

**School of Studies in f Forensic Science
Vikram University, Ujjain (MP)**

SYLLABUS

M. SC. FORENSIC SCIENCE (FOR UTD)

COURSE STRUCTURE

CHOICE BASED CREDIT SYSTEM (CBCS)

*Sudhakar
01/07/2021*

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2021-2023 ONWARDS

SCHOOL OF STUDIES IN FORENSIC SCIENCE

SUBJECT: FORENSIC SCIENCE

SESSION: 2021-2023 ONWARDS

ABOUT THE PROGRAMME

The Masters of Science in forensic science is a two year programme with four semesters CBCS.

About Post Graduate Attributes:

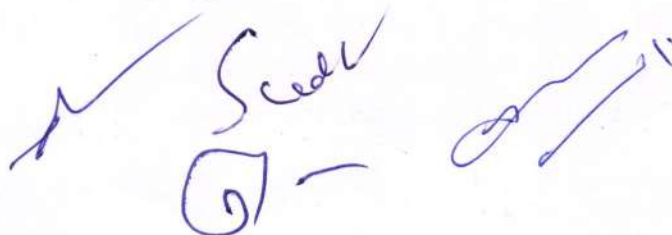
The course explores the collection, analysis and interpretation of scientific evidence, in an integrated approach, with plenty of field studies. This exciting area of science is delivered with expertise from forensic faculty and practitioners. It gives understanding of the major branches of science including anthropology, biology, physics, chemistry biochemistry and medical sciences. It will develop key laboratory skills, and learn to give detailed scientific explanations for the theory and practices used in modern forensic science. The course gives an overview of types of forensic evidence, such as skeletal remains, insects, drugs, toxicology and poisons. It will explain the DNA and human identification techniques, crime-scene processing, counterfeits and forgeries and the application of analytical techniques to analysis of evidence. The students will be introduced to criminal law, and police administration. The course provides with the opportunity to study analysis of body fluids, drugs, fibers, fire investigation and ballistics and advanced analytical techniques or Forensic investigations

All School of Studies in Vikram University, Ujjain will have Choice Based Credit System (CBCS) in M Sc. Forensic Science (For UTD). The student will have to earn 104 actual credits (Valid Credits) and 16 virtual credits (Total 120 credits) in total four semesters (Two year duration). The course will comprise of Lecture (L), Seminars (S), Practical (P), Library Assignments (LA), Project work (PW) and Comprehensive viva.

The Semester will consist of 16-18 weeks of academic work. One Credit is equivalent to one hour (60 minutes) of teaching (Lecture) or two hours (120 minute) of S, P, LA and PW per week in a semester. The credits for the course have been distributed among the courses under Core, Skill Development, Generic Elective and Discipline Specific Elective categories. The credits associated with the courses will be valid credits, while credits associated with Comprehensive viva voce will be virtual credits.

During the semester, a teacher offering the course will do the continuous evaluation of the student at three points of time by conducting three tests of 20 marks each. Of these, two must be written tests and the third may be written test/Quiz/Seminar, Assignment for theoretical courses. Marks obtained in two best tests out of three will be awarded to the student. In each course, there shall be End Semester Examination of 60 Marks. Each student has to appear in at least two tests and End semester examination; otherwise, the student will be awarded Ab grade in that course. Examination and evaluation of the courses will be as per Ordinance 14 of the Vikram University, Ujjain.

Definitions:

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- (i) 'Academic Programme' means an entire course of study comprising its programme structure, *course details, evaluation schemes* etc. designed to be taught and evaluated in a teaching Department/Centre or jointly under more than one such Department/ Centre
- (ii) 'Course' means a segment of a subject that is part of an Academic Programme
- (iii) 'Programme Structure' means a list of courses (Core, Elective, Open Elective) that makes up an Academic Programme, specifying the syllabus, Credits, hours of teaching, evaluation and examination schemes, minimum number of credits required for successful completion of the programme etc. prepared in conformity to University Rules, eligibility criteria for admission
- (iv) 'Core Course' means a course that a student admitted to a particular programme must successfully complete to receive the degree and which cannot be substituted by any other course
- (v) 'General Elective Course' or 'Discipline Specific Elective' means an optional course to be selected by a student out of such courses offered in the same or any other Department/Centre
- (vi) 'Open Elective' means an elective course which is available for students of all programmes, including students of same department. Students of other Department will opt these courses subject to fulfilling of eligibility of criteria as laid down by the Department offering the course.
- (vii) 'Credit' means the value assigned to a course which indicates the level of instruction; One-hour lecture per week equals 1 Credit, 2 hours practical class per week equals 1 credit. Credit for a practical could be proposed as part of a course or as a separate practical course

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Program M. Sc. Forensic Science will develop the ability of the student to think like an investigator. It also develops an aptitude to apply principle of Physics, Chemistry and Biology in Forensic Science while linking a crime to crime scene, victim and suspect. The course will:

- Develop the skills to work in the field of forensic science at different levels of government organization.
- Develop the experiments related to the field of forensic science.
- Provide skills of critical thinking and observation, by working in the artificially-made crime scene.
- Provide knowledge of Instrumentation, Criminal Justice System, Biological, Chemical and Physical techniques being used in various fields of Forensic Science.
- Provide the knowledge of Code of Conduct in the Criminal Justice System.

PROGRAM OUTCOMES (POs)

After completion of the program:

- The student will have a conceptual understanding of Criminal Justice System, Rules of Evidence and Legal System.
- The student will gain the ability of diplomacy and professionalism in group interactions

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throughout the sequence of courses.

- The student will gain the laboratory skills of high standards.
- The student will gain the expertise of a specific field of Forensic Science that will be helpful in deciding their carrier path.
- They will be eligible for applying in various Governmental examinations being held for the post of Forensic Science Laboratories, Forensic Science Educational Institutes etc
- The student understands the principles and their applications in examining an exhibit retrieved from the scene of crime.
- The student understands the working of forensic science divisions in different level of our government.
- The student is able to design and execute the experiments related to crime investigation, analytical instrumental techniques, collection, packaging and forwarding of print or pattern evidences and mathematical and statistical use in forensic science.
- The student will be able to execute a short research project incorporating the techniques of Chemistry, Physics and Biology in the field of Forensic Science.
- The student will be able to analyze the evidence without being biased.

Programme Structure:

The Forensic Science programme is a two-year course divided into four-semester. A student is required to complete XXXX credits for the completion of course and the award of degree.

		<i>Semester</i>	<i>Semester</i>
Part – I	First Year	Semester I	Semester II
Part – II	Second Year	Semester III	Semester IV

The details of the course are given below-:

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VIKRAM UNIVERSITY, UJJAIN MP
SUBJECT- FORENSIC SCIENCE
(Session -2021-2023 onwards)
M. Sc. I SEMESTER (CBCS), SCHEME

Course Code	Course Name	Course type	Credits	Marks		
				Internal Examination Marks	University Examination Marks	Total Marks
FSC 101	Forensic Science Investigation and Criminal Justice System	Core	5	40	60	100
FSC 102	Forensic Physics, Ballistics, Photography and Statistics	Core	5	40	60	100
FSC 103	Instrumental Methods-Physical Chemical and Biological	Core	5	40	60	100
FSC 104	Computer Forensics and Cyber Security	Generic Elective*	5	40	60	100
FSC 105	Dactylography and Biometrics					
FSC 106	Forensic Anthropology					
FSC 107	Entrepreneurship Development (Assignment)	Skill Development course**	4	30	50	80
FSC 108	Laboratory-I (Laboratory Skill Development/Survey)	Core	2	15	25	40
FSC 109	Comprehensive Viva (Virtual Credits)	Core	4		80	80
	Grand Total		30			600

* -Any 01 of 03 Generic Elective can be co-opted by the students.

** -Common course offered by the university/Assignments/MOOC course etc.

-One Credit is equal to 20 marks

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SUBJECT- FORENSIC SCIENCE
M.Sc. II SEMESTER (CBCS) SCHEME

Course Code	Course Name	Course Type	Credits	Marks		
				Internal Examination Marks	University Examination Marks	Total Marks
FSC 201	Forensic Biology and Serology	Core	5	40	60	100
FSC 202	Forensic Chemistry and Explosives	Core	5	40	60	100
FSC 203	Forensic Toxicology and Pharmacology	Core	5	40	60	100
FSC 204	Investigative Tools and Technique	Discipline specific Elective*	5	40	60	100
FSC 205	Forensic Neuroscience and Behavior					
FSC 206	Questioned Document and Their Examination					
FSC 207	Skill Development In Forensic Science/Assignments	Skill Development course**	4	30	50	80
FSC 208	Laboratory-II(Laboratory Skill Development/Field work)	Core	2	15	25	40
FSC 209	Comprehensive Viva (Virtual Credits)	Core	4		80	80
Grand Total			30			600

* -Any 01 of 03 Discipline Specific Elective can be co-opted by the students.

** -Common course offered by the university/Assignments/MOOC course etc.

-One Credit is equal to 20 marks

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SUBJECT- FORENSIC SCIENCE
M. Sc. III SEMESTER (CBCS) SCHEME

Course Code	Course Name	Course Type	Credits	Marks		
				Internal Examination Marks	University Examination Marks	Total Marks
FSC 301	Forensic Odontology.	Core	5	40	60	100
FSC 302	Questioned Documents, Fingerprints and Other Impressions	Core	5	40	60	100
FSC 303	Forensic Medicine and Medical Jurisprudence	Core	5	40	60	100
FSC 304	Narcotics and Drug Abuse	Discipline Specific Elective	5	40	60	100
FSC 305	Emerging Trends in Forensic Science					
FSC 306	Chromatographic Technique					
FSC 307	Personality Development/ Skill Development In Forensic Science/Assignments	Skill Development Course*	4	30	50	80
FSC 308	Laboratory-III (Laboratory Skill Development/ Minor Project)	Core	2	15	25	40
FSC 309	Comprehensive Viva (Virtual Credits)	Core	4		80	80
	Grand Total		30			600

*-Any 01 of 03 Discipline Specific Elective can be co-opted by the students.

**-Common course offered by the university/Assignments/MOOC course etc.

- One Credit is equal to 20 marks

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SUBJECT- FORENSIC SCIENCE
M. Sc. IV SEMESTER (CBCS) SCHEME

Course Code	Course Name	Course Type	Credits	Marks		
				Internal Examination Marks (40%)	University Examination Marks (60%)	Total Marks
FSC 401	Project Work/ Onsite Training	Core	12	100	140	240
	1- Project work and Presentation					
	2- Project Report assessment and Viva-voce					
FSC 402	Industrial Visit/Forensic Science Organization/Institute etc Visit Minor Report writing	Core	4	30 (Report)	50 (Viva voce)	80
FSC 403	Review Writing	Core	4	30 (Report)	50 (Viva voce)	80
FSC 404	Seminar/Group Discussion	Core	3	25 (Write up)	35 (Presentation)	60
FSC 405	Poster Presentation	Core	3	25 (Write up)	35 (Presentation)	60
FSC 406	Comprehensive Viva (Virtual Credits)	Core	4		80	80
	Grand Total		30			600

- One Credit is equal to 20 marks

M. Sc. I SEMESTER (CBCS)
SUBJECT- FORENSIC SCIENCE

**Code No.: FSC 101: FORENSIC SCIENCE INVESTIGATION AND CRIMINAL
JUSTICE SYSTEM (Core)**

Course Objectives:

The objective of this course is to introduce the concept and scope of crime. It will familiarize students with types of crime and its effects as well its prevention. The course would highlight about criminal behavior and related theories. The course aims to discuss the concept of Juvenile delinquency and Victimology. It will disseminate information to students with specific criminal Law, Indian Penal Code: sections, Criminal Procedure Code and police Administration

Course Learning Outcomes:

CO 1 To understand concept of crime and recent development in its control and prevention.

CO 2 To study the aim and scope of criminology.

CO 3 to elucidate Criminal profiling and modus operandi, portrait parley, voice stress analysis

CO 4 To describe History and development of police administration; Police duties, responsibilities and powers

Unit – I

Forensic Science: Basic Principles and its Significance. History & Development of Forensic Science. Nature and Scope of Forensic Science. Organizational Structure of Forensic Science Laboratories at Central & State Level. Ethics in Forensic Science.

Unit – II

Crime, Criminal Theories and Criminal Investigation: Definition, Theories of Causation of Crime: Pre-Classical and Neo-Classical, Constitutional, Geographical, Economic, Psychological, Sociological, Multiple- Causation Approach. General Factors of Crime, Forms of Punishment in Brief, Radical Theory of Crime.

Scene of Crime: Types, Protection of Scene of Crime, Crime Scene Documentation- Note Taking, Video-graphy, Photography and Sketching Methods.

Physical Evidence: Meaning, Types, Searching Methods, Collection and Preservation, Forwarding. Chain of Custody, Collection, Preservation, Packing and Forwarding of: Blood, Semen and Other Biological Stains, Firearm Exhibits, Documents, Fingerprint, Viscera, Hair & Fiber, Glass, Soil and Dust, Petroleum Products, Drugs and Poisons, etc.

Investigation of the Following Crimes: Murder, Theft and House Breaking, Road Accident, Railways and Air Accidents, Arson, Sexual Assault Cases, Dowry Cases and Explosion Cases.

Unit – III

Crime Scene Management and Reconstruction: Elements of Crime Scene Management- Information Management, Technology Management, Man-Power Management & Logistic Management. Introduction to Crime Scene Reconstruction, Nature of Reconstruction, Basic

Principles For Physical Evidence and Reconstruction (Recognition, Identification, Individualization And Reconstruction), Stages in Reconstruction, Types of Reconstruction, Pattern Evidence in Reconstruction (Bloodstain Pattern Analysis for Reconstruction, Glass Fracture Patterns, Fire Burn Patterns, Tire and Skid Mark Patterns), Shooting Scenes, Requirements for Reconstruction after Crime Scene Released, Writing a Reconstruction Report.

Unit – IV

IPC, CrPC and IEA : Indian Penal Code (1860): Introduction, General Exceptions, Offences against Person, Offences against Property, Attempt to Suicide, Sexual Offences.

Criminal Procedure Code (1973): Introduction and General Idea of Sections: 291- 93, 154, 155, 156, 157, 158, 159, 160, 161, 162, 172, 173, 174, 175, and 176.

Indian Evidence Act (1872): Introduction and General Idea of Sections: 32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137, and 159

Unit – V

Criminal Justice System: Police Organization in India, Organization of Courts in India, Jurisdiction of Courts in Criminal Cases, Prosecution, F.I.R., Case Diary, Interrogation of Suspects, Interview of Witness and Procedure in Court as Per Criminal Procedure Code:- Summons Trial, Warrant Trial, and Summary Trial.

Report Writing and Evidence Evaluation: Report Formats of Crime Scene and Laboratory Findings.

Court Testimony: Admissibility of Expert Testimony, Pre Court Preparation & Court Appearance, Examination in Chief, Re-Examination and Cross Examination.

