EKLAVYA UNIVERSITY
ज्ञान प्राप्तये लक्ष्य संधानम्

School of Basic and Applied Sciences

SYLLABUS

PG				
Class				**M.Sc. Forensic Science**
Semester/Year				**II Semester**
Subject & Subject Code				**Forensic Science - MFOSC20S201**
Paper				**Instrumental Methods of Chemical Analysis and their Applications**
Max. Marks				**60 (ETE) + 40 (IA) =100**
L	T	P	**Credits Total**	**4**
4	0	0		

Course Objectives:
To Provide knowledge about
- Various instrumental techniques used in Forensic science
- Importance of chromatographic and spectroscopic techniques in processing crime scene evidence.
- Significance of microscopy in visualizing trace evidence and comparing it with control samples,
- Fundamental Principles and types of microscope used in forensic science.

Course Outcome:
From this course students will learn
- How different evidences are analysed using various instrumental methods.
- The basic principle working and forensic application of electrophoretic techniques, spectroscopic and chromatographic techniques.

Student Learning Outcomes (SLO):
After studying this paper, the students will know –
- The importance of chromatographic and spectroscopic techniques in processing evidence.
- The utility of colorimetry, electrophoresis and neutron activation analysis in identifying chemical and biological materials.
- The significance of microscopy in visualizing trace evidence and comparing it with control samples.

Unit	Syllabus	Periods
UNIT - I	**Distillation** • General idea and basic principle of distillation, • Various types of distillation techniques • Sample treatment techniques – Centrifuge, Filtration, Evaporation, Crystallization etc. • Distribution Law, Solvent extraction technique like LLE, SPE, micro SPE.	12 Hrs.

UNIT - II	**Chromatographic techniques:** • Theory of chromatography, Classification of chromatography, • General idea on planar chromatography, Column chromatography, Adsorption, Partition chromatography, • General principles and working of Planer chromatography: TLC, PC, HPTL • Forensic Application of planar chromatography.	12 Hrs.
UNIT - III	**General principles and working of Column Chromatography** • Selection of mobile phase, column and detectors • Ion-exchange chromatography • Brief idea on working of HPLC, GC, Ion Exchange Chromatography, Exclusion (Permeation) chromatography, Affinity chromatography • Forensic Application of column chromatography.	12 Hrs.
UNIT - IV	**Electrophoretic techniques:** • General principles, Classification of electrophoresis • Factors affecting electrophoresis, Preparative, Horizontal, Vertical, • two-dimensional electrophoresis • Brief idea of Low voltage electrophoresis, High voltage electrophoresis, Gel electrophoresis, Isoelectric focusing etc • General idea and working of Capillary Electrophoresis • Forensic Application of electrophoresis, electrochemical techniques: Genera principles • Electron transport process, Polarography and variants.	12 Hrs.
UNIT - V	**Mass Spectrometry (MS):** • Principle and Instrumentation, Correlation of MS with molecular structure. • A brief idea about the various forms of Mass Spectrometry • Coupling MS with GC, LC, and CE etc. Application of MS in Forensic Science.	12 Hrs.

Suggested Readings-

1. Jarris, K.E., A.L. Gray & R.S. Hock, EDS; handbook of Inductively Coupled Plasma Mass Spectrometry; Glasgow Blockie, (1992)
2. Maclaffrty, F.W. & F. Turecek; Interpretation of Mass spectra; 4th ed Mill Valley, C A Univ. Science Books, (1993)
3. Chapmen, J.R.; Practical Organic Mass spectrometry, A Guide for Chemical and Biochemical Analysis, Wiley, New York, (1993)
4. Lindsay, S.; High Performance Liquid Chromatography, New York, Wiley (1992)
5. Sharma PK: Instrumental Methods of chemical Analysis.
6. Chatwal and anand: Instrumental Methods of chemical Analysis.
7. Kriggle: Instrumental Methods.
8. Willard, Merrit and Dean: Instrumental methods of analysis
9. Saferstein: Forensic Science Handbook Vol. I, II, III.
10. Lee Honry: An Introduction to Forensic Science.
11. Egon Stahl: Thin Layer Chromatography.
12. Shrivastava & Shrivastava: Introduction to chromatography

