSC3 E21 FORENSIC BIOLOGY

Module I: Gene and Genome **(24 hrs)**

Concept of gene – Conventional and modern views. Fine structure of gene, split gene, pseudogene, non-coding gene, overlapping genes and multiple gene families. Mendelian Population, gene pool, Hardy-Weinberg equilibrium, deviation from H-W equilibrium, statistical assessment of deviation from H-W equilibrium, consanguinity, inbreeding, inbreeding coefficient, genotypes, phenotypes, mutation, multiple alleles, genetic variants, biochemical genetics, gene structure, its frequency determination, gene mapping and gene Expression. Genetic markers and their forensic significance. Mutations and their causes, types of mutation, mutation rate, genetic load. Method of mutation detection, population structure and gene flow. An overview of molecules involved in the flow of genetic information, double helical structure of DNA, alternate forms of DNA double helix, denaturation and renaturation of DNA, DNA binding proteins, factors affecting DNA stability, types and structure of RNA, RNA-DNA hybrid helices, DNA repair, direct and indirect evidences for DNA and RNA as the genetic material. Chemical nature of DNA and RNA. Replication of DNA in prokaryotes and eukaryotes, genetic code, degeneracy and universability of genetic code, transcription and translation machinery. Nature and structure of human genome and its diversity. mt-DNA, Y-Chromosomes and the peopling, migration, of modern humans.

Module II: Tissues of the body **(12 hrs)**

Epithelia and glands. Classification of epithelia, types of glands, their classification and function. Connective tissues- basic component, cell in general connective tissues. Different forms of connective tissues, fibres of connective tissues, cells of connective tissues- adipose tissue. Functions of connective tissues. Cartilage, structure, types of cartilage, gross structure of bones, elements comprising bone tissue. Skin and its appendages- structure and functions, pigmentation, blood and nerve supply. Arrector pilli, muscles, sebaceous glands, nails, sweat gland. Muscle-skeletal, striated, non-striated, voluntary, involuntary. Organization of muscle fibres in muscle. Tendons. Nerves tissues- neuron structure, type of neurons, synapse, grey and white matter, peripheral nerves, ganglia.

Module III: Concept of sequence variation (14 hrs)

VNTRs, STRs, Mini STRs , SNPs. Detection techniques - RFLP, PCR amplifications, Amp-FLP, sequence polymorphism, Y-STR, Mitochondrial DNA. Evaluation of results, frequency estimate calculations and interpretation, Allele frequency determination, Match probability – Database, Quality control, Certification and Accreditation. Outline of genetic manipulations, enzymes in genetic manipulation, basic molecular cloning procedures, isolation of specific nucleic acid sequences – complementary DNA, genomic library construction , preparation of plasmid DNA, sub cloning, colony hybridization, Nick translation, Oligo nucleolide probes, expression of genes. Nucleic acid hybridization and DNA sequencing.

Module IV: Body Fluids (18 hrs)

Blood and blood stains– Physical examination, presumptive test (TMB, Kastle-Meyer Test, Luminol) Confirmatory Tests (Takayama, Teichmann, spectrophotometric). Examination of Menstrual blood & its stains-Physical & Microscopic examination, Identification by Fibrin Degradation product. Identification of other body fluids and their stains. Semen and seminal stains-Physical Examination, Presumtive test (Acid Phosphatase Test), Confirmatory test (microscopic examination) Gram staining, cross-over electrophoresis. Examination of vaginal fluid & stains of vaginal secretions-Physical examination, SAP/VAP electrophoresis, Lugol's stain. Examination of saliva & saliva stains-starMFS-iodine test, salivary haemagglutinin test, radial diffusion test for amylase. Examination of vomit-test for mucus,test for free HCL (Gunzberg's test),endothelial cells. Examination of urine stains-Physical stains, odour test ,urea nitrate crystal test, creatinine test. Types and distribution of body fluids, urine formation, composition, properties, abnormal constituents and clinical significance, Beta HCG; CSF, lymph, amniotic fluid, sweat, composition, formation and function; semen, synovial fluid, gastrointestinal secretions composition, formation and function; tears, milk, faeces; saliva, aqueous humour, Vaginal fluid, epithelial cells, etc. their analysis and forensic significance.

Module V: Hair and Fibres (12 hrs)

Morphology and biochemistry of human and animal hair, Comparison between human and non-human hair. Structure of hair and hair follicle, hair cycle- anagen, catagen, telogen. Collection and preservation of hair samples. Morphological and microscopic examination of human and animal hair. Macroscopic and microscopic features of hair. Microscopic features- diameter, pigment, cortex, cuticle, cross section. ABO grouping and isozyme typing from hair roots. Determination of origin race, sex, site from hair. Types of fiber – forensic aspect of fibre examination- fluorescent, optical properties, refractive index, birefringence, dye analysis etc. Identification and comparison of man-made and natural fibre.

Recommended Reading:

1. Robertson, J., ed: Forensic Examination of Fibres. Chichester, West Sussex, England: Ellis Horwood Ltd., (1992).
2. Saferstein, Richard: Criminalistics. An Introduction to Forensic Science, 5th ed., Prentice Hall, 1998.
3. Robertson, J: Forensic Examination of Hair. Taylor and Francis (1999).
4. Saferstein, R: Handbook of Forensic Science (Vol 1,2,3).

5. Eckert: An Introduction to Forensic Science.
6. Kirk, P: Criminal Investigation, Interscience, 1953
7. James, S. H. and Nordby, J. J: Forensic Science: An Introduction to Scientific and Investigative Techniques, CRC Press, 2003 & 2005
8. Siegel, J. A., Sukoo, R. J, and Knupfer, G. C: Encyclopedia of Forensic Science, Vol I, II and III, Academic Press, 2000.
9. Becker, R. F: Criminal Investigation, Aspen Pub., 2000.
10. Lee, H: Physical Evidence, Elsevier, 2000.
11. Rudin, N. & Inman, K; An Introduction to Forensic DNA Analysis, Second Ed.,CRC press, New York, 2001.
12. Spencer, C; Genetic testimony: a guide to forensic DNA profiling, Pearson, New Delhi, 2004.

FSC3 E22 FORENSIC SEROLOGY AND DNA PROFILING

Module I: Immunology and Serology (18 hrs)

Immune system, immune response, innate and acquired immunity, antigens, antibodies, haptenes and adjuvants, immunoglobulin- types, physico-chemical properties and function, raising of anti-sera, Lectins - their forensic significance. Buffers and serological reagents, methods of sterilization employed for serological work. Composition of blood, Formation of blood, Blood groups – history, biochemistry and genetics of ABO, Rh, Mn and other systems. Methods of ABO blood grouping (absorption-inhibition, mixed agglutination and absorption elution) from blood stains and other body fluids/stains viz. menstrual blood, semen, saliva, sweat, tear, pus, vomit, hair, bone, nail etc., blood group specific ABH substances. Secretors and non- secretors. Blood groups that make racial distinctions. Lewis antigen, Bombay Blood groups. HLA antigens and HLA typing. Role of sero-genetic markers in individualization and paternity disputes. Pitfalls in red cell typing.

Module II: Determination of human and animal origin (18 hrs)

Determination of human and animal origin from bones, hair, flesh, nails, skin, teeth body tissue, fluids/ stains viz. blood, menstrual blood, semen, saliva, sweat, tear, pus, vomit, etc., through immunodiffusion and immuno - electrophoresis, cross reactivity among closely related species. Individualization of blood stains: Determination of blood groups, sex age and racial origin from dried bloodstains. Red cell enzymes : Genetics , polymorphism and typing of PGM, GLO-I, ESD, EAP, AK, ADA etc. and their forensic significance. Serum proteins: Genetics, polymorphism and typing of- Hb, HP, Tf, Bf, C3 etc. and their forensic significance.

Module III: Forensic DNA Profiling (20 hrs)

Possible sources for DNA, collection, transportation and preservation of various forensic samples for DNA profiling. DNA extraction techniques for different forensic samples (early techniques, solid phase extraction, differential extraction, chelex extraction, automated techniques, commercial extraction kits), RNA extraction from different forensic samples. Determining quality and Quantity of DNA and RNA, Gel elution technique. DNA Amplification: Types of PCR: Nested PCR, Touchdown PCR, Gradient PCR, Hot-starts PCR, Quantitative PCR, multiplex PCR.

DNA quantification by Slot- blot assay, Pico-green micro-titer plate assay, AluQuant human DNA quantification system, endpoint PCR, PCR inhibitors & solutions, Contamination Issues, etc.

Module IV: Advanced techniques in DNA profiling (12 hrs)

Uni-parentally inherited genetic markers in ethnic and geographical origin detection, DNA Profiling Kits (Easy DNA, Pro-filer, etc.) DNA fingerprinting of degraded samples, Slot-blot assay for quantification of DNA, DNA-DNA Hybridization, next generation sequencing, Nano-particle technology in PCR, Drug- DNA interactions, SNP microarray for supplementary paternity testing. Genetic analysis of chromosome X (pentaplex/heptaplex PCR assay), multicopy Y-STR analysis, mitochondrial DNA analysis, DNA multi-reverse parental analysis, cytochrome b analysis, cDNA Personal Effects and DNA analysis (sources and problems). DNA Profiling Applications: Case studies in disputed paternity cases, child swapping, missing person's identity, civil immigration, veterinary, wild life and agriculture cases ;Legal perspectives – legal standards for admissibility of DNA profiling – procedural & ethical concerns, status of development of DNA profiling in India & abroad; Limitations of DNA profiling; Population databases of DNA markers –STRs, Mini STRs, SNPs. Uses of STR Typing, New & future technologies: Microarrays technology, Synthetic DNA, analysis of Degraded DNA, Low Copy Number DNA, MALDI-ToF, Mass Spectrometry.

Module V: Forensic DNA evidence interpretation (12 hrs)

Interpretation of DNA typing results: Complicating Factors (Multiple contributors, degradation, and extraneous substances), System-specific Interpretational Issues (RFLP, PCR systems). Assessing strength of evidence: Determination of Genetic Concordance, Evaluation of Results, Frequency Estimate Calculations, Population Substructure, Likelihood Ratios, and Uniqueness of DNA Profile. Admissibility standards: Frye, Daubert, and the Federal Rules of Evidence, Landmark cases, The State of Debate. Prosecutor's fallacy, defendant's fallacy. Ethics of DNA analysis and Post conviction DNA analysis.