Essential Readings:

1. Peter R. D. F. (1983). Forensic Science-An Introduction to Criminalistics. USA, McGraw-Hill.
2. Saferstein R. (1995). Criminalistics – An Introduction to Forensic Science. USA, Prentice Hall Inc.
3. Sharma B R. (2003). Forensic Science in Criminal Investigation and Trials. India, Universal Law Publishing Company.
4. Sharma J.D. (1988). Vidhivigyan Avem Vish Vigyan. India, Hindi Granth Academy.
5. Sharma J.D. (2011). Apradhon ka Vigyanik Anveshan. India, Hindi Granth Academy.
6. Siegel J. A. & Kathy M. (2006). Forensic Science: The Basics. USA, CRC Press.
7. Unnithan N.P. (2013). Crime and Justice in India. India: SAGE Pub.

Suggested Readings:

1. Ahuja R. (2001). Criminology. India, Rawat Pub.
2. Aitken C.G.G. & Stoney D.A. (1991). The use of statistics in Forensic Science. England, Ellis Harwood Limited.
3. Bowen R.T. (2016). Ethics and the Practice of Forensic Science. USA, CRC Press.
4. Burke R.H. (2013). An Introduction to Criminological Theory 4th edit. UK, Routledge – Taylor & Francis Group.
5. Horswell J. (2016). The Practice of Crime Scene Investigation. USA, CRC Press.

6. Indian Penal Code, Criminal Procedure Code, Indian Evidence Act.
7. James S.H. & Nordby J.J. (2003). Forensic Science: An Introduction to Scientific and Investigative Techniques. USA, CRC Press.
8. James S. H. (2014). Forensic Science: An Introduction to Scientific and Investigative Techniques. UK, Taylor & Francis.
9. Nordby J. (1999). Dead Reckoning– The Art of Forensic Science Detection. USA, CRC Press.
10. O' Hara & Osterberg. (1949). An Introduction to Criminalistics. New York, The Macmillan Company.

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**Code No.: FSC 102: FORENSIC PHYSICS, BALLISTICS, PHOTOGRAPHY
AND STATISTICS (Core)**

Course Objectives:

The objective of this course is to explain the history and background of firearms, their classification and characteristics. The course also aims to discuss different types of ammunitions, their identification, origin etc. with focus on improvised/ country made/ imitative firearms and their constructional features. It also highlights the identification and examination of internal, external and terminal ballistics.

Course Learning Outcome:

- CO 1 This paper intends to give an overview on Firearms, their classification and characteristics.
CO 2 To describe concept of propellants, their ignition, shape and size of propellants, manner of burning, various factors affecting the internal ballistics.
CO 3 To analyze Firearms, ammunition and their components identification and examination.

UNIT- I

Density, Refractive Index, Birefringence; Other Optical Properties of Crystalline Material. Examination of the Following- 1.Hair and Fiber 2. Soil 3. Dust 4. Paints 5. Glass 6. Glass Fracture 7. Tool Marks 8. Explosives 8.Restoration of Erased / Obliterated Marks, 9.Examination of Wire/ Cables, Counterfeit Coins., 10.Physical Matching of Severed / Broken Objects.

Speaker Identification and Tape Authentication: Voice Production Theory-Vocal Anatomy, Speech Signal Processing & Pattern Recognition- Basic Factors of Sound in Speech, Acoustic Characteristics of Speech Signal, Fourier Analysis, Frequency & Time Domain Representation of Speech Signal, Analogue to Digital Signal and Conversion, Fast Fourier Transform, Quantization, Digitization and Speech Enhancement, Analysis of Audio-Video Signal for Authenticity, Introduction to the Techniques of Pattern Recognition and Comparison.

UNIT-II

History and Background of Firearms, Their Classification and Characteristics, Various Components of Firearms, Different Systems and Their Functions, Rifling, Purpose of Rifling, Types of Rifling, Trigger and Firing Mechanism, Cartridge-Firing Mechanism, Projectile Velocity Determination Identification of Origin, Improvised/Country-Made/Imitative Firearms and their Constructional Features.

Types of Ammunition, Classification and Constructional Features of Different Types of Cartridges, Types of Primers and Priming Composition, Propellants and their Compositions, Various Types of Bullets and Compositional Aspects, Smooth Bore Firearm Projectile, Identification of Origin, Improvised Ammunition and Safety Aspects for Handling Firearms.

Internal and External Ballistics: Definition, Ignition of Propellants, Shape and Size of Propellants, Manner of Burning, Various Factors Affecting the Internal Ballistics, 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, Measurements of Trajectory Parameters.

UNIT- III

Terminal Ballistics : Effect of Projectile on Hitting The Target: Function of Bullet Shape, Striking Velocity, Striking Angle of Intermediate Target, Tumbling of Bullets, Effect of Instability of Bullet, Effect of Intermediate Targets, Influence of Range, Cavitations- 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, Evaluation of Injuries Caused Due to Shot-Gun, Rifle, Handguns and Country Made Firearms, Post-Mortem and Anti-Mortem Firearm Injuries. Principles and Practice of Identification of Firearms, Different Types of Marks Produced During Firing Process on Cartridge and on Bullet, Identification of Various Parts of Firearms, Class and Individual Characteristics, Time of Firing- Different Method Employed and their Limitations, Stereo & Comparison Microscopy.

UNIT- IV

Forensic Photography: Introduction to Forensic Photography, Role of Photography in Forensic Science, Camera its Parts and Functioning, Enlarger and Other Equipment's used in Photography, Developing and Printing Methods. Digital Photography, Specialized Techniques Used for Documents, Fingerprints, Special Photographic Techniques; Use of Instant of Photography, Use of Flash Attachments, Use of Infrared Photography, Use of Ultraviolet Photography & Alternative Light Source. General Photographic Responsibilities and Videography.

UNIT- V

Basic Statistics: Sampling for Collection of Data. Measure of Central Tendency- Mean, Median, and Mode. Measure of Dispersion: Mean Deviation, Standard Deviation. Standard Error of Mean and Probable Error. Coefficient of Correlation (Karl Pearson „S“ „R“). Graphic Representation of Data. Significance of Results: T-Test, F-Ratio (Analysis of Variance) and Chi Square Test.

Essential Readings:

1. O Hara C.E. & Osterburg J.W. (1972), An Introduction to Criminalistics. Blomington, Indiana University Press.
2. Nickolls, L.C. (1956). Scientific Investigation of Crime. London, Bulterwest.
3. Ordog G.J. (1983). Management of Gunshot Wounds. USA, Elsevier.
4. Rose P. (2001). Forensic Speaker Identification: Forensic Science Series. London, Taylor and Francis.
5. Saferstein R. (1988). Forensic Science Handbook. NJ, Prentice Hall, Eglewood Cliffs.
6. Sears F.W., Zemansky M.W. and Young. D. (1988). University Physics. California, Addition-Wesley Pub.
7. Sellieretal K. G. (1994). Wound Ballistics and the Scientific Background. London, Elsevier.

8. Warlow T.A. (1996). Firearms: The Law and Forensic Ballistics. London, Taylor and Francis.
9. Working Procedures Manual: Ballistics. (2000) India, BPR & D Pub.

Photography Book

1. Henry Horeustein .(1995). Colour Photography A Working Manual. Boston, Little Brow Company.
2. Jacobson B.H.E. &Attridge S.R. (1998). The Manual of Photograph. London, Focal Press.
3. Jahne B.(1996). Digital Image Processing. Heidelberg, Springer.
4. Workinson, J.(1994). Art of Digital Video. England, Oxford Focal Press.

Suggested Reading:

1. Bengold & Moryson N. (1999). Speech and Audio Signal Processing. USA, John Wiley & Sons.
2. Caddy B. (2001). Forensic Examination of Glass and Paints Analysis and Interpretation. UK, Taylor and Francis.
3. Hatcher, Jury & Weller. (1977). Firearms Investigation, Identification and Evidence. Harrisburg, Stack pole Books.
4. Heard B.J. (1997). Hand book of Firearms and Ballistics. London, John Willey.
5. Hogg. V. (1982). The Cartridges Guide – A small arms Ammunition Identification Manual. Harrisburg, The Stack pole Co.
6. Jenkins and White, (2003). Fundamentals of Optics. USA, Mc Graw Hill.
7. Johari M. (1980). Identification of Firearms, Ammunition and Firearms Injuries. India, BPR&D.
8. Maio V.D. (1999). Gunshot Wounds. US, CRC Press.
9. Mathews J.H. &Thomas C.C. (1973). Firearms Identification, Vols. 1, 2 & 3. Illinois, Springfield.
10. Murray R.C. & Tedrew J.C.F. (1991). Forensic Geology. New Jersey, Prentice hall.

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Code No.: FSC 103: INSTRUMENTAL METHODS: PHYSICAL, CHEMICAL AND BIOLOGICAL (Core)**Course Objectives:**

The objective of this course is to introduce specialized techniques and their application in forensic science. The students will be able to understand the atomic & molecular spectroscopy, physical instrumentation techniques, radiochemical and nuclear techniques, biological and biochemical techniques with their general principles involved as well as their applied aspects

Course Learning Outcome

CO 1 To know about the concept of Spectroscopy, electromagnetic spectrum, sources of radiation, their utility and limitations.

CO 2 This paper tends to describe the different Physical instrumentation techniques. CO 3 To understand basic principles and theory of radiochemical techniques.

CO 4 To highlight general principles of biological and biochemical techniques.

Unit- I

Concepts of Instrumental Analytical Chemistry: Introduction to Analytical Chemistry: Defining the Problem, Designing the Analytical Chemistry, Sampling, Storage of Samples, Basic Statistics and Data, Sample Preparation (Acid Dissolution & Digestion, Fusions, Dry Ashing and Combustion, Extraction), Performing the Measurement (Signals and Noise, Plotting Calibration Curves), Assessing the Data (Limit of Detection, Limit of Quantification).

Unit-II**Atomic & Molecular Spectroscopy**

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. Elements of X-ray spectrometry, fluorescence, energy dispersive X-ray analysis (EDX), wavelength dispersive X-ray analysis (WDX), X-ray diffraction, augur effect. Application of these techniques in forensic science.

Unit-III**Physical instrumentation techniques**

IR spectroscopy- correlation of infrared spectra with molecular structure, Fourier transform, infrared (FTIR) and Raman spectroscopy, fluorescence and phosphorescence spectrophotometry, Ultra violet and visible spectrophotometry: Types of sources, filters-cells and sampling devices, detectors, resolution, qualitative and quantitative methods for detection.

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 vs AAS methods, quantitative analysis, applications. Techniques -RBS (Rutherford Back Scattering spectrometry) Application of these techniques in forensic science.

Unit-IV

Radiochemical and Nuclear techniques

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 calorimetry and differential analysis, thermogravimetry. Nuclear Magnetic Resonance spectroscopy: Basic principles, theory and in strum, Mass Spectrometry, GCMS, LCMS, Secondary Mass Spectrometry, Laser Mass spectrometry, Fast Atom bombardment and liquid secondary Ion Mass spectrometry, High performance liquid chromatography, Electrospray Ionization mass spectrometry. Application of these techniques in forensic science

Unit-V

Biochemical techniques

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 ImmunoSorbent 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, Application of these techniques in forensic science.

Essential Readings:

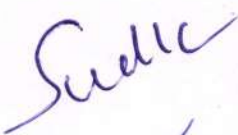


1. Sharma B.K., (2000). Instrumental Methods of Chemical Analysis. India, Krishna Prakashan Media.
2. Silverstein R.M. & Webster F.X., (1997). Spectrometric Identification of Organic Compounds. USA, John Wiley & Sons, Inc.
3. Skoog D.A., Holler F.J. & Stanley R.C. (2017). Principles of Instrumental Analysis, USA, Cengage Learning.
4. Subrahmanyam N. & BrijLal (2004). A Text Book of Optics. India, S. Chand & Co.
5. Thompson K.C. & Renolds R.J. (1978). Atomic Absorption Fluorescence & Flame Emission Spectroscopy: Practical Approach. London, Charles Griffin & Co.

6. Willard H. & Lynne L.M. (1986). Instrumental Methods of Analysis. USA, CBS Publishers & Distributors.
7. Willard H.H., Merrett L. L. Frank J.A.D. & Settle A. (1986). Instrumental Methods of Analysis. USA, CBS Pub. & Distributors.
8. Sharma B.K.(2000). Instrumental Methods of chemical Analysis. India, Krishna Prakashan Media.
9. Shrivastava & Shrivastava(1991). Introduction to Chromatography. India, S. Chand & Co.
10. Smith and Bogusz M. (2007). Handbook of Analytical Separation. Germany, Elsevier Pub.
11. Srivastava M. (2010). High-Performance Thin-Layer Chromatography (HPTLC). Germany, Springer Science & Business Media.
12. Stahl E. (2013). Thin Layer Chromatography. Germany, Springer Science & Business Media.
13. Triggs C.M. Buckleton J.S. & Walsh S.J. (2004). Forensic DNA Evidence Interpretation. USA, CRC Press
14. Walker J.M. & Rapley R.(2009). Molecular Biology and Biotechnology. UK, Royal Society of Chemistry.
15. Willard, Merrit and Dean. (1974). Instrumental Methods of Analysis. USA, Van Nostrand.
16. Li R. (2008). Forensic Biology: Identification and DNA Analysis of Biological Evidence. USA, Taylor & Francis.
17. McClintock J. T. (2014). Forensic Analysis of Biological Evidence, A Laboratory Guide for Serological and DNA Typing. NY, CRC Press.
18. Oates D.W., Brown C.W. & Weigel D.L. (1974). Blood and Tissue Identification of Selected Birds and Mammals. JPR study Projects Lincoln NE Nebraska Game and Perks Commission. Philadelphia, Staff Research Publications.
19. Triggs C. M., Buckleton J. S. & Walsh S. J. (2004). Forensic DNA Evidence Interpretation. NY, CRC Press.
20. Walker J. M. & Rapley R. (2009). Molecular Biology and Biotechnology. UK, Royal Society of Chemistry.
21. Williams P. L. & Warwick R. (1980). Gray's Anatomy. London, Churchill Livingstone.

Suggested Readings:

1. Chatwal and Anand. (2016). Instrumental Methods of Chemical Analysis. India, Himalaya Publishing House Pvt. Ltd.
2. Churáček J. (1993). Advanced Instrumental Methods of Chemical Analysis. Michigan, E. Harwood,
3. Dean J. A. (1995). Analytical Chemistry Handbook. USA, McGraw Hill Inc.
4. Kalri P.S. (2001). Spectroscopy of Organic Compounds. India, New Age International Pub.
5. Khandpur R.S. (2004). Handbook of Analytical Instruments. USA, Tata McGraw Hill Pub. Co.
6. Khanna D.R. & Gulati H.R. (2002). Fundamentals of Optics Geometrical Physical & Quantum. India, R. Chand & Co.
7. Patania V.B. (2004). Spectroscopy. India, Campus Books International.
8. Robinson J.W. (1996). Atomic Spectroscopy, Revised & Expanded. NY, Marcel Dekkar, Inc.