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School of Basic and Applied Sciences

SYLLABUS

PG				
Class				**M.Sc. Forensic Science**
Semester/Year				**II Semester**
Subject & Subject Code				**Forensic Science - MFOSC20S202**
Paper				**Instrumental Methods of Biological Analysis and their Application**
Max. Marks				**60 (ETE) + 40 (IA) =100**
L	T	P	**Credits Total**	**4**
4	0	0		

Course Objectives:
To Provide knowledge about
- Various instrumental techniques used in Forensic Biology
- Importance of centrifugation and immunochemical techniques in processing crime scene evidence.
- Significance of enzyme based and molecular techniques in visualizing trace evidence and comparing it with control samples,
- The utility of different electrophoresis techniques in biological materials.

Course Outcome:
From this course students will be able to
- Analyse different evidences using various instrumental methods.
- Student will have knowledge about different microscopes and photography technique required in evidence collection and examination.
- Students will learn the basic principle working and forensic application of electrophoretic techniques.

Student Learning Outcomes (SLO):
Student will learn Different analytical techniques such as
- Spectrophotometry,
- Immuno-Chemical Methods,
- Electrophoresis,
- Centrifugation methods.

Unit	Syllabus	Periods
UNIT - I	**General principles of Biological/chemical Analysis** • pH and buffers, physiological solution, • Cell and Tissue Culture, • Cell fractionation, Biological variation etc.	12 Hrs.

UNIT - II	**Centrifugation Techniques** • Basic principles of sedimentation, • Types of centrifuges, • Density gradient centrifugation, • Prerogative centrifugation, • Analysis of sub-cellular fractions, ultra-centrifuge, refrigerated centrifuges.	12 Hrs.
UNIT - III	**Enzyme Techniques** • Enzyme kinetics, purification and protein estimation, enzyme assay techniques, visible UV spectrophotometric methods, Luminescence method Radioisotope methods, Immuno-chemical method, automated enzyme analysis, immobilized enzymes.	12 Hrs.
UNIT - IV	**Immunochemical Techniques** • General principles, production of antibodies, precipitation reaction, Gel immunodiffusion, Immune-electrophoresis, complement fixation. • Radio immunoassay (RIA), enzyme immunoassay, metal Ion immunoassay chemiluminescent/fluorescence immunoassay.	12 Hrs.
UNIT - V	**Molecular Biology Techniques** • Outline of genetic manipulation enzyme, Enzymes and in genetic manipulation, cloning procedures, • Isolation of specific nucleic acid sequences-complimentary DNA, Gene libraries, colony hybridization, Nick translation, oligo nucleotide probes, expression of genes.	12 Hrs.

Suggested Readings-

1. Li R. (2008). Forensic Biology: Identification and DNA Analysis of Biological Evidence. USA, Taylor & Francis.
2. McClintock J. T. (2014). Forensic Analysis of Biological Evidence, A Laboratory Guide for Serological and DNA Typing. NY, CRC Press.
3. 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 Gome and Perks Commission. Philadelphia, Staff Research Publications.
4. Triggs C. M., Buckleton J. S. &Walsh S. J. (2004). Forensic DNA Evidence Interpretation. NY, CRC Press.
5. Walker J. M. &Rapley R. (2009).Molecular Biology and Biotechnology. UK, Royal Society of Chemistry.
6. Williams P. L. &Warwick R. (1980). Gray□s Anatomy. London, Churchill Livingston.