Recommended Reading:

1. Wiener, Alexander S; Advances in blood grouping II, Grune & Stratton, (1965).
2. Boorman, Kathleen E,Churchill ; Blood group serology Livingstone,1977.
3. Kabat, Elvin A ; Blood group substances,Academic Press, (1956).
4. Race, R R, Blackwell; Blood groups in man, ScientificPublications, (1975).
5. Mourant, A.; Distribution of the human blood groups, E,Oxford University Press, (1976).
6. Sussman, Leon N, Charles C Thomas ;Paternity testing by blood grouping, 1968.
7. Prakash, M ; Physicology of Blood, Anmol Publications, (1998).
8. Roitt, Ivan M,Blackwell ;Essential Immunology, Scientific Publications, (1977).
9. Gupta, S.K.; Essentials of Immunology,Arya Publications, (2008).
10. Clark, William R; Experimental foundations of modern immunology,John Wiley & Sons, (1986).
11. Fudenberg, H. Hugh; Basic and clinical immunology,Lange Medical Publications, (1976).
12. Gell, P.G.H.; Clinical aspects of immunology,Blackwell Scientific, (1975).
13. Nossal, G J V;Antigens, lymphoid cells, and the immune response, Academic Press, (1971).

14. T.J. Kindt, R.A. Goldsby, B.A. Osborne; Kuby Immunology, W.H. Freeman & company, (2004).
15. Brown, T; Gene cloning and DNA analysis: An Introduction, 5th ed. Blackwell publishing, London, 2006.
16. Butler, J; Advanced Topics in Forensic DNA Typing: Methodology, 1st Ed., Academic Press, London, 2009.
17. Easteal, S. McLeod, N. & Reed, K; DNA Profiling: Principles, Pitfalls and Potential, Harwood Academic Publishers, New Jersey, 1991.
18. Primorac, D & Schanfield, M; Forensic DNA Applications: An Interdisciplinary Perspective, CRC Press, New York, 2014.

FSC3 E23 COMPUTER AND SMART PHONE FORENSIC

Module I: Introduction to Computers (12 hrs)

Applications of computers in science, engineering, technology and communication – Applications of computers in forensic science. The computer system and CPU – Types of computers (Corporate, departmental, desk top – lap top personal computers) – The foundations of modern information technology – binary numbers, digital signals, Moore's law, bits & bytes, the binary code, CPU, the micro processor, the part of progress –Memory – ROM and RAM , Virtual memory – caches – buffers – machine cycle – registers – buses for input and output – adapter cards and multimedia systems – computer ports – USC and fire wire input and output devices – key board – mouse – OCR bar codes – Speech recognition graphics – scanners – Photoshop – digitalizing photos and video pointing devices – pixels and resolution fonts – Range of colour display screens – Types of resolution printers (Laser, dot matrix and ink jet, photo, colour & thermal) – Concepts of hard ware and soft ware. Storage devices and media – storage characteristics – tracks and sectors – storage media – floppy disks, hdd, optical discs, CDs, pen drives – Increasing data storage capacity – back up smart card.

Module II: Introduction to Operating Systems (14 hrs)

Introduction Mainframe systems, Desktop Systems, Multiprocessor Systems, Distributed Systems, Clustered Systems, Real Time Systems, Handheld Systems, Hardware Protection, System Components, Operating System Services, System Calls, System Programs, Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Inter-process Communication. Threads – Overview – Threading issues - CPU Scheduling – Basic Concepts – Scheduling (Criteria, Algorithms, Multiple-Processor, Real Time), The Critical-Section Problems with Synchronization. Other Operating Systems: Windows, Mac, Linux, Unix, Android, Ubuntu boot process and file systems, Working with those operating system on command prompt , understanding basic commands in operating systems, Operating system security, models of security and security evaluation criteria. Networking & network security concepts of these operating systems, Vulnerabilities of these operating system. System Model – Deadlock Characterization – Methods for handling Deadlocks -Deadlock Prevention – Deadlock avoidance – Deadlock detection – Recovery from Deadlocks - Storage Management – Swapping – Contiguous Memory allocation – Paging – Segmentation – Segmentation with Paging. Virtual Memory – Demand Paging – Process creation – Page Replacement – Allocation of frames – Thrashing - File Concept – Access Methods – Directory Structure – File System Mounting – File Sharing – Protection File System Structure – File System Implementation – Directory

Implementation – Allocation Methods – Free-space Management. Kernel I/O Subsystems - Disk Structure – Disk Scheduling – Disk Management – Swap-Space Management. Case Study: The Linux System, Windows.

Module III: Digital Forensic (18 hrs)

Principles of Digital Forensic, Collection of Evidence- Single System, Networked System and Remote System. Digital Forensic Evidence Seizure Methodology, Digital Forensic Software and Hardware tools – Proprietary and Open Source Tools. Imaging and Analysis of Storage Media – Tools and Techniques. Windows Systems and Artifacts: Windows file system, Registry, Event Logs, Shortcuts file, Executables. Linux System and Artifacts: Linux file system: Ownership and Permissions, Hidden Files, User Accounts and Logs. Mac OS X systems and Artifacts: System Startup and Services, Network Configuration, Hidden Directories, System Logs and User Artifacts. Application Password Cracking – Types and Tools for password cracking. Importance of Security & Authentication: Threats to data, who are enemies, what can these enemies do, security tools, antivirus packages, Security policies, Access Control, firewalls encryption, intrusion detection, Zero day or Zero hour attack, data interception, intranet and extranet services data protection system, routing protocols, Distributed denial of service attacks, DNS Security, critical infrastructure protection, real time communication security. Authentication: password based, address based , machine based, distributed system, electronic mail security, PGP, IP security, network management security, covert channel, captcha, ARP attacks route table modification, GSM & CDMA, TDMA, FDMA, SDMA Networks. Mobile ad-hoc networks, WAP.

Module IV: Smartphone/ Mobile Forensic (18 hrs)

History, Professional Applications, Types of evidence, Internal memory, External memory, Service provider logs, Forensic process, Seizure, Acquisition, examination and analysis, Data acquisition types, Manual acquisition, Logical acquisition, File system acquisition Physical acquisition tools, Commercial Forensic Tools, Open Source Tools, Forensic desoldering, Chip re-balling, JTAG, Command Line Tools, System commands AT commands dd Non-Forensic Commercial Tools, Flasher tools, controversies. Live Forensic : live response, volatile memory analysis, volatility, PTFinder, the impact on investigated system, memory image analysis, recovering cached and internet artifacts , internet browsing artifacts, volatile data acquisition, volatile forensic method, runtime disk explorer, logical acquisition, memory dump analyzer, crash dump analyzer, cryptanalysis, MAC times, metadata issues, analyzing file time stamps.

Module V: Image Forensic (18 hrs)

Detecting traces of re-sampling, more images are spliced together, detect high quality and consistent image forgeries, detect geometric transformations such as scaling, rotation or skewing re-sampling and interpolation. Detecting near–duplicated image regions, common type of digital image forgery, copy–move forgery, Noise inconsistencies analysis to conceal traces of tampering altered image regions. Application of cyclostationarity analysis to image forensics, (cyslostationary signals) exhibit periodicity in their statistics. Find the traces of geometric transformation shows promising results. Double JPEG compression, CFA analysis, quantization tables analysis, etc.

Recommend Reading:

1. Miller M.,: Absolute Beginner's Guide to Computer basics (5th Edn.), Que, 2009.
2. Miller M.,: Easy Computer Basics, Windows Vista Edition, Que (2008).
3. Jain, Atul: Cyber Crime – Issues, Threats and Management (Vol. 1 & 2) , Isha books Publishers, (2005).
4. Clark.F & Dileberto, K.,: Investigating Computer Crime , Boca Raton , CRC Press, 1996.
5. Tewari, R.K., Sastry, P. K., & Ravikumar, K.V., Computer Crime & Computer Forensics (2003).
6. Eoghan, C., Computer Crime Investigation, Academic Press (2002).
7. John, R. V., Computer Forensics, Firewall Media, (2002).
8. Jhon R. Vacca., Computer Forensics – Computer Crime Scene Investigation, 2'nd Edn., Charles River Media (Thomson), (2005).
9. Stephenson P,: Investigating Computer – Related crime, CRC Press (2000).
10. James, S.H., & Nordby, J.J.,: Forensic Science: An Introduction to Scientific & Investigative Techniques, 3rd Edn, (2009).
11. Guide to Computer Forensics and Investigations by Bill Nelson, Amelia Phillips, Christopher Stuart.
12. Digital Evidence and Computer Crime, Third Edition Eoghan Casey. Published by Elsevier Inc.
13. Andriod Forensic, Investigation, and Security by Andrew Hogg, Publisher Synergy.
14. Security in Mobile Communication by Professor Noureddine Boudriga
15. Mobile Malware Attacks and Defense By Ken Dunham.

FSC3 E24 CYBER FORENSIC AND CYBER SECURITY

Module I: Internet & Web Technologies (16 hrs)

Role of Networking in IT, Evolution and Impact of Internet, Internet Services, Internet Process-Concept of World Wide Web, History of World Wide Web, Purpose of Web, Functioning & Mechanism of Web, Web Hosting & Development, Website Legal Issues HTML (Elements, Attributes, Headings, Paragraphs, Formatting, Fonts, Styles, Links, Images, Tables, Lists, Forms, Frames, Iframes, Colors, Colornames, Colorvalues, Layout, Doctypes, CSS, Head, Meta ,Scripts, Entities, URLs, URL Encode, Webserver) XML, PHP, Installing PHP on wamp server PHP (Syntax, Variables, String, Operators, If...Else, Switch, Arrays, While Loops, For Loops, Functions, forms, GET, POST, Date, Include, PHP File, File Upload, Cookies, Sessions, E-mail, Secure E-mail, Error, Exception Filter) Cyberspace: - Concept of Cyberspace, Emergence of Cyberspace, Nature & Meaning of Cyberspace, Attributes of Cyberspace, Classification of Cyberspace, Legal Framework for Cyberspace.

Module II: Understanding vulnerabilities in Web Applications (16 hrs)

Understanding vulnerabilities in traditional client server application and web applications, client state manipulation, cookie based attacks, SQL injection, cross domain attack (XSS/XSRF/XSSI) http header injection. Introduction to PHP, MySQL, Apache, Server modules, HTML, CSS, Javascript/ Jquery**:** Browser Security, Authentication and session management, HTTPS goals and

pitfalls, web application security, secure web application, web threat models, web attacker, network attacker, malware attacker, secure user interface, secure user communication, cookies, frames and frame busting. http request, http response, rendering and events, html image tags, image tag security issue, java script on error, Javascript timing, port scanning, remote scripting, running remote code, frame and iframe, browser sandbox, policy goals, same origin policy, library import, domain relaxation, window, post message syntax, legacy browser behaviour, mixed content and network attack, cookies client state, cookie authentication, cookie security policy, secure cookies, http only cookies.

Module III: Secure Website Design (16 hrs)

Architecture and Design Issues for Web Applications, Deployment Considerations Input Validation, Authentication, Authorization, Configuration Management, Sensitive Data, Session Management, Cryptography, Parameter Manipulation, Exception Management, Auditing and Logging, Design Guidelines Summary SQL and command injection: Forms and validity, Technical implementation, Incorrectly filtered escape characters, Incorrect type handling, Blind SQL injection, Conditional responses, Mitigation, Parameterized statements, Enforcement at the coding level, Escaping, Pattern check, Database permissions, Examples, Sql injection Commands. Securing web application XACS.