9. Chapman J.R. (1993). Practical Organic Mass spectrometry, A Guide for Chemical and Biochemical Analysis. New York, Wiley Pub.
10. Chatwal and Anand. (2016). Instrumental Methods of Chemical Analysis. India, Himalaya Publishing House Pvt. Ltd.
11. Harris H., Gaensslen R. & Lee H. (2007). An Introduction to Forensic Science. USA, McGraw-Hill Education
12. Jarris K.E., Gray A.L. & Hock R.S. (1992). EDS; handbook of Inductively Coupled Plasma Mass Spectrometry; Glasgow, Blockie Pub.
13. Lindsay, S. (1992). High Performance Liquid Chromatography. New York: Wiley Pub.
14. Maclafferty F.W. & Turecek F. (1993). Interpretation of Mass spectra. US, Mill Valley, C A Univ. Science Books.
15. Robards K. Jackson P.E. & Haddad P.A. (2012). Principles and Practice of Modern Chromatographic Methods. Germany, Elsevier pub.
16. Saferstein R. (2001). Forensic Science Handbook Vol. I. London, Prentice Hall.
17. (1978). Biology Methods manual. London: Metropolitan Police Forensic Science Laboratory.
18. Albert S., Bray B., Lewis D, Roberts K.& Watson J.D., (1989). Molecular Biology of Cell. New York, Garland Pub.
19. Clifford B.J.(1971). The examination and typing of Bloodstains in the Crime Laboratory. USA, US Court Printing Press.
20. Edwin & Caney H. M. (1993). Human Genetics: The Molecular Revolution. London, Jones & Bartlett Pub.
21. Epplen J. T. & Lubjumhin T.(1995). DNA Profiling and DNA Fingerprinting. Basel, Birkhauser Verlag.
22. Gardner E.J., Simmons M. I. & Snustad D.P.(1991). Principles of Genetics. New York, John Wiley.
23. Glover D.M. & Hames B.D.(1995). DNA Cloning, vol. 1 to 4. England, Oxford University press, Oxford Pub.
24. Joshi A. R. (2002). A Textbook of Practical Biochemistry. India, B. Jain Publishers.



Code No. : FSC 104 COMPUTERS FORENSICS AND CYBER SECURITY (General Elective)

Course Objectives:

The objective of this course is to explain the principles of computer and data storage, hardware and encryption techniques and investigation on imaging methods. It also aims to discuss the types of cyber-crimes, audio-video examination and speaker identification and their application in forensic investigations.

Course Learning Outcome

CO 1 To understand the principles of e-data analysis.

CO 2 To know about the definition and types of cybercrimes, different type of attacks, internet research and investigative tools.

CO 3 To learn about the forensic audio video analysis.

CO4 To elucidate identification, application in automatic speaker identification and verification system.

Unit-I

Fundamentals of a Computer: Introduction to Computers, Hardware and Accessories, Operating System and Software

Unit – II

Computer Forensics: Definition, Various Types of Computer Crimes, Collection, Handling and Preservation of Digital Evidences

Unit- III

Computers and Networking: Networking Concepts, What is Internet and Technology behind Internet.

Unit-IV

Cyber Crime: Definition, Crimes on Internet, Hacking, Virus, Worms, Cookies, Obscenity and Pornography, Program Manipulation, Software Piracy and Intellectual Property

Unit-V

Cyber Crime Investigation: Concept of Network Security and Cyber-Crime Investigation, Relevant Section of Information Technology Act 2000

Suggested Readings:

1. Albert J. M. & Guillossou F. (2012). Cyber Forensics: From Data to Digital Evidence. New Jersey, Wiley Corporate F&A.
2. Casey E. (2009). Handbook of Digital Forensics and Investigation. USA, Academic Press.
3. Marcella A. & Menendez D. (2007). Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes. NY, CRC Press.

Code No.: FSC 105: DACTYLOGRAPHY AND BIOMETRICS (General Elective)

Course Objectives:

The objective of this course is to explain the concept of dermatoglyphics and other impression with their forensic implication. It will also familiarize students with the biometrics, technology involved and multibiometric systems. The course also aims to discuss the foot/ footwear/tyre impressions lip prints, ear prints and their significance in forensic investigations

Course Learning Outcome

- CO1 To understand the history and development of Dermatoglyphics, different classifications used and Modern methodologies in fingerprinting.
- CO 2 This paper furthermore addresses the use of biometric evidences.
- CO 3 To learn methods of taking footprints, their collection and identification of characteristics.
- CO 4 To analyse lip prints and their forensic significance.

Unit – I

Introduction to Fingerprints: History of Finger Print, Formation of Ridges, Finger Print Patterns, Ridge Characteristics, Ridge Count, Ridge Tracing etc, Classification of Finger Print- Ten Digit Classification of Henry.

Unit – II

Development of Fingerprints: Types of Fingerprint, Latent, Visible and Plastic Prints, Location of Finger Print, Development of Latent Prints by Physical and Chemical Methods, Photography and Comparison of Finger Prints.

Unit – III

Biometrics Part-1: Ear Biometrics: Location and Identification of Ears in Real Time; Uniqueness, Permanence, Universality and Collectability, Detection and Recognition in Existing 2D Images of Ear; Criminal Identification.

Unit – IV

Biometrics Part-2: Iris Recognition: Introduction, Anatomical and Physiological Underpinning, Iris Signature Representation and Matching; Localization, Representation, Matching. Retina Biometrics: Structure of Eye; Human Retina and Structure; Unique Pattern of Blood Vessels; Retina Pattern and Identification

Unit – V

Face Recognition: Face Recognition: Introduction, Detection, Representation and Classification, Some Representation and Classification Techniques and Their Applications.

Essential Readings:

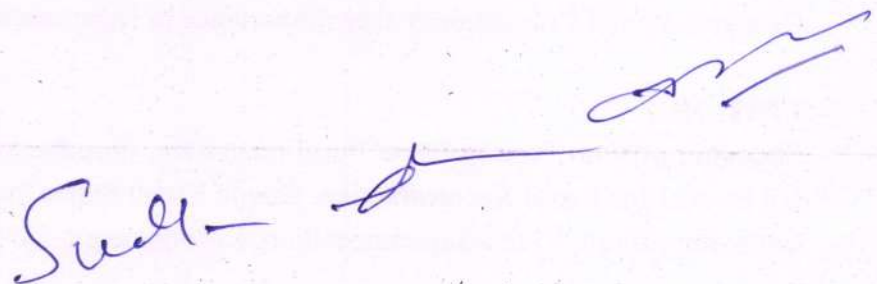

1. Lee H. C. & Ganesslen R. E. (1991). Advances in Finger Print Technology. London, CRC

Press.

2. Malton D. (2009). Handbook of Fingerprint Recognition. Germany, Springer Science & Business Media.
3. Mehta M. K. (1989). Identification of Thumb Impression & Cross Examination of Finger Prints. India, N. M. Tripathi (P) Ltd.
4. Pierce D. S. (2011). Mechanics of Impression Evidence. NY, CRC Press.
5. Stiefel C. (2011). Fingerprints: Dead People Do Tell Tales. NJ, Enslow Publishers.
6. Walker J. M. & Rapley R. (2009). Molecular Biology and Biotechnology. UK, Royal Society of Chemistry.
7. Wilson C. (2011). Vein Pattern Recognition: A Privacy-Enhancing Biometrics. NY, CRC Press.

Suggested Readings:

1. Albert S., Bray B., Lewis D, Roberts K. & Watson J.D. (1989). Molecular Biology of Cell. New York, Garland Pub.
2. Ashbaugh D. R., (1999). Quantitative and Qualitative Friction ridge analysis. NY, CRS Press.
3. Daluz H. M., (2014). Fundamentals of Fingerprint Analysis. NY, CRC Press.
4. Das R. (2014). Biometric Technology: Authentication, Biocryptography and Cloud-Based Architecture. India, CRC Press,
5. Edwin & Caney H. M. (1993). Human Genetics: The Molecular Revolution. London: Jones & Bartlett Pub.
6. Gardner E.J., Simmons M. I. & Snustad D.P., (1991). Principles of Genetics. New York, John Wiley.
7. Jain A., Ross A.A. & Flynn P. (2008). Handbook of Biometrics. India, Springer Press.
8. Jain A., Ross A. A. & Nanda Kumar K., (2011) .Introduction to Biometrics. India, Springer Press.



Code No. : FSC 106: FORENSIC ANTHROPOLOGY (Core)**Course Objectives:**

The objective of this course is to explain the relevance of personal identification and its application using somatometric and somatoscopic observation, tattoo marks, deformities and genetic traits in forensic investigations. It will also explain the basic principles of human growth and development with focus on methods of assessing age-especially dental age and skeletal age. The course would highlight the forensic morphometry of skeletal remains, skeletal analysis and details of forensic odontology

Course Learning Outcome

CO 1 To understand genesis and development of forensic anthropology.

CO 2 To discuss major stages of human growth and development and different methods of assessing age.

CO 3 To describe techniques for recovering skeletonised human remains and their laboratory analysis.

CO 4 To learn methods of age estimation from odontological evidences.

UNIT-I

Forensic Anthropology: Definition, Aims and Scope and its Relevance in Forensic Science, Personal Identification of the Living and Cadavers. Elementary Study of Human Skeleton, Personal Identification from Bones, Determination of Age, Sex, Stature, Reconstruction of Skull and Face

UNIT-II

Personal Identification: Personal Identification Techniques as Somatoscopy, Somatometry, Osteometry and Craniometry their Importance in Determination of Age and Sex.

UNIT- III

Superimposition: Portrait Parle/ Bertillon system, Introduction and Importance of Photofit/ Identity Kit System for Facial Reconstruction, Cranio Facial Super Imposition Techniques as Photographic Super Imposition, Video-Superimposition, Roentgenographic Super imposition.

UNIT -IV

Forensic Odontology: Definition, Types of Teeth and Their Functions, Determination of Age from Teeth: Eruption Sequence, Gustafson's Method, Dental Anomalies Their Significance in Personal Identification.

UNIT -V

Bite Marks: Forensic Significance, Collection and Preservation of Bite Marks, Photography of Bite Marks, and Evaluation of Bite Marks, Legal Aspects of Bite Marks.



Suggested Reading:

1. Adams B. J. (2007). Forensic Anthropology. NY, Chelsea PublishingHouse.
2. Christensen A.M., Nicholas V., Passalacqua & Bartelink (2014). Forensic Anthropology: Current Methods and Practice. USA, Elsevier Press.
3. Dennis D. (2012). A Companion to Forensic Anthropology. Netherlands, Wiley Pub.
4. Maria Teresa A., Tersigni T. & Natalie R. & Shirley (2013). Forensic Anthropology: An Introduction. NY, CRC Press.



Code No.: FSC 107: ENTREPRENEURSHIP DEVELOPMENT (ASSIGNMENT)
(Skill Development Course)

Learning Outcome:

Common course offered by the University/Assignments/MOOC courses etc. / every student will be imparted skills in development of new things and will be evaluated by the concerned teacher. Every student shall deliver at least one seminar on topic of the curriculum/ advances in Forensic Science which will individually be assessed by every available teacher on the basis criteria laid down by the Staff council. Students in audience will also be encouraged to assess the seminar on the given criteria and their evaluation will also be given due consideration. The average marking will be taken into consideration.

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Code No.: FSC 108: LABORATORY-I (Laboratory Skill Development/Survey) (Core)**Learning Outcome:****(A) Crime Scene Investigation I-**

- 1- Demonstration of Crime Scene Management.
- 2- Photography of Scene of Crime Digital Camera.
- 3- Methods for Searching of Physical Evidences at Scene of Crime.
- 4- Sketching of Outdoor Scene of Crime (Homicide or Suicide).
- 5- Sketching of Outdoor Scene of Crime (Accident).
- 6- Sketching of Indoor Scene of Crime (Theft or Dacoity or Robbery).
- 7- Sketching of Indoor Scene of Crime (Murder or Suicide).
- 8- Sketching of Mobile Scene of Crime (Hit & Run Case).
- 9- Collection, Packing, Labeling and Forwarding of Physical Evidence from Scene of Crime to Forensic Science Laboratory.
- 10- Reconstruction of Scene of Crime.

(B) Forensic Physics and Ballistics

1. Identification and Matching of Dust/ Soil Sample by Physical Method (Including Density Gradient Method).
2. Physical Matching of Cloth Sample and Identification of Glass Fractures.
3. Calculate the Refractive Index of Glass by Abbey's Refractometer.
4. Restoration of Erased Punched Mark on Metal Piece by Chemical Treatment.
5. Lifting, Casting and Evaluation of Tyre/Foot Wear Impressions Using Transo Scan Imaging.
6. Comparison of the Questioned Impression with Known Shoes Using Transo Scan Imaging.
7. Comparison of Tool Marks and Fired Cartridge/ Bullet Using Comparison Microscope.
8. Identification of Shots and Pallets.

(C) Instrumental techniques

1. To Understand the Working and Measurement of λ Max of Various Organic Compounds by UV-Vis. Spectrophotometer.
2. To Know the Concentration of Given Liquid by Colorimeter.
3. Sample Preparation and FTIR Analysis of Drugs of Abuse.
4. To Measure the pH of Different Substance using pH Meter.
5. To Know the Practical Working and Handling of Comparison Microscope.
6. To Know the Practical Working and Handling of Stereo Microscope.
7. To Separate & Identify the Plant Pigments using Paper Chromatography.
9. To Identify the Dyes Present in Petroleum Products using Thin Layer Chromatography.
10. To Know Practical Working and Handling of High Performance Liquid Chromatography by Analyzing Depressant Drugs.
11. To Know Practical Working and Handling of High Performance Thin Layer Chromatography by Analyzing the Ink Samples.

12. To Know Practical Working and Handling of Gas Chromatography by Analyzing Volatile Poisons.
13. To Know Practical Working and Handling of Low Voltage and High Voltage Electrophoresis by analyzing the Amino Acids & other Biochemical Samples.
14. To Identify the Dyes Present in Petroleum Products using Thin Layer Chromatography.
15. To Know Practical Working and Handling of High Performance Liquid Chromatography by Analyzing Depressant Drugs.
16. To Know Practical Working and Handling of High Performance Thin Layer Chromatography by Analyzing the Ink Samples.
17. To Know Practical Working and Handling of Gas Chromatography by Analyzing Volatile Poisons.
18. To Know Practical Working and Handling of Low Voltage and High Voltage Electrophoresis by analyzing the Amino Acids & other Biochemical Samples.
19. Demonstration of Handling and Working of PCR.
20. To Perform Protein Estimation of Given Biological Samples.
21. To Separate Cell Organelles in Given Tissues using Centrifuge.
22. Demonstration of Working and Handling of Gel Electrophoresis.
23. Demonstration of Working and Handling of Compound, Stereo Microscope, SEM and TEM.
24. Demonstration of Working and Handling of UV-Spectrophotometer for the Examination of Biological Samples.

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Code No.: FSC 109: COMPREHENSIVE VIVA (VIRTUAL CREDITS) (Core)

A comprehensive viva-voce of 4 virtual credits will be conducted at the end of semester of the programme by a board of four examiners.

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M. Sc II SEMESTER (CBCS)
SUBJECT-FORENSIC SCIENCE

Code No. : FSC 201: FORENSIC BIOLOGY AND SEROLOGY (Core)

Course Objectives:

The objective of this course is to discuss the principles of serology and immunology and to explain the bloodstains investigations techniques. It also aims at informing the students about various protected and endangered species of animals and plants and introduction of wildlife (protection) act 1972. The student would be able to understand the forensic DNA profiling and its application in criminal and civil investigations.

Course Learning Outcome:

CO 1 The paper intends to talk about various serological techniques used to analyse blood samples for criminal investigation.

CO 2 To analyze microscopic and macroscopic examination of biological samples like plant, hair recovered from crime scene.

CO3 To learn the techniques used in DNA Profiling.

CO 4 To understand the Concept of gene and sequence variation.

UNIT-I

Fundamentals of Biology- : Histology: Definition, Meaning and History of Histology.

Cell: Definition, Theories, Classification and Significance of Cells in Forensic Science. Cell Organelles and their Functions, Difference between Eukaryotic and Prokaryotic Cell, Difference between Plant and Animal Cell.

Cell Division: Definition, Types, Difference between Somatic and Germinal Cell and Totipotency and Apoptosis. Basic Concept in Brief for Anatomy and Physiology of Digestive, Respiratory, Circulatory, Skeleton, Nervous, Excretory and Reproductive System etc.

Amino Acids: Definition, Classification, General Properties and Reaction. **Proteins:** Definition, Classification, General Properties and Reaction/Detection. **Carbohydrates:** Definition, Classification and Detection.

UNIT-II

Forensic Biology: Hair: Structure, Development, Anatomy, Pigmentation, Identification Characters and Basic Characters for Forensic Examination of Hair Including Determination of Origin, Race, Sex, Site and other Instrumental Analysis.

Fibers: Definition, Classification, Characters, Difference Between Plant and Animal Fiber and Forensic Aspects of Fiber Examination– Density, Microscopy, Hot Stage Microscopy, Fluorescent, Optical Properties, Refractive Index, Birefringence, Dye Analysis and Spectroscopic Techniques for Fiber Analysis.

Forensic Botany-

Woods and their Identification and Matching. Diatoms and their Forensic Significance in

Drowning Cases; Study and Identification of Pollen Grains, Starch Grains, Powder and Stains of Spices etc. Classification and Identification of Forensically Important Microbes.

Forensic Entomology-

Definition, Meaning and Scope of Entomology. Forensically Significant Species of Insect: Classification, Habitat, Life Cycle. Factor Affecting the Growth of Insect in Dead Body. Determination of Age of Cadaver through Entomological Analysis. Significance of Entomology in Forensic Science.

UNIT-III

Basic Concepts of Genetics: Structure and Function of Cell, Mendel Ion Genetics, Genotypes, Phenotypes, Mutation, Multiple Alleles.

Biochemical Markers of Individuality: General Understanding, Classification of Markers, Biochemical Basis of Genetic Variation. Expression of Gene, Transcription and Translation of DNA and Gene Mapping. Analysis of Protein by Electrophoresis and Related Methods. Protein Polymorphism and Characterization by Electrophoretic Methods.

UNIT-IV

Examination of Biological Fluids and Immunology: Blood: Composition, Histology, Examination of Blood and Blood Stains, Blood Spatter Pattern Identification, Identification of Menstrual and other Stains by Various Methods.

Semen: Composition, Structure of Spermatozoa, Forensic Methods of Detection and Identification of Semen and Seminal Stain.

Origin of Species : 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 Immuno-Diffusion and Immuno-Electrophoresis, Cross Reactivity among Closely Related Species.

Immunology: Immuno System, Immuno Response, Epitops, Paratops, Haptens and Adjuvant, Antigens and Antibodies, Antigen-Antibody Reaction.

UNIT-V

Serogenetic Markers and DNA : Blood Groups: History, Biochemistry and Genetics of ABO, Rh, M and other Systems, Methods of ABO Blood Grouping (Absorption-Inhibition, Mixed Agglutination And Absorption Elution) from Blood Stains and other Body Fluids/Stains, Determination of Secretor/Non Secretor Status, Lewis Antigen, Bombay Blood Group, Polymorphic Enzymes Typing- PGM, ESD, EAP, AK, etc., and their Forensic Significance, HLA Typing, Role of Serogenetic Markers in Individualization, Paternity Disputes etc. Structure of DNA, Damage to DNA, Variation in DNA, DNA as Excellent Polymorphic Marker and Sources of DNA as Forensic Evidence. Different Extraction Techniques of DNA, Basic DNA Typing Techniques; RFLP, PCR, Electrophoresis and Detection Methods.

Essential Readings:

1. Kimball & John W. (1974). Biology. New Delhi, Arvind Publishing Co.

2. Lewis. B. (1980). Gene IV. England, Oxford University Press.
3. Mauersberger H. R. (1954). Mathews Textile Fibres – Their Physical, Microscopic and Chemical Properties. New York, John Wiley.
4. Morrison & Robert D. (2000). Environmental Forensics Principles and Applications. New York, CRC Press.
5. Oates D.W., Brown C.W. & Weigel D.L. (1974). Blood and Tissue Identification of Selected Birds and Mammals. JPR Study Projects Lincoln NE Nebraska Game and Perks Commission. Philadelphia, Staff Research Publications.
6. Pandey R.P. (1998). Plant Anatomy. New Delhi, S. Chand & Co.
7. Saferstein R. (1995). Criminalistics – An Introduction to Forensic Science. USA, Prentice Hall Inc.
8. Walker J.M. & Rapley R. (2009). Molecular Biology and Biotechnology. London, Royal Society of Chemistry.
9. Williams P. L. & Warwick R. (1980). Gray's anatomy. London, Churchill Livingstone.

Suggested Readings:

1. Albert S., Bray B. Lewis D, Roberts K. & Watson J.D. (1989). Molecular Biology of Cell. New York, Garland Pub.
2. Ball S., (1991). Environmental Law – The Law and Policy relating to Protection of Environment. India, Universal Law Pub Co, Delhi.
3. Biology Methods Manual (1978). London, Metropolitan Police Forensic Science Laboratory Pub.
4. Catts E.P. & Haskell N.H. (1990). Entomology and Death: A Procedural Guide. London, Joyce's Print Shop.
5. Clifford & B.J. (1971). The Examination and Typing of Bloodstains in the Crime Laboratory. USA, US Court Printing Press.
6. Edwin & Caney H. M. (1993). Human Genetics: The Molecular Revolution. London, Jones & Bartlett Pub.
7. Gardner E.J., Simmons M. I. & Snustad D.P. (1991). Principles of Genetics. New York, John Wiley.

The image shows several handwritten signatures and initials in blue ink. On the left, there is a circular mark with a vertical line through it. To its right, there are three distinct signatures: the first is a cursive 'S', the second is a stylized 'S' with a long tail, and the third is a more complex, multi-stroke signature.

Code No. : FSC 202: FORENSIC CHEMISTRY AND EXPLOSIVES (Core)**Course Objectives:**

The objective of this course is to introduce the forensic chemistry basics with special focus on arson chemistry, details of adulterants in petroleum products and analytical tools for examination of alcoholic and non-alcoholic beverages. It will explain types of explosives, their synthesis and characteristics, concept of forensic toxicology and pharmacology. The students would be taught about different drugs of abuse including natural and synthetic drugs of abuse.

Course Learning Outcome:

CO 1 This paper intends to acquaint the students with the concept of Forensic chemistry, sampling of chemical evidences and their examination procedure.

CO 2 To understand the classification of explosives.

CO 3 To know the Definition and classification of different types of poisons.

CO 4 To learn the methods of analysis, collection, preservation and transportation of drug evidences.

UNIT-I

Forensic Chemistry: Forensic Chemistry and its Scope, Analysis of Beverages: Alcohol and Non-Alcoholic, Country Made Liquor etc. Adulterated food material.

Drugs of Abuse: Introduction, Classification, Narcotic Drugs & Psychotropic Substances, Sampling, Specific Drugs Types (Cannabis, Heroin, Cocaine, Amphetamine), Drugs of Abuse in Sports. Brief Introduction to Drugs and Cosmetic Act, Excise Act, NDPS Act. An Overview of Clandestine Laboratories.

UNIT-II

Examination of Food and Petroleum Products: Examination of Petroleum Products:

Distillation & Fractionation, Various Fraction and their Commercial Uses, Standard Methods of Analysis of Petroleum Products for Adulteration, Trap Cases: Purpose, Examination of Chemicals Used in Trap Case.

UNIT-III

Examination of Building Material: Examination of Building Materials: Types of Cement and their Composition, Determination of Adulterants by Physical, Chemical and Instrumental Methods, Examination of Brick, Analysis of Cement Mortar and Concrete, Analysis of Gold and Other Metals in Cheating Cases.

UNIT-IV

Arson : Chemistry of Combustion and Arson-: Overview of Combustion, Four Aspects of Combustion (Thermodynamics, Kinetics of Combustion, Heat Transfer, Mass Transfer), Deflagration and Detonation. Fires: Nature and Chemistry of Fire, Classification, Igniters of Fires, Phases of Fires, Main Types of Fires, Examination of Scene of Fires. Arson: Relevant IPC

Sections, Motives, Analysis of Accelerants.

UNIT-V

Examination of GSR and Explosive: Analysis of Gunshot Residues - Mechanism of Formation of GSR, Source and Collection, Spot Test, Chemical Test, Identification of Shooter and Instrumental Methods of GSR Analysis.

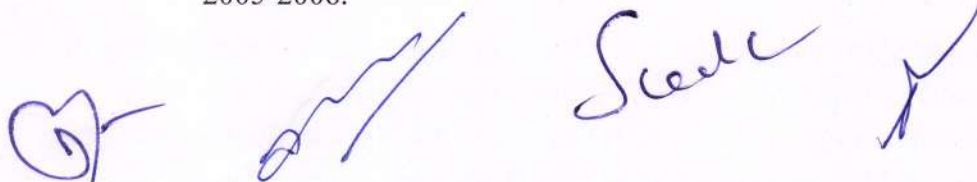
Explosives: Devices, Explosives Classification, Detonation & Deflagration, Primary and Secondary Explosives, Comparison & Characterization of Explosives, Military & Commercial Explosives, Detection of Explosophores (Anions), Detection of Black Powder, Nitrocellulose and Dynamite, Quantitative Determination. Energy Release, Explosive Output, Critical Diameter, Chemistry of Some Common Explosives, Military Explosives, Plastic Explosive, Commercial Explosives, Propellants, Terrorist use of Homemade Explosives, Peroxide Explosives, Exotic Explosives, Energetic Salts. Non – Solid Explosives, Detection of Explosives by Dogs, Colorimetric Detection of Explosives, X – Ray Technologies.

Essential Readings:

1. Feigl (2005). Spot Test in Inorganic Analysis. New Delhi, Elsevier Pub.
2. Finar L. (2009). Organic Chemistry Vol. II. India, Pearson Education.
3. Jitrin Y. (1993). Modern Methods & Application in Analysis of Explosives. England, John Wiley & Sons.
4. Morrison R.T. & Boyd R.N. (2003). Organic Chemistry, 6th Ed. India, Prentice Hall.
5. Silverman (2005). Organic Chemistry of Drug Design & Drug action. New Delhi, Elsevier Pub.
6. Skoog D.A. West D.M. & Holler F.J. (2000). Analytical Chemistry – An Introduction. USA, Saunders College Pub.
7. Watson C.A. (1994). Official and standardized Methods of Analysis. UK, Royal Society of Chemistry.
8. Working Procedure Manual – Chemistry, Explosives and Narcotics (2000). India, BPR&D Pub.

Suggested Readings:

1. Burger A. (2004). Medicinal Chemistry & Drug Discovery, 6 Vol Set, 6th Ed. NY, John Wiley & Sons.
2. Bassett M. (2004). Vogel's Textbook of Quantitative Chemical Analysis. England, Longman Essex.
3. Boudreau J.E. (1977). Arson & Arson Investigation, Survey & Assessment National Institute of Law Enforcement, U.S. Department of Justice. USA, USA Govt. Printing Press.
4. Brean S. F. (1998). Vogel Textbook of Practical Organic Chemistry. Edinburg, Addison Wesley Longman.
5. Burger A. (1970). Medicinal Chemistry, Vol. II. NY, Wiley Inter-Science.
6. Dettean J. D. (2002). Kirk's Fire Investigation. NY, Prentice Hall, Eaglewood Cliffs, w.e.f. 2005-2006.



Code No. : FSC 203: FORENSIC TOXICOLOGY AND PHARMACOLOGY (Core)**Learning Objectives:**

After studying this paper the students will know: The significance of toxicological studies in forensic science, the classification of poisons and their modes of actions, the absorption of poisons in body fluids, The forensic identification of illicit liquors, The classification and characteristics of the narcotics, drugs and psychotropic substances, The menace of designer drugs, The methods of identifying and purifying narcotics, drugs and psychotropic substances.

Learning Outcome:

CO1 Understand the importance and scope of forensic chemistry and its use in chemical detection.

CO2 Analyze the different components of petroleum products.

CO3 Determine different types of poisons from viscera and its post mortem examination

CO4 Summarize the significance of NDPS Act and the classification of various drugs in it.

CO5 Interpret the components of the fire and explosive material

UNIT-I

Forensic Toxicology: Introduction, Concept and Significance.

Poisons: Definition, Classification of Poisons, Types of Poisoning, Sign and Symptoms of Poisoning, Mode of Action, Factors Modifying the Action of Poisons, Toxicological Exhibits in Fatal and Survival Cases, Their Preservation, Treatment in Cases of Poisoning, Analysis Report.

UNIT-II

Extraction, Isolation and Clean-Up Procedures: Extraction of Non-Volatile Organic Poison, Stas-Otto, Dovbriey Nickolls (Ammonium Sulphate) Method, Acid Digest and Valov (Tungstate) Methods, Solid Phase Micro Extraction Techniques, Solvent Extraction Methods. Volatile Poisons: Industrial Solvent Acid and Basic Distillation. Toxic Cations: Dry Ashing and Wet Digestion Process.

Toxic Anions: Dialysis Method, Total Alcoholic Extract.

UNIT-III

General Study and Analysis: Barbiturates, Methaqualone, Hydromorphone, Methadone, Meprobamate, Mescaline, Amphetamines, LSD, Heroin, Cannabinoids, Phinothiazines.