Module IV: Circuit Switched Networks (16 hrs)

SONET - DWDM -Fiber to the Home - DSL - CATV - ISDN – Broadband ISDN. Wireless Networks: Mobile Communications technologies- wireless channel- Network design-Ad hoc Networks-Bluetooth technology. Recent Trends: Optical Networks - VoIP –Advanced intelligent Networks-Home networking. OSI, TCP/IP, IP, Addressing, CIDR, DHCP, IPV6, TCP, ARP, RARP, ICMP, VPN, VLAN, DNS, RIP, Wireless, IEEE 802.11, IEEE 802.16, Bluetooth, SIP, VOIP, CTI, ATM: Addressing Signaling & Routing - Header Structure - ATM Adaptation layer - Management control. Internetworking with ATM: LAN - IP over ATM - Multiprotocol over ATM - Frame Relay over ATM.

Module V: Network Architecture & Security (16 hrs)

Network Scanning, Eaves dropping techniques and counter measures. Network security including firewalls. Internet and E-commerce security issues. Networks and vulnerabilities, networking software - Client side and server side, secure network infrastructure, security protocol layers, create usage policy, conduct risk analysis, security violation and restoration. Network security zone, encapsulation of network services, allocation of traffic control functions. Internal boundary systems. Hardening a Network - Basic services, extended services, Perimeter defence tools, Cryptographic tools, Systems penetration testing, Studying computer forensics issues associated with computer networks, telecommunications and distributed systems. Wireless Network Security – Introduction and Standards, Vulnerabilities, Countermeasures, Management Issues of Wireless and Mobile Devices. Network & Anti-Computer Forensics: Ethernet analysis, Network interface card analysis, wireless forensic, attackers footprints, firewall logs, IDS/IPS, web proxies, traffic captures, DHCP log examination, sniffing traffic, analyzing proxy cache, tools like tcpdumps, Snort, ngrep, tcpxtract, and wireshark. Email tracker pro, analyzing index.dat, input debugging, controlled flooding, ICMP traceback, packet marking techniques, honeypots and honeynets, source path isolation engine (SPIE). Anti-Computer Forensic: Definition, Sub-categories, Purpose and goals, Data hiding, Encryption, Steganography, Other forms of data hiding, Artifact wiping,

Disk cleaning utilities, File wiping utilities, Disk degaussing/ destruction techniques, Trail obfuscation, Attacks against computer forensics Physical, Effectiveness of anti-forensics.

Recommended Reading:

1. Walrand.J. Varaiya, High Performance Communication Network, Morgan Kauffman - Harcourt Asia Pvt Ltd, 2nd Edition, 2000.
2. William Stallings, ISDN & Broadband ISDN with frame Relay & ATM, PHI 4th Edtion 2000.
3. Uyless Black, Emerging Communications Technologies2/e Prentice Hall 1997.
4. Bates & Donald W.Gregory, Voice & Data Communications Handbook, Mc-Graw Hill, Edition, 3rd edition 2000.
5. Behrouz A Forouzan and Firouz Mosharraf, Computer Network (A Top-Down Approach), TMH.
6. Andrew S. Tanenbaum, Computer Network, 4th Edition, Pearson Prentice Hall.
7. Optical Networking Best Practices Handbook by John R. Vacca.
8. R.C.Gonsales R.E.Woods, "Digital Image Processing", Second Edition, Pearson Education.
9. Anil K. Jain, "Fundamentals of Image Processing", PHI William Pratt, "Digital Image Processing", John Wiley.
10. R.O.Duda, P.E.Hart and D.G.Stork, "Pattern Classification 2nd Edition", John Wiley, 2007.
11. Milan Sonka,Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision" Thomson Learning.
12. B. Chanda, D. Dutta Majumder, "Digital Image Processing and Analysis", PHI.
13. E. Gose, R. Johansonbargh, "Pattern Recognition and Image Analysis", PHI.
14. Harvey M. Deitel, "Operating Systems", Second Edition, Pearson Education Pvt. Ltd, 2002.
15. Andrew S. Tanenbaum, "Modern Operating Systems", Prentice Hall of India Pvt. Ltd, 2003.
16. William Stallings, "Operating System", Prentice Hall of India, 4th Edition, 2003.
17. Pramod Chandra P. Bhatt – "An Introduction to Operating Systems, Concepts and Practice", PHI, 2003.
18. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", Sixth Edition, John Wiley & Sons (ASIA) Pvt. Ltd, 2003.
19. Web security and commerce by simson garfinkel.
20. Foundations of security by neil daswani, anita kesavan.
21. Hacking Exposed Web Applications, Second Edition by Joel Scambray, Mike Shema, Caleb Sima Professional Pen Testing for Web Applications by Andres Andreu.
22. Preventing Web Attacks with Apache by Ryan C. Barnett.

FSC3 C25 PRACTICAL

1. Photography of indoor crime scene.
2. Photography of outdoor crime scene.
3. Digital photography.
4. Enlargement and printing of photographs (digital/films).
5. Presentation of evidence through photographs and charts.
6. Document photographic techniques-close up photography, UV, IR, Transmitted and Oblique light photography.
7. Contact and trick photography.
8. Photography of secret writings.
9. Indoor Crime Scene Investigation (Indoor/Outdoor/Mobile/Water)
10. Crime Scene Sketching (Baseline Method, Triangulation Method, Polar-coordinate Method)
11. Blood Spatter Analysis (Height of fall, Angle of Impact, Velocity, etc.)
12. Crime Scene Reconstruction of Various Scenarios (Hit n Run, Burglary, Murder, etc.)
13. Collection and Packaging of different evidences (Biological/Physical/Chemical)
14. Latent Fingerprint Development using Powder Methods
15. Casting/Lifting/Evaluation of Footprints/Footwear Impressions
16. Casting/Lifting/Evaluation of Tyre marks/skid marks
17. Casting/Lifting/Evaluation of tool marks on different objects
18. Serial number restoration on various surfaces
19. Classification/Lifting/Analysis of Lip prints
20. Casting/Lifting/Evaluation of Ear prints
21. Casting/Lifting/Evaluation of Bite marks on various surfaces.
22. Photography and sketching of crime scene involving firearms.
23. Collection, packing and forwarding of physical clues related to crime involving fire arms.
24. To perform chemical tests for powder residues (Walker's test) around gun-shot holes in fabrics.

FSC3 E26 PRACTICAL

1. Laboratory Equipments:- Working and handling of Stereo Zoom Microscopes, Comparison Microscope, Video Spectral Comparator, Electrostatic Detection Apparatus.
2. Forensic identification of class and individual characteristics of handwriting
3. To detect and decipher alterations in a document
4. To decipher secret writings, indentations and charred documents.
5. To study the handwriting of ethnic and population groups.
6. Reconstruction of torn sheets of paper.
7. Examination of creases and folds and determination of sequence of strokes.
8. Examination of paper.
9. Analysis of inks by TLC.

10. Identification of normal/ disguised writings.
11. Detection of built-up documents.
12. Examination of anonymous letters.
13. Application of Forensic Stylistics in personal identification.
14. Effect of writing instruments, posture and emotions on handwriting.
15. Examination of rubber stamp impressions and other mechanical impressions.
16. Determination of relative age of the document.
17. To obtain class characteristics of fingerprints
18. To obtain individual characteristics of fingerprints
19. Study of pores on friction ridges
20. Sweat Analysis of palmer and plantar surfaces.
21. To perform ridge tracing and ridge counting.
22. Fingerprint classification using Henry system
23. To measure the Gait of Individuals under various circumstances
24. To study various wear and tear characteristics on footwear
25. To examine anatomical difference in footprints of individuals. Under various circumstances.

FSC3 E27 PRACTICAL

1. Florescence examination of glass samples and determination of U.V. absorption cut-off of transparent sheet.
2. Studies of hackle and rib marks in radial and concentric fractures in a glass sheet caused by pointed tool at different angle.
3. Determination of number of layers, sequence of layers and their thickness in paint chip.
4. Microscopic and spectroscopic examination of man-made fibre.
5. To detect adulteration in cement samples.
6. To determine the ratio of cement, fine aggregate and course aggregate in cement concrete sample.
7. Comparison of control soil samples with soil sample taken from victim/suspect by density gradient distribution method.
8. Determination of ignition loss and pH of soil samples.
9. Mineralogical study of soil samples.
10. Physical and microscopic studies of affected electric wires, panel boards due to electrical overload and short-circuit.
11. Studies of cut-marks/tear marks characteristic on cloths using different cutting and tearing tools.
12. Studies of cut-marks striations on metallic wire cut-ends using cutting pliers and its linkages with cutting plier tools.
13. Studies of different characteristics hammer impressions of iron metal sheet and their linkage with the hammers used.
14. Studies of cut marks striations using motorized hacksaw blade and hand driven hacksaw tool.
15. Photographic juxtaposition comparison of tool marks striation.
16. Study of microscopic characteristics of fused bulb filaments of vehicle head light.
17. Photography of road signs, road signals, pavements and road markings and its documentations.

18. To separate different components of shotgun cartridges, identify them and record their different measurements.
19. To separate different components of all-metal cartridges, identify them and record their different measurements.
20. To dismantle and assemble various components of firearms.
21. To study the characteristics of firearms-caliber, choke, proof marks etc., to prepare sulphur casts of bore.
22. To study the locks of various firearms, measurement of trigger pull, liability of accidental discharge of firearms.
23. To determine shot number from size and weight of shots
24. Determination of velocity and energy of bullets.
25. Comparison of compression/ striated tool marks - to prepare cast/sample for study of compression and striated tool-marks.
26. To determine whether given ammunition/ components of ammunition are fired or not.
27. TLC/ HPTLC/HPLC/GC of propellants loaded in shotgun, rifle and handgun cartridges.
28. IR spectra of propellants loaded in shotgun, rifle and handgun cartridges
29. FTIR analysis of propellants particles found inside the fired cartridge case, barrel and on the target around gun-shot hole- comparison of results.
30. Preparation of gel block and study of wound ballistic parameters for bullets fired from handguns and .22-rifle – determination of entry, exit and path of the bullet on fired gel block.

FSC3 E28 PRACTICAL

1. Analysis of liquor as per, BIS specifications.
2. Analysis of country liquor and denatured spirit by Gas Liquid Chromatography.
3. Analysis of petrol, kerosene and diesel by chemical physical and gas liquid chromatograph for detection of adulteration of petrol and diesel with kerosene.
4. Detection and identification of pesticide in a given formulation by colour test, TLC and UV-visible spectrometer/GLC.
5. Analysis of dyes by TLC and UV-visible spectrometer.
6. Comparison of component of cosmetic stain from crime scene and suspect is clothing by spectrophotometry method UV/FTIR.
7. Chemical analysis of given fertilizer by chemical test and instrumental techniques.
8. Analysis of dye and pigments by using TLC technique.
9. Analysis of phenolphthalein in trap cases by UV-Visible.
10. Analysis of phenolphthalein in trap cases by TLC and HPLC.
11. Analysis of alcohol content in sample by derivatization into known organic compounds and its analysis by GC.
12. Analysis of alcohol content in sample by derivatization into known organic compounds and its analysis by GCMS, HPLC.
13. Detection of adulteration in oils and fats by chemical analysis and TLC/ HPTLC.
14. Determination of Mercury in biological materials by spectrophotometry.
15. Analysis of animal Poisons using TLC.
16. Analysis of Plant poisons using TLC.
17. To study the separation of metal ions by paper chromatography.
18. Determination of alcohol in blood and urine sample. .
19. Analysis of food material in case of food poisoning by chemical, microscopic and instrumental techniques.