Insecticides: Types, General Methods for their Analysis. Alkaloids: Definition, Classification, Isolation and General Characterization.

Vegetable Poison: General Studies and Analysis of Some Vegetable Poisons, Opium, Abrus, Cyanogenetic Glycosides, Dhatura, Marking Nuts, Nux-Vomica, Oleander Aconite etc.

UNIT-IV

Examination and Analysis of Poisons: Metallic Poisons: Arsenic, Mercury, Lead, Bismuth, Copper, Aluminium, Iron, Barium, Zinc etc. Analysis of Ethyl Alcohol in Blood and Urine, Illicit

Liquor, Methanol, Acetone, Chloroform, Phenol, Snake Venoms and other Animal Poisons, Irrespirable Gases etc.

UNIT-V:

Basics of Pharmacology: Pharmacological Studies: Absorption, Distribution, Metabolism, Pathways of Drug Metabolism. Pharmacodynamics: Introduction, Nature & Scope.

Essential Readings:

1. Parikh C.K. (1972). Forensic Medicine and Toxicology. India, Medical Publications.
2. Poison C.J., Gee D.J. & Knight B. (1985). Forensic Medicine. UK, Pergamon Press.
3. Rao N.G. (2010). Textbook of Forensic Medicine & Toxicology. India, Jaypee Brothers Medical Publishers Ltd.
4. Reddy K.S.N. (2014). Forensic Medicine. India, Jaypee Brothers Publishers Ltd.
5. Simpsen K. & Knight B. (1996). Forensic Medicine. UK, Taylor & Francis.
6. Taylor A. S. (1853). Medical Jurisprudence. Blanchard & Lea.
7. Thompson T. & Sue B. (2006). Forensic Human Identification: An Introduction. USA, CRC Press.

Suggested readings:

1. Aggrawal A. (2016). Textbook of Forensic Medicine and Toxicology. India, Avichal Publishing Company.
2. Bardale R. (2011). Principles of Forensic Medicine & toxicology. India, Jaypee Brothers Medical Publishers Ltd.
3. Biswas G. (2012). Review of Forensic Medicine and toxicology, 2nd Edition. India, Jaypee Brothers Medical Publishers.
4. Catanese C.A. (2009). Color Atlas of Forensic Medicine and Pathology. USA, CRC Press.
5. James J.P. & Simpson's S.K. (2014). Forensic Medicine. USA, CRC Press.
6. Krishan V. (2014). Textbook of Forensic Medicine & Toxicology: Principles & Practice. UK, Elsevier Health Sciences.
7. Mallet X. (2014). Advances in Forensic Human Identification. USA, CRC Press.
8. Modi J.S. (2011). Medical Jurisprudence and Toxicology. India, Law Publishers.
9. Molina D. K. (2009). Handbook of Forensic Toxicology for Medical Examiners. USA, CRC Press.

Code No.: FSC 204: INVESTIGATIVE TOOLS AND TECHNIQUE
(Discipline Specific Elective)

Course Objectives:

The objective of this course is to explain the concept of dermatoglyphics and other impression with their forensic implication. It will also familiarize students with the biometrics, technology involved and multibiometric systems. The course also aims to discuss the foot/ footwear/tyre impressions lip prints, ear prints and their significance in forensic investigations

Course Learning Outcome:

- CO 1 To understand the history and development of Dermatoglyphics, different classifications used and Modern methodologies in fingerprinting.
CO 2 This paper furthermore addresses the use of biometric evidences.
CO 3 To learn methods of taking footprints, their collection and identification of characteristics.
CO 4 To analyze lip prints and their forensic significance

UNIT-I

Detective Methods : Brief Knowledge about Detective and Detective Agencies in India, Role of Detectives in Criminal Justice System, Quality of a Detective.

UNIT-II

Detective Tools: Essential Components of Secret Book Box/Detective Box, Flashlight, Magnifying Glass, Digital Camera, Binoculars, Recording Instruments, Fingerprinting Kit and Casting Kit, Laser Trajectory Kit, Cell Phones/ Mobile Phone Detective Equipment's, Computer Related Detective, Equipment's, Self Defense Products (Tasers, Stun, Guns, Personal Alarms, Mace, Pepper Spray, Batons).

UNIT-III

Detective Techniques: Interview, Interrogation, Face Reading, Genealogy, Mobile Phone Tracking System, Global Positioning System.

UNIT-IV

Surveillance and its Importance: Surveillance- Introduction, Scope & its Importance, Various Types of Surveillance Methods, Fixed Surveillance, Electronic Surveillance, Surveillance on Cell Phones, Surveillance through Computer, Surveillance on Internet, Undercover Operations.

UNIT-V

Modern Detective Tools : Spy Equipment's, Listening Devices, Night Vision Goggles, Tracking Devices, Bluetooth Tracking Devices, Spy Cameras, Microchips, Taping Microphones, Drones, & Bugging.

Essential Readings:

1. Karl G. S. (1994). Wound Ballistics and the Scientific Background. London, Elsevier.

2. Mathews J. H. & Thomas C.C. (1973). Firearms Identification, Vols. 1, 2& 3. Illinois, Springfield.
3. Ordog G. J. (1983). Management of Gunshot Wounds. New York, Elsevier.
4. Vincent D. M. & P. A. (1999). Gunshot Wounds. USA, CRC Press.
5. Warlow T. A. (1996). Firearms: The Law and Forensic Ballistics. London, Taylor and Francis.

Suggested Reading:

1. Working Procedures Manual: Ballistics.(2000). India,BPR & D Pub.
2. Brain J. H.,(1997). Hand book of Firearms and Ballistics.England,John Willey.
3. Hatcher, Jury & Weller(1977). Firearms Investigation, Identification and Evidence. Harrisburg, Stackpole Books.
4. Hogg L.V.(1982). The Cartridges Guide – A small arms Ammunition Identification Manual. Harrisburg, The Stackpole Co.
5. JohariM.(1980). Identification of Firearms, Ammunition and Firearms Injuries. New Delhi, BPR&D Pub.

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Code No.: FSC 205: FORENSIC NEUROSCIENCE AND BEHAVIOR (Core)

Learning Objectives: After studying this paper the students will know: The overview of forensic psychology and its applications. The legal aspects of forensic psychology, the significance of criminal profiling, The importance of psychological assessment in gauging criminal behavior, The tools and techniques required for detection of deception, The critical assessment of advanced forensic techniques like polygraphy, narco analysis and brain electrical oscillation signatures.

Learning Outcome:

After studying this paper the students will know

CO1 The overview of forensic psychology and its applications.

CO2 The legal aspects of forensic psychology.

CO3 The significance of criminal profiling.

CO4 The importance of psychological assessment in gauging criminal behavior.

CO5 The tools and techniques required for detection of deception.

Unit – I

Forensic Neuroscience: Introduction to Forensic Neuroscience; Neuroscience in Criminal Investigation and Justice System

Unit – II

Brain: Introduction to the Structure and Function of the Vertebrate Nervous System. Anatomy of Nervous System, Neurons, Synapse and Neurotransmitter. Cellular Basis of Neuronal Activities, Physiological Bases of Motor Control, Sensory Systems, Motivated Behaviors and Higher Mental Processes.

Unit – III

Signal Transmission: Action Potential Generation, Synaptic Transmission, Molecular and Physiological Studies of Ion Channels, Second Messengers, Simple Neural Circuits, Synaptic Plasticity, Learning and Memory, and Neural Development.

Unit – IV

Neurobiology of Behavior: Neurobiology of Motivation, Violence, Empathy, Deception, Aggression, Depression and Suicidal Ideation. Neurobiology of Brain Disorders. Behavioral Analysis and Neuropsychiatric Disorders Including Depression, Schizophrenia and Anxiety.

Unit – V

Brain Imaging : Principles of Brain Imaging and Rules of Scientific Evidence. Behavioral Neuroscience and Brain Imaging Techniques, Functional and Structural Magnetic Resonance Imaging (MRI) and Positron Emission Tomography (PET), Role of Behavioral Sciences in

Courtroom Decision-Making. Use of Behavioral Neuro- Evidence in the Justice System.
Evaluation of Brain Imaging and other Neuroscience Data in Forensic and Legal Settings.

Essential Readings:

1. Russell R. (2006). The Brain Book: Know Your Own Mind and How to Use it. USA, Routledge – Taylor & Francis Group.
2. Scarabino T. & Salvolini U. (2003). Atlas of Morphology and Functional Anatomy of the Brain. NY, Springer.
3. Simpson J. R. (2012). Neuroimaging in Forensic Psychiatry: From the Clinic to the Courtroom. England, John Wiley & Sons.
4. Stone T. W. (1996). CNS Neurotransmitters and Neuromodulators. NY, CRC Press.
5. Vincent N. A. (2013). Neuroscience and Legal Responsibility. England, Oxford Press.
6. Walsh A. & Bolen J.D. (2012). The Neurobiology of Criminal Behavior: Gene- Brain-Culture; Interaction. USA, Routledge – Taylor & Francis Group.
7. Walsh A. (2012). Biology and Criminology: The Biosocial Synthesis. USA, Routledge – Taylor & Francis Group.
8. Webster R. (2001). Neurotransmitters, Drugs and Brain Function. England: John Wiley & Sons.

Suggested Readings:

1. Andreasen N. C. (1989). Brain Imaging: Applications in Psychiatry. USA, American Psychiatric Pub.
2. Benarroch E. E. (2006). Basic Neurosciences with Clinical Applications. USA, Elsevier.
3. Bohlen O. V., Halbach & Dermietzel R. (2006). Neurotransmitters and Neuromodulators: Handbook of Receptors and Biological Effects. England, John Wiley & Sons.
4. Davies G.M. & Beech A.R. (2012). Forensic Psychology: Crime, Justice, Law Interventions. England, John Wiley & Sons.
5. Flanagan C. (2008). Psychology: Complete Study and Revision Guide. England, Letts and Lonsdale.
6. Hall H. V. (2007). Forensic Psychology and Neuropsychology for Criminal and Civil Cases. NY, CRC Press.
7. Hauser P. (1991). Brain imaging in affective disorders, USA, American Psychiatric Press.



Code No.: FSC 206: QUESTIONED DOCUMENT AND THEIR EXAMINATION
(Discipline Specific Elective)

Learning Objectives:

After studying this paper the students will know: The importance of examining questioned documents in crime cases, the tools required for examination of questioned documents, the significance of comparing hand writing samples, the importance of detecting frauds and forgeries by analyzing questioned documents

Learning Outcome:

CO1 Have an understanding of questioned documents, its classification and its detection methods.

CO2 Analyze the handwriting characteristics of an individual

CO3 Have a better understanding of the working of a camera and its part.

CO4 Determine the photography of different physical evidence

CO5 Assess the digital evidences retrieved from a scene of crime.

Unit- I

Nature and Scope of Questioned Documents: Definition of Questioned Document, Types of Questioned Document, Collection, Preservation & Handling of Questioned Document, Photography of Questioned Document, Preliminary Examination of Questioned Document, Confirmatory Examination of Questioned Document.

Unit- II

Tools in Questioned Document: Basic Tools Needed for Forensic Document Examination- Ultraviolet, Visible, Infrared, and Fluorescence Spectroscopy, Photomicrography, Microphotography, Visible Spectral Comparator, Electrostatic Detection Apparatus, Determining The Age And Relative Age of Documents.

Unit- III

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

Unit – IV

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

Unit V-

Forgeries : Alterations in Documents, Including Erasures, Additions, Over-Writing, and

Obliterations. Indented and Invisible Writings, Charred Documents, Examination of Counterfeit Indian Currency Notes, Passports, Visas, and Stamp Pads

Essential Readings:

1. Mallet X. (2014). Advances in Forensic Human Identification. NY, CRC Press.
2. Maltoni D. (2009). Handbook of Fingerprint Recognition; Germany, Springer Science & Business Media.
3. Mehta M. K. (1989). Identification of Thumb Impression & Cross Examination of Finger Prints. India, N. M. Tripathi Ltd.
4. Osborn A. S. (1998). The Problem of Proof Second Ed. New Delhi, Universal Law Publishing.
5. Pierce D. S. (2006). Mechanics of Impression Evidence. NY, CRC Press.
6. Pierce D. S. (2011). Mechanics of Impression Evidence. NY, CRC Press.
7. Stiefel C. (2011). Fingerprints: Dead People Do Tell Tales. NJ, Enslow Publishers.
8. Thomas C. C. (1971). I.S.Q.D. Identification System for Questioned Documents. USA, Billy Prior Bates Springfield, Illinois.

Suggested Readings:

1. Ashbaugh D. R. (1999). Quantitative and Qualitative Friction ridge analysis. NY, CRS Press.
2. Daluz H. M. (2014). Fundamentals of Fingerprint Analysis. NY, CRC Press.
3. Fisher B. A. J. & Fisher D. R. (2012). Techniques of Crime Scene Investigation. NY, CRC Press.
4. Harrison W. R. (1997). Suspect Documents – Their Scientific Examination. Delhi, Universal Law Publishing.
5. Haynes W. M. (2016). CRC Handbook of Chemistry and Physics. NY, CRC Press.
6. Hilton O. (1982). Scientific Examination of Questioned Documents. NY, Elsevier.
7. James S. H. (2014). Forensic Science: An Introduction to Scientific and Investigative Techniques. USA, Taylor & Francis Group.
8. Kelly J. S. & Lindblom B. S. (2006). Scientific Examination of Questioned Documents. NY, CRC Press.
9. Lee H. C. & R. E. (1991). Advances in Finger Print Technology. London, CRC Press.

The image shows several handwritten marks in blue ink. On the left, there is a circular scribble with a horizontal line extending to the right. In the center, the word 'Sue' is written in a cursive script. To the right of 'Sue', there are two distinct, stylized signatures or scribbles, one above the other.

Code No. : FSC 207: SKILL DEVELOPMENT IN FORENSIC SCIENCE/ASSIGNMENT
(Skill Development Courses)

Every student will be imparted skills in development of new products and will be evaluated by the concerned teacher/Assignments/MOOC courses etc./Common course offered by the University Every student shall deliver at least one seminar on topic of the curriculum/ advances in food technology which will individually be assessed by every available teacher on the basis criteria laid down by the Staff council. Students in audience will also be encouraged to assess the seminar on the given criteria and their evaluation will also be

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**Code No.: FSC 208: LABORATORY- II (LABORATORY SKILL DEVELOPMENT/
FIELD WORK (Core)**

Objective:

To understand the effect of various Biological, serological, chemical, Toxicological and Pharmacological etc. techniques used on the crime and cyber crime.

Learning Outcome: The students will be able to understand and utilize different Biological, serological, chemical, Toxicological and Pharmacological etc. techniques. Sampling techniques and preparation of test samples,.