20. Analysis of viscera in case of food poisoning by chemical, microscopic and instrumental techniques.
21. Comparison of polythene films by IR spectrophotometry.
22. Analysis of viscera for volatile Organic and inorganic poisons.
23. Analysis of non- metallic (anionic) poisons in viscera.
24. Analysis of viscera for organochloro, organophosphoro, carbamates and pyrethroids by colour test TLC/HPTLC and UV-visible spectrometry method.
25. Determination of poisonous metals in biological materials by AAS.
26. Analysis of Na and K contents in soil sample by Flame Photometry.

FSC3 E29 PRACTICAL

1. Confirmatory tests of blood, semen, saliva, vomit etc.
2. Identification of species (precipitin test)
3. Blood grouping.
4. ABO grouping from hair root
13. Rh grouping of bloodstains
14. MN grouping of blood stains
15. Experiments on electrophoresis of red cell isozymes viz. PGM, GLO, EsD, EAP, ADA, AK.
16. Experiments on electrophoresis of serum proteins Hp, Tf, C3, Bf, Gc etc.
17. Experiments on separation of SAP/VAP.
18. DNA – isolation from blood and bloodstains.
19. DNA – Isolation from bones.
20. DNA – Isolation from teeth.
21. DNA – Isolation from organs/tissues.
22. DNA – Isolation from saliva stains.
23. DNA – Isolation from hair root.
24. DNA – Isolation from other seminal stains
25. DNA – Isolation from nails.
26. DNA – Isolation from vegetable material.
27. Quantity and quality assessment of DNA extracted by various methods from different biological samples.
28. PCR – amplifications and STR typing through vertical polyacrylamide gel electrophoresis and silver staining.
29. PCR – amplifications and STR typing with automatic DNA sequencer.

FSC3 E30 PRACTICAL

1. Encrypting and Decrypting the partition using Bitlocker
2. Analysing the image file for hidden files and folders including slack space.
3. Wireless Network attacks, Bluetooth attacks
4. Drive and partition carving process
5. Malware – Keylogger, Trojans, Keylogger countermeasures
6. Understanding Data Packet Sniffers

7. Understanding the buffer overflow and format string attacks
8. Using NMAP for ports monitoring
9. Working with Trojans, Backdoors and sniffer for monitoring network communication
10. Implementing Web Data Extractor and Web site watcher.
11. Using IP TABLES on Linux and setting the filtering rules
12. Configuring S/MIME for e-mail communication
13. Lan Scanner using look@LAN, wireshark.
14. Advance firewall auditing
15. Auditing with and without network traffic
16. Auditing Authentication, Authorization, accounting and logging configuration
17. Intrusion detection and prevention configuration
18. Implementing Web Data Extractor and Web site watcher.
19. Using IP TABLES on Linux and setting the filtering rules
20. Configuring S/MIME for e-mail communication

FOURTH SEMESTER

FSC4 C31 COMPULSORY PROJECT/ DISSERTATION

A part of the project/ dissertation shall be done in collaboration (association) with CFSL/FSL/RFSL/FPB/Chemical Examiner's Laboratory/ Kerala Police Academy/ Any other State or Central Institutions of Forensic importance.

FSC4 E32 ADVANCED FINGERPRINT DEVELOPMENT METHODS

Module I: Powder Method (16 hrs)

Traditional powder, Magnetic Powder, Luminescent powder, Thermoplastic Powder, Nanotechnology Powder, Anti stroke Powder. Powder suspension technique:-Small particle reagent, Black powder suspension, White powder suspension, fluorescent suspension, Operational usages and sequencing, etc

Module II: Advanced Methods (16 hrs)

Radioactive technique, Biological technique, reflected ultraviolet Imaging system, X-ray fluorescence, Chemical imaging. Challenging surface: Thermal Surface- Solvent treatment, amino acid/Protein reagent, Fuming method. Metallic reagent- Gun bleaching method, Oxidation reduction method, Electrochemical/corrosion method, Fuming method. Glows- Deposition and development latent print on glows. Adhesive tape-Tape separation method, processing the adhesive and non adhesive side of tape. Skin- Iodine silver plate transfer, Electronography, Powder method, Cyno-acrylate fuming, Iodine-Napthoflavone, Direct lifting method.

Module III: Chemistry & Reaction Mechanisms (16 hrs)

Amino acid reagent, Ninhydrin-Chemistry and reaction Mechanism, Forensic application. Metal salt enhancement, Ninhydrin analogous, first analogous, aryl, alkyl and alkoxy analogous, 1,8-Diazafluoren-9-One and 1,2-Indanedione, miscellaneous amino acid reagent-p-Dimethylaminocinamaldehyde, NBD chloride, Dansyal chloride, o-Phthalaldehyde, Fluorescamine, Genipin**.** Cyanoacrylate fuming, health and safety precaution, Cyanoacrylate pretreatment, atmospheric and vacuum CA fuming, Chemistry of CA dye stains- Ardrox, basic yellow 40, MBD, Rhodamine 6G, MRM 10, RAY, thenoyl europium chelate, gentian violet, sudan black. Iodine fuming, Iodine fixation, Operational uses- vapor method, dusting method, Solution method, miscellaneous fuming method-Osmium/ruthenium Tetroxide, soot method, Disulfur dinitrite, etc.

Module IV: Metal Deposition Methods (16 hrs)

Silver nitrate, Physical developer- Chemistry and mechanism, Sequencing, regent reliability test, bleach toning, potassium iodide toning, other toning process. Single Metal Deposition, Multi-metal deposition- I, II, III, IV, fluorescent and vacuum metal deposition-reaction mechanism,

conventional gold zinc process, sequencing. Lipid Reagent: Sudan black, chemistry and mechanism of Oil red O, nile red, Europian chelate, etc. Nanoparticles in Fingerprinting.

Module V: Automated Fingerprint Identification System (16 hrs)

Fingerprints and AFIS, History of automated identification system: Early print, single database, growth and development of AFIS system, Transmission standard, ANSI standard, compression standard. NCIC classification system, Henry and American classification system, working of AFIS- Database, processing ten print, latent print processing, latent search. Types of AFIS searches: Ten print to Ten print search, Latent to ten print search, Latent to latent search. AFIS report: Ten print report and latent print report.

Recommended Reading:

1. Moenssens: Finger Prints Techniques, 1975, Chitton Book Co., Philadelphia, New York.
2. Mehta, M. K.: Identification of Thumb Impression & Cross Examination of Finger Prints, 1980 N. M. Tripathi (P) Ltd. Bombay.
3. Bridges: Practical Finger Printing, 1942, Funk and Washalls Co. New York.
4. H.C. Lee, R.E. Gaensslen "Advances in Fingerprint Technology", 2nd ed. NY: CRC Press, 2001.
5. S.A. Cole, Suspect Identities: A History of Fingerprint and Criminal Identification. Harvard Univ. Press, May 2001.
6. Cherril, F.R. : The Finger Prints. System at Scotland Yard, 1954; Her Majestuy's office, London.
7. C. Champod and P.A. Margot, ªComputer Assisted Analysis of Minutiae Occurrences on Fingerprints, Proc. Int'l Symp. Finger-print Detection and Identification, J. Almog and E. Spinger.
8. E. Roland Menzel; Fingerprint Detection with Loseres; Second edition; Marcel Dekker, Inc. 1999.

FSC4 E33 FORGERY AND ITS FORENSIC DETECTION

Module I: Types of forgery (20 hrs)

Types of forgery, attributes of assisted hand signatures, disguise, discriminators of device, flag of forgery and characters of genuineness, indicators of illiteracy, sign of senility, symbol of sinistrality, gender discrimination. Scope of questioned document examination. Anachronistic features and their importance, detection and decipherment of alterations and erasures including additions, over writings, obliterations, examination of carbon copies and carbonless copies.

Module II: Examination of signatures (20 hrs)

Examination of signatures – characteristics of genuine & forged signatures, examination of built-up of documents, identification of writer of forged writings/signatures. Importance of tremor in identification of writings and signatures, difference between tremors of fraud and genuine tremors

in writings and signatures, hesitations, factors responsible for variations (under threat, while travelling, illness, old age, mental state, etc.).

Module III: Forensic accounting and auditing (16 hrs)

Corporate frauds, forensic accounting and auditing, Use of computers in document examination, automated Signature verification system, determination of age of documents- relative and absolute age of documents, case studies. Examination of security documents including currency notes, Revenue stamps, travel documents - passports, visas, air - tickets, identity cards, lottery tickets, driving license, Bills, educational and financial documents, etc. different types of security features and their examination including watermarks, wire marks, security fibre/threads, Ghost/imitated marks/ security printing, optical variable inks, holograms and all other security features.

Module IV: Forensic examination of digital and other documents (24 hrs)

Types and working of Photostat machine, fax machine, printers, scanners. Identification & linkage of Photocopies and photocopier, typewriter, fax machine, scanner, Desktop printing including image processing device, their role in counterfeit currency and certificate etc. Holographic mark and their examination, Examination of credit, debit and other plastic cards, examination of photocopies, scanned documents, Fax copies etc., and case studies. Numismatic forgery- Introduction, tool, equipments and other resource, method of forgery- alteration, tooling, embossing, application and plating, Casting: Rubber mold model, wax model from mold, Burn out wax, treatment of casting, Creating dye- Cutting by hand, plating, casting and hubbing. Explosive impact copying preparation of detail report with reasons and illustrative charts, uses of standard terminology.

Recommended Reading:

1. Ordway Hilton; Scientific Examination of Questioned Documents. Revised Edition, Elsevier, NY (1982).
2. Albert S. Osborn; Questioned Documents, 2nd Ed., universal Law Pub., Delhi (1998).
3. Albert S Osborn; The Problem of Proof, 2nd Ed., Universal Law Pub. Delhi (1998).
4. Charles C. Thomas; I.S.Q.D. Identification System for Questioned Documents, Billy Prior Bates Springfield, Illinois, USA (1971).
5. Wilson R. Harrison; Suspect Documents Their Scientific Examination, Universal Law Pub. Delhi Indian Reprint (2001).
6. Hard less H.R; Disputed Documents. Handwriting and Thumb – Print Identification, profusely illustrated, Law Book, Allahabad (1988).
7. Morris Ron N; Forensic Handwriting Identification, Acad Press, London (2001).
8. Kurtz Sheila; Graphotypes a new Plant on Handwriting Analysis, Crown Pub. Inc., USA (1983).
9. Lerinson Jay; Questioned Documents, Acad Press, London (2001) Vacca John R; Computer Forensics- Computer crime scene Investigation, Firewall Medial, An imprint of Laxmi Pub(2002).
10. Casey Eoghan; Handbook of computer crime Investigation, Forensic Tools & Technology- Academic Press (2002).
11. Ellen Davin; Questioned Documents – Scientific Examination, Taylor & Francis, Washington (1997).
12. Roy A Huber, AM Headrick, Handwriting Identification-Facts & Fundamental, CRC Press (1999).

13. Andrea Mc Nichol, Jeffrey A Nelson; Handwriting Analysis Putting it to work for you, Jaico Books, Delhi (1994).
14. Morris (2000); Forensic Handwriting Identification (fundamental concepts & Principals).
15. Madinger J & Zalopany AR; (1999) -Money Laundering- CRC Press.
16. Manning CA;(1999) -Financial Investigation & Forensic Accounting- CRC Press.
17. Brewster F.; Contested Documents and Forgeries," The Eastern Law House, Kolkata.
18. Quirke AJ; Forged Anonymous & Suspect Documents- 1930, Reorge Rontledge & Sons Ltd, London.
19. Katherine M Kappenhaver, CDE-Forensic Document Examination-Humana Press.
20. Jan Seaman Kelly & Brian S Lindblom-Scientific Examination of Questioned Documents-Taylor Francis Group London and New York.

FSC4 E34 FORENSIC AUDIO VIDEO ANALYSIS

Module I: Mechanism of speech Production (16 hrs)

Speech Anatomy, Mechanism of speech Production, Acoustic Properties of Vocal Tract, Uniqueness in person's voice, interspeaker and intraspeaker variation. Articulation- Manner & Place of Articulation, Phonemes, Vowel, Consonant and Glides, Phonetics in Speaker Identification, IPA (The International Phonetic Alphabets), Forensic Phonetics, Effect of context, Supra segmental (Prosodic features). Audio-enhancement, Sound Recording/Playback Devices: Analog Tape recorders, Digital recorder, Microphone types, Digital audio formats. Apex Court Judgments on Speaker Identification. Court presentation of report based on speaker Identification.

Module II: Digital Signal Processing (20 hrs)

Digital Signal Processing, A to D Conversion- Sampling, Quantization, Digital Audio Formats, Pulse Code Modulation, Coding and Decoding, Computer Representation of Speech Speaker Recognition: Principles of speaker recognition/identification, Methods on Speaker Recognition. Various approaches in Forensic Speaker Identification, Interpretation of result, Statistical interpretation of probability scale, Objective/Subjective methods, discriminating tests, closed test, open test, likelihood ratio calculation, Concept of test and error in Speaker Identification. Introduction to Pattern Recognition, Pattern Recognition application in Automatic Speaker Identification and Verification System, Different algorithm of automatic speaker identification.

Module III: Audio Evidence Examination (20 hrs)

Audio Evidence Examination: Handling of audio recording evidences, Procedure for preparation of working copies, Phonetic transcription, Analysis of linguistic & phonetic characteristics, Temporal measurement, Text-dependent and text-independent speaker recognition. Instrumental Analysis of speech sample: Verbatim, Clue words, IPA marking, CSL & Linear predictive coding technique, Fourier transformation, Examination using SPID, Vocal behaviours-alcohol speech relationships. Authentication of recorded audio: Type of alterations, Auditory Examination by Critical Listening. Waveform analysis, Speech Spectrographic analysis, Magnetic developing, Optical Method.

Module IV: Introduction to video technology (14 hrs)

Video standards, Recording formats- Analog and Digital, Introduction to video devices, Linear and Non-linear editing, Concept of video film production, Graphics and animation technique. Image perception, Colour space & representation, Storage, Image processing application. Introduction to image enhancement, Image restoration, Concept of digital water marking, Image compression, Retrieval of video files, Integrity of images, Facial image recognition. Forensic analysis of audio/video in video recording: Authentication of video recording, Visual examination technique on video frame sequence, Video image analysis- object, costumes, Facial image recognition from video frame image, Video signal analysis.

Module V: Biometrics (10 hrs)

Biometric evidences such as finger impressions, retina, iris pattern, voice, gait pattern, face recognition, 3D face recognition, Geometric Morphometrics, automatic forensic dental identification, hand vascular pattern technology, Multibiometric systems, Recent developments, biometric databases.

Recommended Reading:

1. Arthur R Weeks Jr; Fundamentals of Electronic Image. SPIE Press, (2003)
2. Bengold & Nelson Moryson; Speech and Audio signal processing, John Wiley & Sons, USA (1999)
3. D.B. Fry; The Physics of Speech, Cambridge University Press. (2004)
4. David Cheshire; The Complete Book of Video Techniques Subjects Equipment, Dorling Kindersley, London (1992)
5. Des Lyver & Graham Swainson; Basics of Video Production, 2nd Ed. Focal Press (1999)
6. Dwight Bolinger et. al.; Aspects of Language, Third Edition, Harcourt Brace Jovanovich College Publishers, USA. (1981)
7. Gloria J. Borden et. al. Speech Science Primer (Physiology, Acoustics and perception of Speech), 6th Ed, a Wolters Kluwer Company, USA. (2011)
8. Harry Hollien; Forensic Voice Identification, Academic Press, London. (2001)
9. Harry Hollien; The Acoustics of Crime- The New Science of Forensic Phonetics, Plenum Press, New York and London (1990)
10. Husrev Taha Sencar, Nasir Memon; Digital Image Forensics: There is More to a Picture than Meets the Eye. Springer (2013)
11. John C. Russ; Forensic Uses of Digital Imaging CRC Press, (2001)
12. Martin Uren; BKSTS Illustrated Dictionary of Moving Image Technology, 4th Ed, CRC Press, (2013)
13. Oscar Tosi; Voice Identification-Theory of Legal Applications, University Park Press, Baltimore (1979)
14. O'Shaughnessy, Douglas; Speech Communication, Hyderabad Universities Press (India) Pvt. Ltd. (2001)
15. Patricia Ashby; Speech Sounds, 2nd Ed. Routledge, London and New York (2005)
16. Philip Rose; Forensic Speaker Identification, Taylor and Francis, Forensic Science Series, London (2002)
17. Randy Crane; A Simplified Approach to Image Processing, Prentice Hall. (1996)

18. Simon J. Godsill; Digital Audio Restoration, Springer, (1998)
19. Gary H. Anderson; Video Editing and Post-Production- A Professional Guide, 4th Ed, Focal Press, (1998).
20. Iannavelli, A.V; Ear Identification, Forensic Identification Series, Paramount, (1989).
21. Jain, A.K., Flynn, P & Ross A.A., Handbook of Biometrics, Springer, New York (2008).
22. Fred L. Bookstein. Morphometric tools for landmark data: Geometry and biology. Cambridge University Press, (1991).

FSC4 E35 ADVANCED FORENSIC BALLISTICS

Module I: Identification of fired firearm (28 hrs)

Testing of barrel wash, chemical tests for testing of lead/ copper around gun-shot holes in clothes, skin and other objects, use of instrumentation techniques in identification of gun-shot holes. Determination of time elapsed since firing, usefulness, different methods employed and their limitations, attempts based on analysis of residue inside the barrel left after the firing of cartridges loaded with black/smokeless powders, attempts based on analysis of CO, CO2, nitrogen oxides, etc., reasons for not being able to estimate time elapsed since firing. Use of instrumentation techniques for analysis of propellant particles found on hands of shooter, fired cartridge case, barrel and target.

Module II: Restoration of erased numbers (24 hrs)

Restoration of erased numbers, methods of marking-cast, punch and engraved, methods used for removal of serial numbers, theory behind number restoration, restorations of marks on cast iron, aluminum, brass, wood, leather etc., chemical methods of restoration (etching), reagents used for various metals, electrolytic methods of restoration-reagents used, ultrasonic cavitation for restoration, magnetic particle method for restoration, other methods of restoration, laser etched serial numbers and bar codes and their restoration, recording of restored marks. Gun-handling tests-Introduction, Ferrozine test. Ballistics Data Measurement System.

Module III: Shooting reconstruction (28 hrs)

Reconstruction of sequence of events involved in a shooting case, theory and practice of shooting reconstruction, scientific method of shooting reconstruction, suicide, murder, accident, self-defence, encounter cases. All considerations during direct investigation of shooting incident or without the benefit of original crime scene investigation- the scene of occurrence, photography of crime scene, sketching of crime scene, medico-legal report, basic ballistic facts, laboratory examination reports, firearms and ammunition, clothes of victim etc. On scene evidence-evaluation and documentation, off –scene evaluation and investigation, limitations of shooting reconstruction, simple mathematics involved in shooting reconstruction. Documentation & evaluation of bullet holes, ricochet marks, pellet patterns, estimation of angle of impact, bullet holes in tires and other plastic materials determination of bullet path-use of lasers, cartridge case ejection pattern. Plotting of gun-shot injuries on body-diagrams, evaluation of gun-shot injuries, to determine wounds of entry/ exit, direction of firing, number of rounds fired etc., reconciliation of bullet holes in clothes with underlying wounds, use of blood spatter in reconstruction.

Determination of number of participants/firearms involved, their location, position, orientation at the moment of firing, discussion of some important and complicated cases.

Recommended Reading:

1. Sharma, B.R.; Firearms in Criminal Investigation & Trials, Universal Law Publishing Co Pvt Ltd, New Delhi, 4th Edn,(2011).
2. Mathews, J.H; Firearms Identification, Vol I, II and III, Charles C. Thomas, USA, (1977)
3. Hatcher, Jury and Weller; Firearms Investigation, Identification and Evidence, Stackpole Books, Harrisburg, Pa,(1997)
4. Heard, B.J; Handbook of Firearms and Ballistics, John Wiley, England, (1997)
5. Warlow, T.A.; Firearms, The Law and Forensic Ballistics, Taylor and Francis, London,(1996)
6. Jauhari M; Identification of Firearms, Ammunition, & Firearms Injuries, BPR&D, New Delhi.
7. Burrard; The Identification of Firearms and Forensic Ballistics, Herbert Jenkins, London, (1956)
8. Gunther and Gunther; The Identification of Firearms, New York, (1935)
9. Wilber; Ballistic Science for the Law Enforcement Officer, Charles C. Thomas, USA, (1977)
10. Lucas ; Forensic Chemistry and Scientific Criminal Investigation, London, (1945)
11. Williams, Practical Handgun Ballistics, Charles C. Thomas, USA, (1980)
12. Nonte, Jr, Firearms Encyclopedia, Wolfe Publishing Limited, London, (1973)
13. Davis, J.E, An Introduction to Toolmarks, Firearms & the Striagraph, Charles C. Thomas, USA, (1958)
14. Hueske, Practical Analysis and Reconstruction of Shooting Incidence, CRC Press, NY,(2006)
15. Saferstein, Criminalistics, Prantice Hall, NJ, (1995)

FSC4 E36 EXPLOSIVES AND EXPLOSION

Module I: Introduction to Explosives (24 hrs)

Chemistry of explosives, Temperature of chemical explosion, Force and pressure of explosion, Kinetics of explosive reactions. Types of explosives (primary & secondary explosives) Differentiation between High and Low Explosives. General methods of manufacture of explosives.