1. Preliminary & Confirmatory Examination of Chemicals Used in Trap Cases.
2. Preliminary & Confirmatory Examination of the Chemicals Seized in Case of Acid Attack.
3. Estimation Analysis of Petroleum Products using different methods like Density, Viscosity etc.
4. Detection of Adulterants in Cement Samples.
5. Determination of Percentage of Proof Spirit of Ethyl Alcohol in Illicit Liquor.
6. Separation and Identification of Volatile Liquid by Simple Distillation.
7. Chemical Examination of the Component of Crackers.
8. Preliminary Examination Black Powder.
9. Examination of Petroleum Products by GC & UV-VIS Spectrophotometry.
10. Examination of Country-made Liquor by UV-VIS Spectrophotometry
11. Identification of Common Plants i.e. Calotropis, Cannabis, Dhatura, Nux- Vomica, Marking Nut,
12. Abrus Precatorius, Opium Poppy etc. by Physical Examination and Color Test.
13. Identification of Different Vegetable Poisons by Thin Layer Chromatography etc.
14. Extraction and Identification of Insecticides and Pesticides by Color Test/TLC.
15. Extraction and Identification of Drugs/ Toxicants from Biological Matrix and their Detection.
16. Identification of Salts and Metals by Simple Color Test in Case of Metallic Poisoning.
17. Extraction and Identification of Metallic Poisons from Viscera Using Dry Ashing Method Followed by Reinsch's Test.
18. Primary and Confirmatory Examination of Blood/ Semen Samples.
19. Microscopic Examination of Seminal Stains for the Detection of Spermatozoa.
20. Identification of Species from the Hair Sample.
21. Examination of Fiber by Physical and Chemical Method.
22. Determination of Blood Groups from the Given Samples of Different Species.
23. Detection & Examination of Salivary Stains.
24. Identification of different Plant Species using External Features

The image shows four handwritten signatures or initials in blue ink. From left to right: a circular mark with a vertical line through it, the word 'Sueen' written in a cursive style, a stylized signature, and another stylized signature.

Code No. : FSC 209: COMPREHENSIVE VIVA (VIRTUAL CREDITS) (Core)

A comprehensive viva-voce of 4 virtual credits will be conducted at the end of semester of the programme by a board of four examiners.

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M. Sc. III SEMESTER (CBCS)
SUBJECT-FORENSIC SCIENCE
Code No. : FSC 301: FORENSIC ODONTOLOGY (Core)

Course Objective

1. The Importance of Forensic Odontology
2. Dental Identification and its importance in Post Mortem
3. Sex determination with the help of Teeth as an evidence
4. Importance of Bite marks in criminal Identification
5. Role of report writing in Dentistry

Course Outcomes

1. Students will learn about the basic structure of teeth also the importance of dentistry in the field of Forensics
2. Students will learn about the Dental Identification
3. Understanding Sex determination from dental and skeletal Morphology
4. Role of Bite marks and evidence collection from suspect and victim
5. Principles of report writing and quality assurance in evidence collection.

Unit I: Introduction to Forensic Odontology

History of Forensic Dentistry, Scope of Forensic Odontology, Basic Structure of tooth Composition of teeth, Types of teeth, Permanent Teeth and Deciduous teeth, Eruption of teeth, Maintaining dental records.

Unit II: Dental identification

Definition, Basis for dental identification, Postmortem changes of oral structures- Postmortem procedures, Different types of dental records

Unit III Sex determination

Sex determination in adults from radiographs, Sex determination in adults from dental and skeletal morphology, Age estimation in adults- Radiographic and clinical method, Dentist's role in mass disasters

Unit IV: Bite mark

the victim and suspect of bite mark, Analysis and comparison, Animal bite investigation Definition and classification, Basis for bite mark investigation, Bite mark appearance, Macroscopic and microscopic ageing of bite marks, Evidence collection from

Unit V: Report Writing and Documentation

Principles of report writing, International Organization for Forensic Odonto-Stomatology (IOFOS) and American Board of Forensic Odontology (ABFO) quality assurance guidelines in evidence collection, preservation, analysis and report writing.

Suggested Readings

1. David R Senn : Forensic Dentistry, Paul G Stimson

2. RichikTripathi : Handbook of Forensic Odontology and Medical Jurisprudence
3. SandhayaRamanujam : Medicolegal aspect for the dental profession
4. Modi J. S. : Medical Jurisprudence and Toxicology.
5. Taylor : Medical Jurisprudence
6. Parikh C.K. :Chikitsa Nyaya Shastra AurVishVigyan.
7. KiethSimpson& Bernard Knight : Forensic Medicine
8. Poison : CJ, DJ, Gee, B. Knight : Forensic Medicine
9. Reddy : Forensic Medicine



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**Code No.: FSC 302: QUESTIONED DOCUMENTS, FINGERPRINTS
AND OTHER IMPRESSIONS (Core)**

Course Objectives:

1. The objective of this course is to disseminate the knowledge about various types of forensic documents including genuine, forged and holographic documents.
2. It also aims to discuss the principles of handwriting, its identification, tools needed for forensic document examination & their use in forensic science.
3. The course will explain the typewritten, printed documents and forgery detection techniques to students

Course Learning Outcome

- CO1 The paper tends to introduce students to document examination. Also describes classification, variation, nature and problems of document examination.
- CO2 To learn writing features, their estimation, general characteristics, individual characteristics, ethnic and gender variability of handwriting, various types of forgeries and their detection
- CO3 To identify typescripts, various types of printing processes and their examination
- CO4 To Determine identification of age of documents by examination of signatures, paper, ink etc.

Unit- I:

Document and Writing Instruments: Questioned document and their types. Instruments used to prepare documents, ink and its types, Physical and Chemical examination, Paper & its Type, Manufacturing and examination of paper, collection, handing. Preservation and forwarding of documents seized from crime scene.

Examination of Documents: Preliminary examination of documents, instruments required for examination.

Handwriting: Class and Individual Characteristics, Basis of Handwriting Comparison, Making of Exemplar, Variation in Handwriting.

Signature: Genuine & Forged signatures and their Examination. Digital signature.

Unit –II:

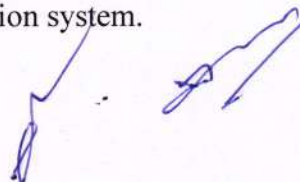
Forged Documents: Alteration – Erasure, Addition, Obliteration and Sheet insertion; Secret writing & its decipherment; Charred documents & their decipherment; Indented writing

Typed & Printed Document: Class and individual characters & their comparison; Typed & Printed matter, their examination

Photocopied and Scanned Documents: Class and individual characters and their comparison.

Digital Signature: Automated signature verification system.

Unit – III:



Fingerprints: History, Dactylography, Dactyloscopy, Friction Skin, formation of Ridges, Ridges and Farrow, Ridge Characteristics, Finger Prints Patterns, Type Line, Focal Point, Pattern Area, Core, Delta, Ridge counting in Loops, Ridge Tracing in Whorl, Types of fingerprints- Latent, Visible and Plastic Prints.

Classification of Fingerprints: Henry System and Its Modification, Battley Classification.

Edgeoscopy, Poroscopy

Unit – IV:

Fingerprint Development: Location of Fingerprints, Development of Latent Prints by Physical and Chemical Methods; Other Emerging Methods of Development; Lifting of Fingerprint.

Development of Fingerprint from Cadavers

Automation: Introduction, History, AFIS, FACT, CCTNS, AMBIS, AADHAR.

Unit – V:

Other Impressions: Foot and footwear prints, gait pattern, casting of print on different surface and their comparison; Forensic importance of Lip Print, Bite Mark and Palm Print.

Laws reference to IPC and IEA:

IPC- 29, 29A, 34, 120B, 409, 415, 416, 418, 420, 467, 468, 470, 471, 489 (A-E)

IEA- 3, 45, 45A, 47, 73, 114

Suggest Reading :

1. Rev. ED : Ordway Hilton ; Scientific Examination I of Questioned Documents, Elsevier, New York ; (1982)
2. Albert S. Osborn ; Questioned documents, Second Ed; Universal Law publishing, Delhi; (1998)
3. Albert S. Osborn ; The Problem of Proof – Secon Ed. ; Universal Law Publishing Delhi ; (1998)
4. Charles C. Thomas, Typewriting Identification I.S.Q.D. Billy Bates; Springfield, Illinois, USA, (1971)
5. Charles C. Thomas, I.S.Q.D. Identification system for Questioned documents ; Billy Prior Bates Springfield, Illinois, USA, (1971)
6. Wilson R. Harrison ; Suspect documents – Their Scientific Examination; Universal Law Publishing, Delhi. (1997)
7. Hard less, H.R. : Disputed documents, handwriting and thumbs- print identification : profusely illustrated, Law book Co., Allahabad, (1988)
8. David R. Ashbaugh : Quantitative and Qualitative Friction ridge analysis, CRS press, (1999)
9. Mehta M.K. : Identification of Thumb Impression & cross Examination of finger prints, N.M. Tripathi (P) Ltd. Bombay (1989)
10. Henry C. Lee & R.E. Ganesslen, Advance in Finger print Technology, ~ RC press, Boca Raton, London, (1991)

Essential Readings:

1. Mallet X. (2014). Advances in Forensic Human Identification. NY, CRC Press.
2. Maltoni D. (2009). Handbook of Fingerprint Recognition; Germany, Springer Science & Business Media.
3. Mehta M. K. (1989). Identification of Thumb Impression & Cross Examination of Finger Prints. India, N. M. Tripathi Ltd.
4. Osborn A. S. (1998). The Problem of Proof Second Ed. New Delhi, Universal Law Publishing.
5. Pierce D. S. (2006). Mechanics of Impression Evidence. NY, CRC Press.
6. Pierce D. S. (2011). Mechanics of Impression Evidence. NY, CRC Press.
7. Stiefel C. (2011). Fingerprints: Dead People Do Tell Tales. NJ, Enslow Publishers.
8. Thomas C. C. (1971). I.S.Q.D. Identification System for Questioned Documents. USA, Billy Prior Bates Springfield, Illinois.
9. Ashbaugh D. R. (1999). Quantitative and Qualitative Friction ridge analysis. NY, CRS Press.
10. Daluz H. M. (2014). Fundamentals of Fingerprint Analysis. NY, CRC Press.
11. Fisher B. A. J. & Fisher D. R. (2012). Techniques of Crime Scene Investigation. NY, CRC Press.
12. Harrison W. R. (1997). Suspect Documents – Their Scientific Examination. Delhi, Universal Law Publishing.
13. Haynes W. M. (2016). CRC Handbook of Chemistry and Physics. NY, CRC Press.
14. Hilton O. (1982). Scientific Examination of Questioned Documents. NY, Elsevier.
15. James S. H. (2014). Forensic Science: An Introduction to Scientific and Investigative Techniques. USA, Taylor & Francis Group.
16. Kelly J. S. & Lindblom B. S. (2006). Scientific Examination of Questioned Documents. NY, CRC Press.
17. Lee H. C. & R. E. (1991). Advances in Finger Print Technology. London, CRC Press.

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Code No.: FSC 303: FORENSIC MEDICINE AND MEDICAL JURISPRUDENCE (Core)**Course Objectives:**

1. The objective of this course is to introduce the medico legal aspects of death with early and late changes after death.
2. It will also explain the types of injuries and related investigations focusing the abrasions, bruises, lacerations, incised wounds, stab wounds, firearm injuries, defense injuries, fabricated injuries.
3. Traffic accident injuries: vehicular injuries etc. It aims at explaining the concept of forensic entomology and forensic psychology with details involved and their application in forensic investigations.

Course Learning Outcome:

- CO 1 This paper able to understand the Medico legal aspects of death, signs of death and changes after death.
- CO 2 To learn different types of injuries and their forensic investigations.
- CO 3 To understand the concept of Forensic Entomology their history and significance.
- CO 4 To analyze different methods used in forensic psychology like Lie detection, brain fingerprinting, narco-analysis, hypnosis, neuro-anthropological and psychological testing.

Unit – I:

Introduction: Definition of Forensic Medicine and Medical Jurisprudence, Basic knowledge about legal procedure in Courts, Criminal Court and their powers, Inquest, Subpoena & oath of medical expert; Recording of medical expert evidence in courts, Professional negligence, Kinds of witness and rules for giving evidence.

Unit –II:

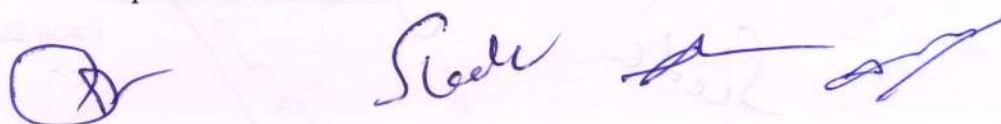
Personal Identity : Definition and importance, parameters contributing to personal identity- Race, Sex, Age, Complexation, Features & Photographs, Anthropometry, Stature, Scar, Hair, Teeth, Wounds, Foetal Age, Bite Mark, Fingerprints, Footprints, Tattoo marks, Birth marks, Malformation, Occupational Marks, Handwriting, Clothes and Ornaments, Voice & Speech, DNA, Disputed paternity.

Unit – III:

Wounds & Injuries: Introduction, its types, Mechanical injury- Abrasion, Contusion, Laceration, Incised wound, Stab, Self-inflicted and fabricated, Firearm injury, bomb explosion wounds.

Regional Injuries: Head injury, Skull, Traffic accident, Air craft, boxing, railway, mass-disasters.

Medico – Legal aspects, post mortem & ante mortem wounds: General characteristics of injuries from cold, heat, burns, scalds, lightning, electricity and radiation. Forensic importance of wounds.



Unit – IV:

Death and its Medico- legal aspects: Modes of death (Coma, Syncope, Asphyxia), Sudden death.

Post-Mortem Changes: Cessation of Vital function, changes in the eyes, skin and muscles, temperature, post-mortem lividity, rigor mortis and condition simulating rigor mortis, decomposition, adipocere, mummification, post mortem interval, estimation time since death.

Mechanical Asphyxia: hanging and its types, ligature marks and its examination, strangulation, bansadola, Garroting, mugging, suffocation, smothering, gagging, choking and Café coronary.

Traumatic Asphyxia: Burking, Postural Asphyxia, sexual asphyxia, drowning (Anti mortem and post mortem)

Unit – V:

Post – Mortem Examination: Importance, post -mortem report format, external & internal examination in brief; Viscera & its preservation. Examination of decomposed and mutilated bodies. Exhumation, Cause of death.

Sexual Offences: Sexual offences, virginity and pregnancy.

Essential Readings:

1. Parikh C.K. (1972). Forensic Medicine and Toxicology. India, Medical Publications.
2. Polson C.J., Gee D.J. & Knight B. (1985). The Essentials of Forensic Medicine. France, Pergamon Press.
3. Simpsen K. & Knight B. (1996). Forensic Medicine 11th edit. USA, Taylor & Francis.
4. Taylor A. S. (1853). Medical jurisprudence. Phyladelphia, Blanchard & Lea.
5. Thompson T., Black S. (2006). Forensic Human Identification: An Introduction. NY, CRC Press.
6. Vij K. (2014). Textbook of Forensic Medicine & Toxicology: Principles & Practice. India, Elsevier Health Sciences.