Module II: Type of Explosions (16 hrs)

Types of Explosions: Atomic explosion, Physical explosion, Chemical explosion, Explosion and effects, Type of hazards, Effect of blast wave on structures and human etc.

Module III: Development of explosives (28 hrs)

Black powder, Nitro Cellulose, Nitro Glycerin, Dynamite, Ammonium nitrate, Commercial explosives (permitted explosives, ANFO and slurry explosives), Military explosives (picric acid, tetry TNT, Nitro guanidine, PETN, RDX, HMX and polymer bonded explosives), IEDs.

Module IV: Post Blast Investigation **(12 hrs)**

Bombs, Crude bombs, Home-made bombs, Improvised Explosive Devices (IEDs), Molotov Cocktail, Disposal of bombs, Explosions effects, Role of Forensic Scientist in Post blast investigation, Collection of samples, Colour tests, Methods for extraction of explosive from post blast material/ debris, Qualitative analysis of explosives and explosion residue by colour test, TLC/HPTLC and High Performance Liquid Chromatography and FTIR, GC-mass. X ray diffraction, ICP for metallic component analysis, equipment used for Detection of explosives and explosive device. Technical report frame work, Evaluation and assessment of explosion site and reconstruction of sequence of events.

Recommended Reading:

1. Akhavan Jacqueline : Chemistry of Explosive, The Royal Society of Chemistry (2004)
2. Saferstein R : Criminalistics : An Introduction to forensic Science
3. Asthana N.C and Nirmal Anjali; The Ultimate Book Of Explosives, Bombs and I E Ds , Pointer Publishers (2008). 4. Suceska, T; Test Methods for Explosives, Springer (1995).
4. Working Procedure Manual on Explosives, Directorate of Forensic Science MHA Govt. of India (2005)
5. Cooper PW and Kurowski S R; Introduction to the Technology of Explosive VCH publisher
6. Cooper P. W; Explosive Engineering, VCH publisher (1997).
7. Urbanski T; Chemistry and Technology of Explosives, Pergamon Press (1985).
8. Lurie Iras & Witwer J D ; High Performance Liquid Chromatography in Forensic Chemistry, Marcel Dekker (1983)
9. Feigl F ; Spot Test in Inorganic Analysis , Elsevier Publ. New Delhi (2005)
10. Feigl, F ; Spot Test in Organic Analysis , Elsevier Publ .New Delhi (2005)
11. Yallop H J ; Explosion Investigation ,Forensic Science Society Academy press (1980)

FSC4 E37 PHARMACOLOGY AND FORENSIC ANALYSIS OF DRUGS

Module I: Drugs, Other Chemicals **(20 hrs)**

Introduction, Pharma drugs (barbiturates, benzodiazepine & other pharma drugs), Substance abuse, Drug abuse in sports & Date rape drugs: Introduction, common prohibited substances, analytical approach, Forensic Pharmacological studies, Ingestion of drugs, absorption, distribution, metabolism, pathways of drug metabolism, drug metabolism and drug toxicity, excretion of drugs, detection of drugs on the basis of their Metabolic studies. Solvent Abuse (chlorinated hydrocarbons, Aromatic hydrocarbons, alcohols, glycols, fuel and fuel additives): absorption, distribution, and metabolism, psychological & clinical effects. Analysis: collection of sample, distillation & extraction, Analysis by GC, HPLC. Legal Aspect:- Case Studies and Relevant Provisions of – The Drugs Control Act, 1940. The Drugs and Cosmetics Act, 1940. etc.

Module II: Drugs commonly encountered for analysis **(16 hrs)**

Narcotic drugs, depressants, stimulants, hallucinogens, designer drugs, club drugs, drugs of sports and precursors. Field test, colour test, micro crystal test, thin layer chromatography. Performance Enhancing Drugs in sports.

Module II: Analysis of Narcotic & Psychotropic drugs (20 hrs)

Opium (alkaloids, morphine, heroin and opioids), Cannabis and its derivatives (Bhang, ganja, hashish (Charas) and Cocaine, Depressants: Barbiturates, methaqulone, benzodiazepines Stimulants: Methaquinolines, amphetamines and related derivatives, Hallucinogens: LSD, Mushroom and Cactile, etc.

Unit IV: Adulterants and other chemicals (24 hrs)

Detection of common adulterants and determination of percentage purity in seized samples, detection identification, quantization of drugs in pharmaceutical products. Analysis of illicit drugs and search of clandestine laboratory, precursors and their analysis. Estimation of morphine in opium and heroin in smack. Analysis of drugs in biological samples and their importance: Hair, urine, blood, viscera, methods of extraction of drugs/consultation of drugs. Limitation of chemical analysis of drugs. Report writing and interpretation of drugs. Court testimony in NDPS Act cases. Case studies and ground for acquittal and grant of bail.

Suggested Reading:

1. Turner : Drugs & Poisons.
2. Samford : Poisons Their Isolation Identification.
3. Dubois and Celling: Textbook of Toxicology.
4. R. C. Froede: The Laboratory Management of the Medico-Legal, Specimen Analytical Chemical Laboratory Sciences.
5. Gurudip R. Chatwal, Sham K. Anand: Instrumental Methods of Chemical Analysis, First Edition Reprint 2010, Himalaya Publication.
6. Skoog, Holler, Crouch: Instrumental Analysis, India Edition, 2009.
7. Willard, Merritt, Dean, Settle: Instrumental Method of Analysis, Seventh Edition.
8. M. N. Gleason and et. Al.: Clinical Toxicology of Commercial products.
9. D. K. Molina: Handbook of Forensic Toxicology for Medical Examiners, CRC Press, 2009.
10. T. Altug: Introduction of Toxicology and Food, CRC Press, 2012.
11. Clarke's Analytical Forensic Toxocology by A. Negrusz and G. Cooper, 2nd Ed., Pharmaceutical Press, 2013.
12. Spot test in Organic Chemistry by Feigl.
13. M D Cole: The Analysis Of Drugs Of Abuse: An Instruct ion Manual
14. Curry A.S: Analytical Methods in Human Toxicology, Part II, CRC Press Ohio (1986).
15. E. Stahl: Thin Layer Chromatography: A Laboratory Handbook.
16. Clerk's Analysis of Drugs & Poisons VOL.-I & II by Clerke
17. Marie P. Kautsky: Steroid analysis by HPLC.

FSC4 E38 FORENSIC- ANTHROPOLOGY, ENTOMOLOGY AND ODONTOLOGY

Module I: Forensic Anthropology (20 hrs)

Theories for Anthropology: The scope of anthropology (Paleoanthropology, skeletal biology and human osteology, Paleopathology and Bio-archeology, Forensic Anthropology), Fossil formation, taphonomy, Relative dating techniques, Chronometric dating techniques;, Bio-cultural and evolutionary approaches to disease, Birth, growth and aging, infectious disease and bio-cultural evolution. Role of anthropology in mass disaster, Physical Anthropology and its forensic aspects.

Module II: Bio-archaeology (14 hrs)

Field recovery methods, Laboratory processing, curation and chain of custody, Age at death, sex, ancestry, height and weight, pre-mortem injury and disease, taphonomy, peri-mortem trauma, postmortem trauma, DNA Kinship and identity, Identification and forensic Anthropology: Time since death, ante-mortem records and positive ids, facial reconstruction.

Module III: Personal Identification of Living & Dead (18 hrs)

Identification through somatometric and somatoscopic observation, nails, occupation marks, scars, tattoo marks and deformities; handwriting and mannerisms. Genetic traits of forensic significance: ear lobe, brachydactyly, polydachtyly, widow's peak, eye and hair-color, face form, frontal eminences, nasal profile, nasal tip, lips, chin form. Skeletal age (Earlier years)**:** Prenatal ossification. Postnatal appearance and union of centers of ossification, Differences due to race, Skeleton age (Later years): Cranial suture closure, pubic symphysis, Sexing skeletal Remains: General consideration and age factors. Sex differences in skull, Pelvis and long bones. Calculation of stature of long bones: Studies on stature reconstruction in various population groups. Use of fragmentary long bones in stature reconstruction. Racial differences in human skeleton; distinguishing humans from other non- human skeletal remains; Forensic odontology, DNA isolation from bones and teeth. Age estimation. Facial Reconstruction 2-D, 3-D, etc.

Module IV: Forensic Entomology (16 hrs)

Taxonomy and Biology of forensically important insects**:** Coleoptera – General characters, taxonomy and biology of Silphidae (carrion beetles), Staphylinidae (rove beetles), Histeridae (clown beetles), Dermestidae (hide & skin beetles), Cleridae (checkered beetles), Carabidae (Ground beetles). Diptera - General characters, taxonomy and biology of Calliphoridae, Sarcophagidae, Phoridae, Muscidae, Fannidae. Insects of forensic importance, collection of entomological evidence during legal investigations; collection of: meteorological data, specimens before body removal, ground-crawling arthropods on and around the body, entomological samples from the body, entomological samples during autopsy, specimens from buried remains, from enclosed structures & aquatic habitats. Laboratory rearing of insects of forensic significance: Larval rearing, rearing containers, monitoring growth, larval dispersal in laboratory, adult emergence, rearing aquatic insects, unique host preference, rearing beetles in the laboratory, factors that influence insect succession on carrion: Attraction to the remains, geographical differences in succession, effects of season, humidity, effects of sunlight exposure, urban versus rural scenarios, bodies found inside buildings, effects of burial, bodies in water, bodies in vehicles, bodies in enclosed spaces, hanged bodies, burnt remains, wrapped remains, Role of

aquatic insects in forensic investigations, estimating the postmortem interval, soil environment and forensic entomology, entomo-toxicology, chemo-ecology, molecular methods for forensic entomology.

Module V: Forensic Odontology (12 hrs)

Definition and Scope of Forensic Odontology, Types of dentition, Basic structure of human teeth, types of teeth & their morphology, and determination of age from teeth using various methods, dental anomalies and their role in Personal Identification. Bite marks: Types & forensic importance. Collection and preservation of samples, analysis of Bite marks, presentation of bite mark evidences in court of law. Role of Forensic Odontology in mass disaster victim identification. Dental Charting. Comparison of Ante-mortem and post-mortem dental records.