Suggested Readings:

1. Adelman H. C. (2007). Forensic Medicine, NY, Infobase Publishing.
2. Aggrawal A. (2016). Text book of Forensic Medicine and Toxicology. India, Avichal Publishing Company.
3. Catanese C. A. (2009). Color Atlas of Forensic Medicine and Pathology. NY, CRC Press.
4. Deoskar A. S., Tank A. H. (2010). Medical Jurisprudence, Toxicology and Forensic Science for Class Room, Investigation and Court Room with Case Laws, 3rd Ed. India, All India Refreshers.
5. Jason P. J. & Busuttill A. (2003). Forensic Medicine: Clinical and Pathological Aspects. England, Cambridge University Press.
6. Jason P. J. & Simpson K. (2014). Simpson's Forensic Medicine, NY, CRC Press.
7. Mallet X. (2014). Advances in Forensic Human Identification. NY, CRC Press.

8. Modi J.S. (2011). Medical Jurisprudence and Toxicology. India, Law Publishers.
9. Molina D. K.& M.D. (2009). Handbook of Forensic Toxicology for Medical Examiners. USA, CRC Press.

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Code No.: FSC 304: NARCOTICS AND DRUG ABUSE (Discipline Specific Elective)**Course Objectives:**

1. The objective of this course is to introduce the forensic chemistry basics with special focus on arson chemistry, details of adulterants in petroleum products and analytical tools for examination of alcoholic and non-alcoholic beverages.
2. It will explain types of explosives, their synthesis and characteristics, concept of forensic toxicology and pharmacology.
3. The students would be taught about different drugs of abuse including natural and synthetic drugs of abuse.

Course Learning Outcome:

After completing this course, the student will be able to realize:

CO1 The significance of toxicological studies in forensic science

CO2 The classification of poisons and their modes of actions.

CO3 The absorption of poisons in body fluids and the forensic identification of illicit liquors.

CO4 The classification and characteristics of the narcotics, drugs and psychotropic substances.

CO5 The methods of identifying and purifying narcotics, drugs and psychotropic substances.

Unit – I

Introduction to ND & PS: Narcotics Drugs and Psychotropic Substances, Narcotics, Drug and Cosmetics Act, Classification and Characteristics of Narcotics Drugs, Legal Issues and Challenges.

Unit – II

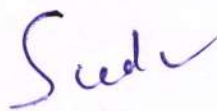
An Overview of Drug of Abuse: Types and Classification of Drugs, Drugs of Abuse, Drug Addiction, Drug Dependency; Synergistic Effect of Drugs, Drug Trafficking, Safety Measures and Precautions.

Unit – III

Pharmacology of Drugs: Pharmacological Studies: Absorption, Distribution, Metabolism, Pathways of Drug Metabolism, Mechanism of Action of Drugs, Effect on Brain and Various Other Body Systems.

Unit – IV

General Study and Analysis: Barbiturates, Methaqualone, Hydromorphone, Methadone, Meprobamate, Mescaline, Amphetamines, LDS, Heroin, Cannabinoids, Phinothiazines, Forensic Examination of Drugs of Abuse,

Unit – V

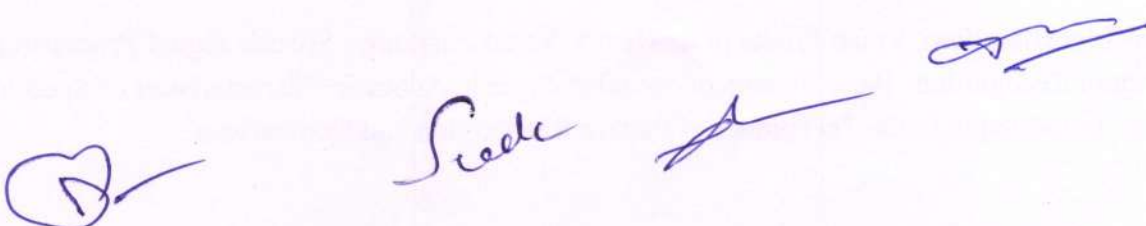
Recent Advancement in Drugs: Rave Drugs, Drug Designing, Doping, Drug Discovery Program, Structural Modification In Drugs, Drug Monitoring Agencies.

Essential Readings:

1. Modi J.S. (2011). Medical Jurisprudence and Toxicology. India, Law Publishers.
2. Molina D. K. (2009). Handbook of Forensic Toxicology for Medical Examiners. USA, CRC Press.
3. Parikh C.K. (1972). Forensic Medicine and Toxicology, India, Medical Publications.
4. Reddy K.S.N. (2014). Forensic Medicine 3rd edit. India, Jaypee Brothers.
5. Saferstein R. (1995). Criminalistics :An Introduction to Forensic Science. USA, Prentice Hall Inc.
6. Satoskar R.S., Rege N & Bhandarkar S.D.(2015). Pharmacology and Pharmacotherapeutics. India, Elsevier Health Sciences.
7. Sharma J. D. (1988). Vidhi vigyan Avem Vish Vigyan. India, Madhya Pradesh Hindi Granth Academy.
8. Vij K. (2014). Textbook of Forensic Medicine & Toxicology: Principles & Practice. India, Elsevier Health Sciences.

Suggested Readings:

1. Working Procedure Manual – Chemistry, Explosives and Narcotics (2000). India, BPR&D Pub.
2. Aggrawal A. (2016). Textbook of Forensic Medicine and Toxicology. India, Avichal Publishing Company.
3. Burger A. (2004). Medicinal Chemistry & Drug Discovery. NY, John Wiley & Sons.
4. Clark E.G.C. (1986). Isolation and Identification of Drugs, Vol. I and Vol. II. Britain, Academic Press.
5. Connors K.A. (1975). A Text Book of Pharmaceuticals analysis. New York, Inter Science Pub.
6. Davies S., Johnston A. & Holt D. (2016). Forensic Toxicology: Drug Use and Misuse. England, Royal Society of Chemistry.



Code No.: FSC 305: EMERGING TRENDS IN FORENSIC SCIENCE
(Discipline Specific Elective)

Course Objectives:

1. The objective of this course is to discuss the principles of poly graph analysis and to explain the Lie Detector investigations techniques.
2. It also aims at informing the students about various protected and endangered species of animals and plants and introduction of wildlife (protection) act 1972.
3. The student would be able to understand the forensic DNA profiling and its application in criminal and civil investigations.

Learning Outcome:

- CO 1 The paper intends to talk about various polygraph analysis techniques used to analyze Lie Detector investigation for criminal investigation.
- CO 2 To analyze microscopic and macroscopic examination of biological samples like plant, hair recovered from crime scene.
- CO3 To learn the techniques used in DNA Profiling.
- CO 4 To understand the Concept of gene and sequence variation

Unit – I

Polygraph and Narco-analysis: Polygraph Analysis: Lie Detector with MRI; Narco Analysis: Basics of Narco Analysis and its Significance in Forensic Science; Brain Fingerprinting and its Use in the Criminal Identification.

Unit – II

DNA Profiling: Structure of DNA, Damage to DNA, Variation in DNA, DNA as Excellent Polymorphic Marker, Basis of DNA Typing and Techniques. Touch DNA: Structure of DNA, Damage to DNA, Variation in DNA, DNA as Excellent Polymorphic Marker, Basis of DNA Typing and Techniques, Traces of DNA and Analysis.

Unit – III

Voice Identification: Voice Production, Theory-Vocal Anatomy, Speech Signal Processing & Pattern Recognition- Basic Factors of Sound in Speech, Acoustic Characteristics of Speech Signal. Introduction to the Techniques of Pattern Recognition and Comparison

Unit - IV

Forensic Entomology: General Entomology, Significance of Terrestrial and Aquatic Insects in Forensic Investigations and their Role in Crime Detection, Insect's Succession and its Relationship to Determine Time Since Death. Impact of Ecological Factors on Insect's Developments,

UNIT-V

Wild Life Forensic: Introduction and Importance of Wild Life, Protected and Endangered Species of Animals and Plants, Wild Life Species - Identification and Examination of Physical Evidence by Conventional and Modern Methods, Identification of Pug Marks of Various Animals, Wild Life Census, Wild Life and Environment Protection Act.

Essential Readings:

1. Nordby S.H. & James J.J. (2003). Forensic Science: An Introduction to Scientific and Investigative Techniques. USA, CRC Press.
2. O'Hara & Osterberg (1949). An Introduction to Criminalistics. New York, the Macmillan Company.
3. Saferstein R. (1995). Criminalistics – An Introduction to Forensic Science. USA, Prentice Hall Inc.
4. Sharma B.R. (2003). Forensic Science in Criminal Investigation and Trials. India, Universal Law House.
5. Tessarolo A.A. and Marignani (1996). Forensic Science and the Internet. Canada: The Canadian Society of Forensic Science Journal.

Suggested Readings:

1. James S.H. (2014). Forensic Science: An Introduction to Scientific and Investigative Techniques. New York, Taylor & Francis.
2. Jorg T. & Epplen T. L. (1995). DNA Profiling and DNA Fingerprinting. Basel, Birkhauser Verlag.
3. Lee H. C. & Ganesslen R. E. (1991). Advances in Finger Print Technology. London, CRC Press.
4. Leshin C.B. (1997). Internet Investigation in Criminalistics. New Jersey, Prentice Hall.
5. Mordby J. (2000). Dead Reckoning – The Art of Forensic Science Detection. USA, CRC Press LLC.

Code No.: FSC 306: CHROMATOGRAPHIC TECHNIQUE (Discipline Specific Elective)**Course Objectives:**

1. The objective of this course is to introduce specialized techniques and their application in forensic science.
2. The students will be able to understand the HPLC, GC & TLC Chromatography instrumentation techniques with their general principles involved as well as their applied aspects.

Course Learning Outcome:

- CO 1 To know about the concept of Chromatography, their utility and limitations.
CO 2 This paper tends to describe the different types of Chromatography techniques.
CO 3 To understand basic principles and theory of Chromatography techniques.
CO 4 To highlight general principles and Application of Chromatography techniques.

Unit – I

Introduction to Chromatography: Basics of Chromatography, History and Origin, Basic Concept and Principle of Chromatography.

Unit – II

Theory of Chromatography: Theory & Classification of Chromatography; Adsorption Chromatography, Partition Chromatography etc.

Unit – III

Planar Chromatography: Adsorbing Material, Separation and Purification of Compounds. Planer Chromatography: Paper Chromatography, Thin Layer Chromatography, HPTLC.

Unit – IV

Column Chromatography: High Performance Liquid Chromatography, UPLC, LC-MS Gas Chromatography, GC-MS.

Unit – V

Sample Preparation: Application of Chromatographic Techniques, Sample Preparation Techniques for Liquid and Gas Chromatography, Procedure for Method Development, Interpretation of Chromatogram.

Essential Readings:

1. Saferstein R. (2001). Forensic Science Handbook, Vol. I. New Jersey, Prentice Hall.
2. Scott R. P.W. (1995). Techniques and Practice of Chromatograph. NY, CRC Press.
3. Sharma B. K. (2000). Instrumental Methods of Chemical Analysis. India, Krishna Prakashan Media.
4. Shrivastava & Shrivastava, (1991). Introduction to Chromatography. India, S. Chand & Co.
5. Smith and Bogusz M., (2007). Handbook of Analytical Separation. Netherlands, Elsevier

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6. Srivastava M. M. (2010). High-Performance Thin Layer Chromatography. Germany: Springer Science & Business Media.

Suggested Readings:

1. Ahuja R.S. (2003). Chromatography and Separation Science. India, Academic Press.
2. Bouchonnet S. (2013). Introduction to GC-MS Coupling. NY, CRC Press.
3. Chatwal and Anand (2016). Instrumental Methods of Chemical Analysis. India, Himalaya Publishing House Pvt. Ltd.
4. Egon S. (2013). Thin Layer Chromatography. Germany, Springer Science & Business Media
5. Hübschmann H.J. (2015). Handbook of GC-MS: Fundamentals and Applications. USA, John Wiley & Sons.
6. Katz E. (2009). Quantitative Analysis Using Chromatographic Techniques. USA, John Wiley & Sons.
7. Lindsay S. (1992). High Performance Liquid Chromatography. New York, Wiley.
8. Khandpur R.S. (2004). Handbook of Analytical Instruments. India, Tata McGraw Hill Pub. Co.
9. Robards K. & Jackson P.E. (2012). Principles and Practice of Modern Chromatographic Methods. Netherlands, Elsevier Pub.

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**Code No. : FSC 307: PERSONALITY DEVELOPMENT/ SKILL DEVELOPMENT IN
FORENSIC SCIENCE (Skill Development Course)**

Every student will be imparted skills in development of new products and will be evaluated by the concerned teacher/Assignments/MOOC courses etc./Common course offered by the University Every student shall deliver at least one seminar on topic of the curriculum/ advances in Forensic Science which will individually be assessed by every available teacher on the basis criteria laid down by the Staff council. Students in audience will also be encouraged to assess the seminar on the given criteria and their evaluation will also be

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Code No.: FSC 308: 308: LABORATORY-III (Laboratory Skill Development/Minor Project)
(Core)

Objective: To understand the chemistry of Forensic Science and to develop skills related to evaluation of biochemistry using various qualitative techniques.

Learning Outcome: The students shall acquire the practical skills for the sampling of crimes and shall be able to carry out quality evaluation forensic science. They will learn biochemical techniques for estimation of content in different type of samples, analysis of bloods and Proteins.etc.