Recommended Reading:

1. Application areas of anthropology, Anil Mahajan & Surinder Nath Reliance Publishing house,
2. Dental Anthropology, V.Rami Reddy Inter-India Publication,
3. A manual of biological Anthropology, Indra P. Singh & M.K. Bhasin Kamla Raj Enterprises,
4. Anthropology, Fred Plog, Clifford J. Jolly & Danial G. Bates Alfred A. KNOPF NewYork,
5. Anthropology, Kroeber Oxford & IBH Publishing Co.,
6. The use of Forensic Anthropology, Robert Pickering & David Bachman CRC Press,
7. Physical Anthropology, B.R.K. Shukla & Sudha Rastogi Palaka Prakashan,
8. The Forensic Anthropology Laboratory, Michael W. Warren, Heather A.Haney& Laurel E. Freas; CRC Press,(2008)
9. Forensic recovery of human remains: Dopras, Schultz, Whirler, Williams
10. Advances in Forensic Taphonomy, Method theory and Archaeological perspective.
11. Forensic Dental evidence, Mike Bowers, Elsevier Publ
12. Practical forensic odontology, DH Clark, Butterworth-Heinemman Publis
13. Forensic odontolgy, G Gustafson, 1st Ed, Elsevier, 1966
14. Forensic Radiology, B.G. Brogdon, 1st Ed, CRP Press, 1998
15. Bite Mark Evidence, Robert BJ Dorian, 1st Ed, CRP Press, 2004
16. Dental Autopsy, William E Silver, Richard R Souviron, 1st Ed, CRP Press, 2009
17. Forensic Dentistry, Senn DR and PG Simson, 2nd Ed, CRP Press, 2010.
18. Forensic Entomology: Jason H Byrd & James L Castner
19. Insect Biology : Hovard Evan
20. Fundamentals of Entomology, Richard J. Flzinga Prentice hall of India pvt ltd, (1978)
21. Entomology & death- A procedural guide, Catts E.P & Haskell NH; Joyce's print shop (1990)
22. A manual of Forensic Entomology Smith DGV; Ithaca NY Camstock Univ. Press, USA (1986).
23. General text book of Entomology, O.W. Richards & R.G. Davis; Chapman & hall ltd, (1973).

FSC4 E39 FORENSIC- BOTANY, WILDLIFE AND MICROBIAL FORENSIC

Module I: Forensic Botany (16 hrs)

Introduction, types, location, collection evaluation and forensic significance of fungi and plants in forensic science, wood and pollen grains, Methods of identification and comparison, various types of planktons and diatoms and their forensic importance; Limnology, Diatoms types and morphology, methods of isolation from different tissues. Study and identification of pollen grains, Identification of starch grains, powder and stains of spices etc.; Paper and Paper Pulp identification, Microscopic and biochemical examination of pulp material. Study of Various types of Poisonous Plants. Identification of wood-physical properties, colour, fluorescence, hardness, weight, odour, lustre, texture, anatomical features, pore/vessel distribution, size and arrangement, pore numbers, pore arrangements, inclusions, colored deposits, etc.

Module II: Other Biological Evidences (10 hrs)

Identification of Food stuffs & their stains: Plants used as food, animals used as food. Examination of plant foods (starch, herbs, spices & flavorings, fruits, vegetables). Examination of animal foods(meat & fish) – microscopic and macroscopic examination, chemical examination, muscles, skin, hairs, scales, bones & cartilage. Histopathological examination of tissues. Examination of faecal matter & faecal stains-Physical appearance, microscopic examination, urobilinogen test. Examination of stomach contents- microscopic examination.

Module III: Wildlife Forensic (20 hrs)

Protected and endangered species of animals and plants; Sanctuaries and their importance; Relevant provision of wild life and environmental act; Types of wildlife crimes, different methods of killing and poaching of wildlife animals; Enforcement of wildlife protection policy, Wild animals as pharmacopeias, Wildlife artifacts (Bones, skin, fur, hair, nails, blood, feather, etc.), Trade in wild animals, elephant, Indian rhino, wild cat, poisonous snakes for venom and skin, crocodiles, salamanders, deer, birds (feathers Macau parakeets), whales, sharks, spectacle bear, Himalayan antelopes. Recovering evidence at poaching scenes, Locating the burial: Anomalies on the surface international trade in reptile skins, Challenges to species identification of reptile skin products, species and products represented in the reptile skin trade, reptile scale morphology basics and current limitations, Identifying features of major reptile groups. Wildlife (Protection) Act-1972).

Module IV: Environmental Forensics (14 hrs)

Introduction to Environmental Forensics. Mercury- Natural and anthropogenic sources, detecting mercury in indoor environment and forensic aspects. Asbestos-sources and detection in air, water, fibres etc. Sewage, Lead- sources, compounds, analytical methods and lead forensics. Arsenic-sources, compounds, analytical methods and forensic aspects. Pesticides- Types, analytical testing and forensic techniques. Polycyclic aromatic hydrocarbons (PAHS)- sources, types and analytical techniques. Crude oil and refined products- oil analysis methods, oil spill analysis protocol. Environmental Legislation: central and state boards for the prevention and control of environmental pollution, powers and functions of pollution control boards, penalties and procedure, duties and responsibilities of citizens for environmental protection. The Water (Prevention and Control of Pollution) Act 1974. Prevention and Control of Air Pollution Act

1981, Forest Conservation Act 1981, Environment (protection) Act 1986, Hazardous waste (Management and Handling) Rules, 1989, Bio-Medical Waste (Management and Handling) Rules, 1998. Issues involved in enforcement of environmental legislation, public awareness, and public interest litigations (PILs) and its role in control of environmental pollution in India.

Module V: Microbial Forensics (20 hrs)

Defining the microbial forensics program, epidemiology, Microbial forensic tools. Dynamics of disease transmission, Outbreak Investigation. Deliberate introduction of a biological agent. Emerging Microbial Forensic Techniques- PCR, Terminal Restriction Fragment Length Polymorphism (TRFLP), Amplified Fragment Length Polymorphism (AFLP), Single Stranded Conformation Polymorphism Analysis (SSCP), Thermal and Denaturating Gradient Gel Electrophoresis (TGGE, DGGE), Amplified Ribosomal DNA Restriction Analysis (ARDRA), Randomly Amplified Polymorphic DNA (RAPD). Non-PCR DNA Fingerprinting Techniques with Applicability in Forensic Studies-Restriction Fragment Length Polymorphisms (RFLP) and Ribotyping. Forensic Interpretation of DNA Data, Isotopic Testing and Correlation to Contaminant Source, etc. Microbes of Forensic Importance: *Bacillus anthracis, Yersinia pestis, Francisella tularensis, Brucella spp., Burkholderia Pseudomallei, Clostridium botulinum, Listeria monocytogenes* and their morphological & biochemical studies.DNA of microbes in soil for crime detection. Fungi of forensic importance: Opportunistic mycoses, *Chytridiomycota zygomycota*, *Aspergillus fumigates*, *Microsporidum*, *Pneumocytosis jiroveci*, *Asp.flavus* & *Candida* sp, epidemiology, Antifungal agents. Food borne – shigella, salmonella. Etc. Forensic Aspects of Biological Toxins. Microbial Forensic Analysis of Trace and Unculturable Specimens. Etc. Biological agents in warfare: Collection, transportation and preservation of microbial forensic samples, Categories of biological weapons, study of potential bacteria, fungi, viruses, and their toxins, mode of action, identification, preventive measures during handling, laboratory setup, epidemiologic investigation for public health, investigation of suspicious disease outbreak, Biosafety and biosecurity, Bio surveillance, documentation, and case studies, Toxin analysis using mass spectrometry, Non-DNA methods for Biological Signatures, Electron beam based methods for bio-forensic inestigations, proteomics development and application for bio-forensics, design of genomics, design of nucleic acid signature for pathogen identification and characterization.

Recommended Reading:

1. Concept in wildlife Management, Hosetti, B.B Daya publishing 103House
2. Forensic science in wild life investigation, Linarce, Adrian CRC Press, Taylor & Francis
3. The wild life (protection) act, Baalu, T.R.1972, Nataraj Publication
4. Wild life (Protection act, 1972), Universal Publication
5. Wildlife protection act, 1972; Natraj Publishers
6. Timber Identification, N. Clifford; Leonard Hill ltd.,
7. A manual of wood identification, Herbert L. Edlin Viking Press,
8. Man-made fibres, R.W. Moncrieff Newness butter worth
9. Identification of vegetable fibres,. Dorothy catling & John Grayson Chapman & hall ltd
10. Pollen morphology & Plant taxonomy: angiosperms (an introduction to palynology), Erdtman, G Hafner Publishing Co.,
11. Forensic botany, Coyle, Heather Miller CRC Press,
12. College botany, Gangulee, Hirendra Chandra New Central Book Agency,

13. Plant anatomy, Esau, Katherine Wiley Eastern Ltd,
14. Plant anatomy, Chandurkar, P J Oxford & IBH Publishing Co,
15. Systematic botany for degree students, Singh, Jagjit S Chand & Co.,
16. The poisonous plants, H.C. Long Asiatic Publishing House,
17. Plant Anatomy, B.P. Pandey S. Chand& Co., New Delhi, (1998)
18. Environmental Law- The Law & policy relating to protection of environment, Ball Simon Universal Law Pub Co, Delhi,
19. Environmental Forensic Principles and Applications, Morrison Robert D, CRC Press,
20. Microbial Forensics : Roger G Breeze, Bruce Budowle, Steven E Schutzer
21. Microbial Forensics : Bruce Budowle, Steven E Schutzer, Roger G Breeze, Paul S Keim, Stephen A Morse
22. Chemical and Physical Signatures for Microbial Forensics: Cliff, J.B, Kreuzer, H.W, Ehrhardt C.J, Wunschel,D.S.

FSC4 E40 ETHICAL HACKING AND RECOVERY FORENSIC

Module I: Ethical Hacking (20 hrs)

Computer Image Verification and Authentication, understanding Malicious and hostile code including viruses, Trojan horses, worms, backdoors, trapdoors honeytrap forensics and spyware. Identification, Authentication and Authorization including passwords, smartcards and biometrics. Physical, environmental and organizational considerations for deploying forensic computing initiatives. Computer security and analyze security breaching attacks, Risk analysis, risk assessment and contingency planning for information security.Risk management. Impact and probability of threat.

Module II: System Hacking and prevention (20 hrs)

DoS Attacks and prevention, Session Hijacking and prevention, Hacking Web server and prevention, Hacking Web Application and prevention, SQL Injection and prevention, Social Engineering and prevention, Recognize the range of surveillance techniques and countermeasures. Investigate a range of security issues relating to operating systems, PC systems, threats vulnerabilities and security mechanisms.

Module III: Recovery Forensic (20 hrs)

Understanding the storage mechanism of devices like CD, DVD, USB, flash card, Hard disk, floppy disk etc, Data deletion concept, Breadth of Recovery software, limitations of recovery software, partition recovery (NTFS, FAT), recover data from CD, DVD, recover lost partition, Gpart recover data when sector 0 is damaged, data recovery form corrupted/formatted/repartitioned/ deleted hard drive, backup of master boot record, restoration of firmware, Carving, recovering data from damaged storage devices.