1. Draw and Label the Bones of Human Body.
2. Determination of Age and Sex of a Person from Long Bones.
3. Determination of Age and Sex of a Person from Skull.
4. Recording of Bite Marks by Casting & their Photography.
5. Collection and Identification of Important Insects for Forensic Studies.
6. Collection and Identification of Pollen Grains, Diatoms of Forensic Importance.
7. Determination of Race and Species by Blood Grouping Methods.
8. Examination of Lip Prints.
9. Introduction of Computer, Accessories & Operating Systems.
10. Collection and Handling of Digital Evidences.
11. Detection of Origin of e-Mails (IP Address) etc.
12. Software for Protection of Data & Security.
13. Software used in Detection of Various Types of Cyber Crime.
14. Collection, Preservation, Handling & Forwarding of Charred Document.
15. Photographic Comparison of Handwriting & Signature.
16. Comparison of Forged and Genuine Document by VSC & Other Methods.
17. Decipher of Secret Writing by Physical & Chemical Methods.
18. Examination of Questioned Document & Currency by VSC.
19. Examination of ink by TLC
20. Examination of Various Ink Samples Using Planer Chromatographic Techniques.
21. Decipherment of Secret, Erased, Obliterated, Indented Hand Writing Using Physical/Chemical Methods.
22. Study of Handwriting on Different Surfaces.
23. Handling and Preserving of Charred Documents.
24. Matching of Hand Writing and Signatures (Genuine/Forged).
25. Examination of Type Written and Printer Generated Prints.
26. Print your own 10 Digit Finger Print Card Using Black Ink.
27. Primary and Secondary Classification of Given Finger Print Chart.
28. Location, Development and Lifting of Latent Finger Print.
29. Casting and Matching of Foot/Footwear Print on Soft Surface.
30. Comparison of Chance Finger Prints.
31. Introduction of Computer, Accessories & Operating Systems

32. Collection and Handling of Digital Evidences.
33. Network Analysis for Security Purposes.
34. Study of Computer Forensics and Cybercrime Investigations Being Used by Developed Nations like USA, UK and Comparison with India.
35. To Record a Finger Print Chart by Direct Print Method and Rolling Method.
36. To Identify the Finger Print Patterns along with Core and Delta.
37. To Perform Ridge Tracing and Ridge Counting of the Fingerprints.
38. Identification of Ridge Characteristics of Fingerprint by Transo-Scan Lab Imaging System Method.
39. Development of Latent Prints by Powder Method and Chemical Methods on Porous and Non-Porous Surfaces.
40. Lifting of Fingerprint by Different Methods.
41. Identification of Chance Prints Found on Different Surfaces.
42. To Take Palm and Lip Prints and Their Examinations by TransoScan Lab Imaging System.
43. Identification of Common Plant i.e. Cannabis, Tobacco and Opium Poppy by Morphological Features.
44. Preliminary Examination of Drugs Used for Committing Drug Facilitated Sexual Assaults.
45. Systematic Extraction and Identification of Narcotic/ Sedative/ Tranquilizer Drugs from Viscera/ Blood/ Urine (Simulated Sample).
46. Separation of Abusive Drugs from the Suspected Sample by HPLC.
47. Extraction of The Alcohol Content from the Country Made Liquor Using Simple Distillation Technique and its Preliminary Examination.
48. Examination of Drugs of Abuse by UV-Vis Spectrophotometer.
49. Measurements on Facial Indices for Personal Identification.
50. Anthropometric Measurements of Upper Limb of a Human Body.
51. Measurements of Long Bones and Girdles Indices for the Determination of Sex Differences.
52. Individualization of a Person by ABO Blood Grouping Method.
53. Recording of Bite Marks Using Photography and their Comparison
54. Preparation of Thin Layer Chromatographic Plates Using Silica Gel-G.
55. Analysis of Various Ink Samples by PC and TLC.
56. Separation of Pharmaceutical Compounds by HPLC.
57. Separation of Agrochemicals by TLC and HPLC.
58. Separation of Dyes by High Performance Thin Layer Chromatography.

Code No. : FSC 309: COMPREHENSIVE VIVA (VIRTUAL CREDITS) (Core)

A comprehensive viva-voce of 4 virtual credits will be conducted at the end of semester of the programme by a board of four examiners.

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M. SC. SEMESTER- IV
SUBJECT-FORENSIC SCIENCE

Code No.: FSC 401: PROJECT WORK/ONSITE TRAINING (Core)

1. Project Work and Presentation

2. Project Report Assessment and Viva voce

Objective: Every student is supposed to prepare a Dissertation based on field work or laboratory work (minimum tenure three months) based on in a specialized field chosen by the student in consultation with their supervisor. The project report will be submitted in the form of dissertation duly certified by the supervisor of the dissertation by any research organization, industry, national institutes and/or Universities in India, by seeking the placement. Two hard copies of the dissertation to be submitted by the student in the Department for its evaluation by the end of month of April/May, the student then shall have to appear for the viva voce examination.

Course Learning Outcome:

CO 1 To learn about field work techniques

CO 2 To understand pilot survey relevance

CO 3 To teach about specific laboratory techniques chosen by the student.

Provide students with theoretical knowledge and practical abilities required to work in the Forensic Science, research centers, and related national and international organizations. Contribute to a healthier population by imparting education and understanding of forensic science. Develop confident and competent individuals, able to adapt to the changing fabric of society through their professional expertise and personal traits.

Guidelines for Dissertations Report Layout:

The report should contain the following components:

Title or Cover Page: The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

Acknowledgements (optional): Acknowledgment to any advisory or financial assistance received in the course of work may be given.

Abstract: It should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to objectives. The abstract have to be concise summary of the scope and results of the project.

Table of Contents: Titles and subtitles are to correspond exactly with those in the text.

Introduction: A brief introduction to the problem that is central to the project and it should aim to catch the imagination of the reader, so excessive details should be avoided.

Materials and Methods: This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Results and Discussion: Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

Note during writing, all figures & tables should as far as possible be next to the associated text, in same orientation as main text, numbered, & given appropriate titles.

Conclusion: This is the final section in which outcome of the work is mentioned briefly.

Future prospects (if applicable)

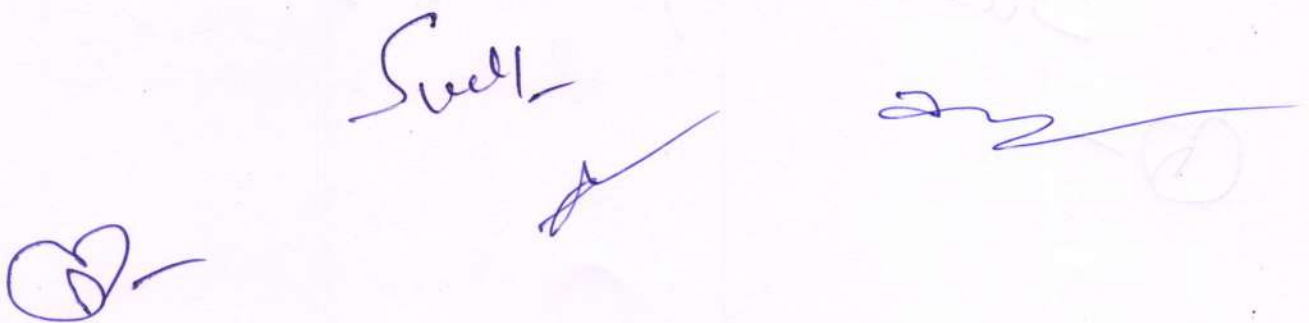
References / Bibliography: This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname.

Appendices: This contains material which is of interest to reader but not an integral part of the thesis and may be useful to document for future reference.

Assessment and Viva voce of the Project File:

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution. Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project

Swell

The page contains several handwritten signatures and initials in blue ink. On the left, there is a circular mark with a vertical line through it. In the center, the word 'Swell' is written in a cursive style. To the right of 'Swell' is a long, horizontal, sweeping signature. Further to the right, there is another signature that appears to be 'S. Patel' followed by a long horizontal line. At the bottom right, there is a circled number '1'.

**Code No.: FSC 402 INDUSTRIAL VISIT/FORENSIC SCIENCE
ORGANIZATION/INSTITUTE ETC VISIT MINOR REPORT WRITING (Core)**

Course Objective:

1. The students are supposed to prepare a report of the field visits to crime scenes, police stations, FSLs, court rooms etc. and.
2. The students are supposed to prepare a report on the basis of the out- house trainings at FSLs/ CFSLs/University and Research laboratories/ GEQD's for 2-3 weeks and submit a brief report on the work done on the same for the evaluation

Learning Outcome:

The student will be able to appreciate different Investigation in Organization settings. The student will be exposed to the diverse setting in Forensic Science.

CO 1 To visit crime scenes/ police stations/ FSLs / biological laboratories/ court rooms for a specified duration.

CO 2. To record day to day event of the specific visit site

CO 3 To prepare a detailed report of cases evidences during the visits.

CO 4 To Visit forensic laboratory or forensic institutes in India.

CO 5 To learn specific techniques from the allotted/ selected laboratory/ institute for 2-3 weeks.

CO 6 To prepare a brief report of the training undertaken at Forensic Laboratory/ Institute.

Swati *[Signature]* *[Signature]*

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Code No.: FSC 403: REVIEW WRITING (Core)**Objective:**

1. A literature review is a survey of everything that has been written about a particular topic, theory, or research question.
2. It may provide the background for larger work, or it may stand on its own. Much more than a simple list of sources, an effective literature review analyzes and synthesizes information about key themes or issues.

Learning Outcome:

1. To discover what has been written about a topic already, to determine what each source contributes to the topic, to understand the relationship between the various contributions, identify and (if possible) resolve contradictions, and determine gaps or unanswered questions.

What is involved in writing a literature review?

1. Research – to discover what has been written about the topic
2. Critical Appraisal – to evaluate the literature, determine the relationship between the sources and ascertain what has been done already and what still needs to be done
3. Writing – to explain what you have found

Steps to writing an effective literature review:

Gathering sources focus your topic: A literature review aims to cover all of the research on a given topic. If the topic is too large, there will be too much material to cover it adequately.

Read with a purpose: Although you will need to briefly summarize sources, a good literature review requires that you isolate key themes or issues related to your own research interests.

Evaluating sources: For each book or article consider:

Credentials: Is the author an expert?

Argument/Evidence: Does the evidence support the conclusion? Is the argument or evidence complete?

When comparing sources, consider:

Conclusions: Does all research arrive at the same conclusion or are there differing opinions? What evidence or reasoning are the differences based on?

Gaps or omissions: What questions are raised by the literature?

Writing a Literature Review-:

Introduction: The introduction should identify your topic, some discussion of the significance of that topic and a thesis statement that outlines what conclusion you will draw from your analysis and synthesis of the literature. If your literature review is part of a larger work, explain the importance of the review to your research question.

Body: In the body, discuss and assess the research according to specific organizational principles (see examples below), rather than addressing each source separately. Most, if not all, paragraphs should discuss more than one source. Avoid addressing your sources alphabetically as this does not assist in developing the themes or key issues central to your review.

Organizing Principles

Principle	When to Use	Example
Theme	When explaining key themes or issues relevant to the topic -This is the most common way to organize literature reviews.	A literature review of 31 relevant articles published between January 1999 and March 2004 identified 12 categories of neighborhood characteristics relevant to maternal and child health: income/wealth, employment, family structure, population composition, housing, mobility, education, occupation, social resources, violence and crime, deviant behavior and physical conditions. [Example adapted from Rajaratnama, J.K., Burke, J.G. & O'Campo, P. (2006). Maternal and child health and neighborhood context: The selection and construction of area-level variables. <i>Health and Place</i> , 12, 547-556.]
Methodology (also called a methodology review)	When discussing interdisciplinary approaches to a topic or when discussing a number of studies with a different approach.	In dentistry, fluorescent imaging been used for many applications revealing a variety of information about bonded restorations. This review evaluates the different methods used in this area with the intent of determining if standardized methodologies exist. [Example adapted from D'Alpino, P.H.P. et al (2006). Use of fluorescent compounds in assessing bonded resin-based restorations: A literature review <i>Journal of Dentistry</i> , 34 623-634.
Chronology	When historical changes are central to explaining the topic.	A literature review is presented on the evolution of water pollution management and its impact on land pollution from 1900 to 2000 within a hypothesis of whether we could have done more, sooner. Stream pollution science in the context of the fundamental sanitary engineering concepts of reasonable use and assimilative capacity is examined in light of evolving regulatory frameworks from the early 1900s, when regulation and standards were mostly lacking, to the zero discharge goals and comprehensive federal command/control regulations of the late 20th century. [Example adapted from Shrifin, N.S. (2005). Pollution Management in the Twentieth Century. <i>Journal of Environmental Engineering</i> , 131, 676-691.]

Conclusion: The conclusion should provide a summary of YOUR findings from the literature review. Explain what your analysis of the material leads you to conclude about the overall state of the literature, what it provides and where it is lacking. You can also provide suggestions for future research or explain how your future research will fill the gaps in the existing body of work on that topic.

Code No.: FSC 404: SEMINAR/GROUP DISCUSSION (Core)

Objective: Objectives In this paper, you will learn how to: select relevant information, organize material, choose a speaking style appropriate to the situation, use appreciative language, express yourself clearly and audibly, use appropriate non-verbal communication when speaking, use audiovisual aids to support the presentation, deliver an effective presentation, contribute to a group presentation, deal with difficult situations, evaluate your own performance.

Learning Outcome: At the end of the Seminar, go back to these objectives and self-assess your capabilities.

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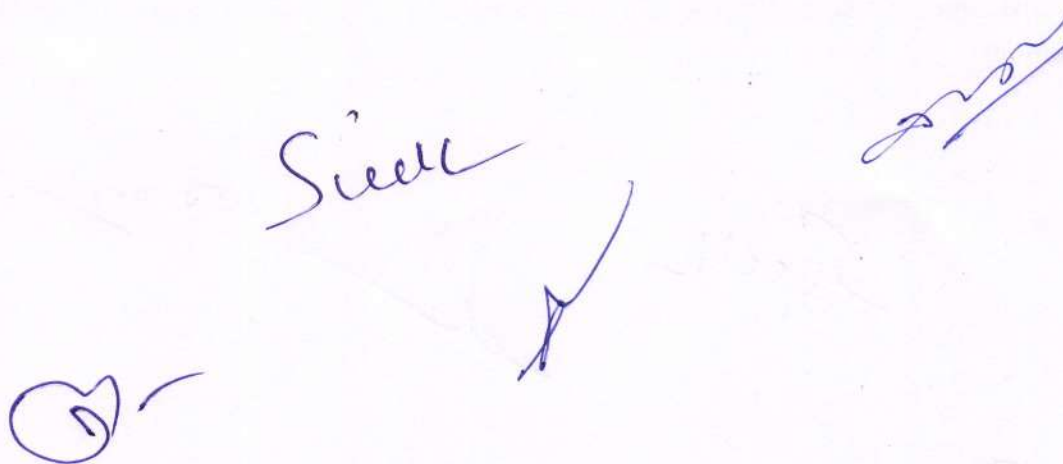
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Code No. : FSC 405: POSTER PRESENTATION (Core)

Objective: Is my abstract effective? Why should anyone care? What am I adding to current knowledge? Do I need to explain methods? Have I told them what I found and recommend?

Learning Outcome: A poster can be better than giving a talk, more efficient because: you totally bomb at giving talks, can be viewed while you nap, can hang in the department for years, can reach folks not in your field of research:

Sierra

The image shows handwritten text in blue ink. The word "Sierra" is written in a cursive style. To its right is a scribble consisting of several overlapping lines. Below "Sierra" is a checkmark-like symbol. To the left of "Sierra" is a circle with a vertical line through it. To the right of the scribble is another scribble.

Code No.: FSC 406: COMPREHENSIVE VIVA (Virtual Credits) (Core)

A comprehensive viva-voce of 4 virtual credits will be conducted at the end of semester of the programme by a board of four examiners.

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