Module IV: Winhex (20 hrs)

Recovering digital evidence using winhex, creation and study of event logs in winhex, analysis of physical view and logical view, Disk cloning, disk imaging, RAM editor, Analyzing files,

Analyzing files, wiping unused space, editing data structure, splitting files, viewing and manipulating files, hiding data and discovering hidden data, API, Cyber forensic application of Winhex.

Recommended Reading:

1. Preventing Web Attacks with Apache by Ryan C. Barnett
2. Innocent Code : A Security Wake-Up Call for Web Programmers by Sverre H. Huseby
3. HackNotes(tm) Web Security Pocket Suggesive readingsby Mike Shema
4. Testing Web Security: Assessing the Security of Web Sites and Applications by Steven Splaine
5. Improving Web Application Security: Threats and Countermeasures by Microsoft Corporation
6. Hacking the Code: ASP.NET Web Application Security by Mark Burnett
7. How to Break Software Security by James A. Whittaker and Herbert H. Thompson
8. Exploiting Software : How to Break Code by Greg Hoglund and Gary McGraw
9. Advances in digital forensic VI by kam pui chow, sujeet shenoi
10. Malware forensic by Cameron malin
11. Windows registry forensic by Harlan carvey,
12. Digital forensic for network internet and cloud computing clint garrison
13. Wireless crime and forensic investigation by Gregory kipper
14. Digital image forensic by husrev taha, nasir memon
15. Computer forensic investigating data and image files by Ec-council
16. Network forensic tracking hackers by sherri Davidoff
17. Mastering windows network forensic by steven anson
18. Anti computer forensic by Gred numitor
19. Computer forensic Nathan Clarke
20. The secret of hacking
21. The art of human hacking , Kevin mitnik
22. Gray hat hacking, the ethical hackers handbook-Allen Harper,Shon Harris,Jonthan
23. Hardware hacking by Kelvin D. Mitnick

FSC4 E41 DIGITAL IMAGE PROCESSING

Module I: Digital Image Processing **(20 hrs)**

Fundamental Steps in Image Processing, Elements of Digital Image Processing, Digital Image Fundamentals, Image Enhancement in the Spatial Domain, Image Enhancement in the Frequency Domain, Image Restoration. Image Compression: Fundamentals, Redundancies, Image compression models, Error free compression, Lossy compression, Image compression standards. Morphological Image Processing, Image Segmentation: Introduction to Dilation, Erosion, Opening, Closing, Hit-or-Miss transformation, Morphological algorithm operations on binary images, Morphological algorithm operations on gray-scale images. Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Oriented Segmentation.

Module II: Pattern Recognition **(20 hrs)**

Introduction to Pattern Recognition, Bayesian decision theory: Classifiers, Discriminant functions, Decision surfaces, Normal density and Discriminant functions, discrete features, Principal Component Analysis (PCA), Expectation Maximization (EM), Hidden Markov models for sequential pattern classification, Nonparametric: Density estimation, Parzen window method, Probabilistic Neural Networks (PNNs), K-Nearest Neighbour, Estimation and rules, Nearest Neighbour and Fuzzy Classification. Linear Discriminant function based classifiers: Perceptron, Support Vector Machines (SVM).

Module III: Steganography & Steganalysis **(20 hrs)**

Information Hiding, Steganography, and Watermarking, History of Watermarking, History of Steganography, Importance of Digital Watermarking, Importance of Steganography Applications and Properties. Steganography: Information-Theoretic Foundations of Steganography, Steganographic Methods: Statistics Preserving Steganography, Model-Based Steganography, Masking Embedding as Natural Processing, Minimizing the Embedding Impact. Steganalysis: Steganalysis Scenarios, Some Significant Steganalysis Algorithms.

Module IV: Models of Watermarking **(20 hrs)**

Communication-Based Models of Watermarking, Geometric Models of Watermarking, Modeling Watermark Detection by Correlation, Robust Watermarking Approaches. Watermark Security: Security Requirements, Watermark Security and Cryptography, Some Significant Known Attacks, Content Authentication.

Recommended Reading:

1. Ingemar Cox, Matthew Miller, Jeffrey Bloom, and Jessica Fridrich . Digital Watermarking and Steganography, 2nd Ed, (The Morgan Kaufmann Series in Multimedia Information and Systems). (Hardcover - Nov 16, 2007)
2. Frank Y. Shih. Digital Watermarking and Steganography: Fundamentals and Techniques, CRC Press.
3. Stefan Katzenbeisser, Fabien, and A.P. Petitcolas. Information Hiding Techniques for Steganography and Digital Watermarking, Artech House.

4. Neil F. Johnson; Zoran Duric; Sushil Jajodia. Information Hiding: Steganography and Watermarking - Attacks and Countermeasures, Springer.
5. Gregory Kipper. Investigator's Guide to Steganography, Auerbach Publications.

FSC4 E42 PRACTICAL

1. To develop latent finger Prints with Powder methods.
2. To develop latent finger Prints with Fuming methods.
3. To develop latent finger Prints with Chemical methods.
4. Development of fingerprint on pen drive.
5. Development of fingerprint on CD/ DVD.
6. Development of fingerprint on hard disk.
7. Development of fingerprint on glass.

FSC4 E43 PRACTICAL

1. Detection of Forgeries including freehand and traced forgery.
2. Detection of simulated forgery.
3. Examination of alterations, additions, obliterations, overwritings and erasures. .
4. Examination of typescripts and printed matters.
5. Examination of computer printouts.
6. Examination of photocopies and scanned documents.
7. Examination of fax copies.
8. Examination of Security Documents – Indian Bank Notes under VSC.
9. Examination of Travel Documents – Indian Passports and Visas under VSC.
10. Examination of Plastic Cards.
11. Examination of Stamp Papers and Lottery Tickets.

FSC4 E44 PRACTICAL

1. Recording of speech samples using tape recorder & digital recorders and measures for keeping it in the safe custody.
2. Speaker wise segregation of speech sample of recorded conversation spoken between two speakers.
3. Transfer of audio file from a digital media to other media using standard software and authentication of recorded speech.
4. Comparison of linguistic and phonetic features of audio recording voice samples of two speakers.
5. Spectrographic analysis of voice samples of two speakers using voice spectrograph and comparison of their spectrographic features.
6. Video analysis and detection of tampered video files using Video analyzing tool.
7. Facial, ear landmark measurements and comparison using Geometric Morphometrics.

FSC4 E45 PRACTICAL

1. Restoration of erased serial number on firearms.
2. To perform chemical tests for powder residues around gun-shot holes in hard targets.
3. To perform spot test around holes suspected to have been caused by passage of jacketed /non-jacketted projectiles.
4. To perform chemical tests of firearms for detection of firearm discharge residues – to find out whether a given firearm has been fired or not.
5. Reconstruction of sequence of events in shooting incidents.
6. To study glass fractures, determination of direction of firing and sequence of shots.
7. Measurement of spread of pellets fired from shot-guns and determination of range of firing.
8. Given evidence pattern of tattooing, suspected firearms and ammunition recovered -to conduct test firings and estimate range of firing.
9. To determine/ measure rifling details on fired bullets, determination of make/model of suspected firearm firing the bullet.
10. Examination of air guns / rifles/ handguns as per Arms Act.
11. Examination of air guns / rifles as per Arms Act 1959.
12. Identification of shooter: gun-shot residue analysis by AAS.
13. Identification of suspected gun-shot holes in garments, walls, furniture etc. by AAS.

FSC4 E46 PRACTICAL

1. TLC analysis of explosive residues.
2. HPTLC analysis of explosive residues
3. HPLC analysis of explosive residues.
4. Identification and comparison of explosives by FTIR.
5. GC-MS analysis of explosive residues.

FSC4 E47 PRACTICAL

1. Extraction, Systematic identification of Narcotic Drugs and Psychotropic substances (opiates, cannabis and barbiturates, benzodiazepines and amphetamines) by spot colour tests
2. UV-Vis Spectrophotometric, GC and GC-MS analysis of barbiturates.
3. Gas chromatography analysis of Ganja and Charas.
4. Interpretation of given spectral data of various compounds.

FSC4 E48 PRACTICAL

1. Age determination from bones.
2. Side and site determination from long bones.
3. Stature estimation from bones.
4. Sex determination from various bones.
5. Age estimation from teeth.
6. Examination of nails, occupation, scars, tattoo marks, and other deformities.

7. Estimation of time since death from entomological evidences

FSC4 E49 PRACTICAL

1 Separation of bacterial cells from culture media by differential centrifugation,
2 Microscopic and biochemical examination of wood, pulp, paper.
3 Examination of plant and animal foods.
4 Amplification of 16 s rDNA by using PCR
5 Amplification of 18 s r DNA by using PCR
6 Preparation and transformation of competent E. Coli using calcium chloride.

FSC4 E50 PRACTICAL

1. Firewalls Intrusion Detection and Honeypots
2. Malware – Keylogger, Trojans, Keylogger countermeasures
3. Password guessing and Password Cracking.
4. Windows Hacking – NT LAN Manager, Secure 1 password recovery
5. Penetration Testing and justification of penetration testing through risk analysis
6. Windows Hacking – NT LAN Manager, Secure 1 password recovery
7. Denial of Service and Session Hijacking using Tear Drop, DDOS attack.
8. Understanding DoS Attack Tools- Jolt2, Bubonic, Land and LaTierra, Targa, Nemesy Blast, Panther2, Crazy Pinger, Sometrouble, UDP Flood, FSMax.
9. Email header and URL analysis

FSC4 E51 PRACTICAL

1. Scanning for vulnerabilities using (Angry IP, HPing2, IPScanner, Global Network Inventory Scanner, Net Tools Suite Pack.)
2. NetBIOS Enumeration Using NetView Tool, Nbtstat Enumeration Tool (Open Source).
3. How to Detect Trojans by using – Netstat, fPort, TCPView, CurrPorts Tool, Process Viewer.
4. Understanding SQL Injection
5. Steganography using tools: Tool: Merge Streams, Image Hide, Stealth Files, Blindside, STools, Steghide, Steganos, Pretty Good Envelop,

Model Question Papers

FIRST SEMESTER M. Sc. DEGREE EXAMINATION, JANUARY 2018

(CCSS)

FORENSIC SCIENCE
FSC 1C 01 – FUNDAMENTALS OF FORENSIC SCIENCE & CRIMINAL LAWS

Time: Three Hours Maximum: 80 Marks

I. Write an essay on any *TWO* of the following: (2 X 15 = 30 marks)

1.

2.

3.

4.

II. Write short essays on any *THREE* of the following: (3 X 10 = 30 marks)

5.

6.

7.

8.

9.

III. Write short notes on any *FIVE* of the following: (5 X 4 = 20 marks)

10.

11.

12.

13.

14.

15.

16.

17.

ghjkjkll ghhhjjkk