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Estd by Madhya Pradesh Niji Vishwavidyalaya Sthapna Evam Sanchalana Adhiniyam 2020

School of Basic and Applied Sciences

SYLLABUS

PG				
Class				**M.Sc. Forensic Science**
Semester/Year				**II Semester**
Subject & Subject Code				**Forensic Science - MFOSC20S203**
Paper				**Forensic Pharmacology and Toxicology**
Max. Marks				**60 (ETE) + 40 (IA) =100**
L	T	P	**Credits Total**	**4**
4	0	0		

Course Objectives:
This course provides
- The classification of poisons and their modes of action.
- The classification and characteristics of the narcotics, drugs and psychotropic substances.
- The significance of toxicological studies in forensic science.

Course Outcome:
Student will be able to
- Identify the poisons and modes of action of poison.
- Classification and Identification of NDPS, Narcotics, stimulants, depressants and hallucinogens.
- Extraction, Isolation and Clean-up procedures.
- General Study and Analysis of drugs.

Student Learning Outcomes (SLO):
Student will learn about-
- Different types of poisons and their extraction, isolation and examination.
- Treatment in cases of poisoning
- Analysis of different drugs and their pharmacological effects

Unit	Syllabus	Periods
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.	12 Hrs.

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UNIT - II	**Extraction, Isolation and Clean-up procedures:** • 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.	12 Hrs.
UNIT - III	**General Study and Analysis:** • Barbiturates, methaqualone, Hydromorphine, Methadone, Meprobamate, Mescaline, Amphetamines, LDS, Heroin, Cannabinoids, Phinothiazines • Insecticides: Types, General methods for their analysis • Alkaloids: Definition, classification, Isolation and General characterization.	12 Hrs.
UNIT - IV	**Forensic Examination of Metallic Poisons:** • Arsenic, Mercury, Lead, Bismuth, Copper, Aluminium, Iron, Barium, Zinc • Analysis of Ethyl Alcohol in blood and urine, illicit liquor, Methanol, Acetone, Chloroform, Phenol Snake venoms and Poisons, Irrespirable gases.	12 Hrs.
UNIT - V	**Forensic Pharmacological studies:** • Absorption, Distribution, Metabolism, Pathways of drug metabolism • General studies and Analysis of some vegetable poisons, Opium, Abrus, Cyanogenetic glycosides, Dhatura, Marking nuts, Nux-vomica, Oleander and Aconite.	12 Hrs.

Suggested Readings-

1. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
2. S.B. Karch, The Pathology of Drug Abuse, CRC Press, Boca Raton (1996).
3. Kennedy, Thomas J., Christian, Jr., Donnell Basic Principles of Forensic Chemistry, Springer
4. Saferestein, Criminalistics: An Introduction to Forensic Science. Prentice Hall.
5. Goutam, M. P. and Goutam S Analysis of Plant Poison, Selective & Scientific Books, New Delhi.
6. Feigl; Spot Test in Organic Analysis, Elsevier Pub., New Delhi.
7. Clark, E.G.C.; Isolation and Identification of Drugs, Vol I&II, Academic Press.
8. Sunshine I; Year book of Toxicology, CRC Press Series, USA.
9. Michael J. Deverlanko et al: Hand Book of Toxicology CRC Press, USA.
10. Parikh C.K; Text Book of Medical Jurisprudence Forensic Medicines and Toxicology. CBS Pub. New Delhi.

School of Basic and Applied Sciences

SYLLABUS

PG				
Class				**M.Sc. Forensic Science**
Semester/Year				**II Semester**
Subject & Subject Code				**Forensic Science - MFOSC20S204**
Paper				**Forensic Physics and Computer Forensics**
Max. Marks				**60 (ETE) + 40 (IA) =100**
L	T	P	**Credits Total**	**4**
4	0	0		

Course Objectives:
This course will provide the knowledge of
- Various physical evidences found at crime scene and their significance in investigation,
- Tools and techniques used in computer forensics,
- Different cyber-crimes and their investigation.

Course Outcome:
Student will be able to
- Forensic examination of different physical evidences, Restoration and examination of tool marks.
- Analysis of tapes for speaker identification and authentication
- Cryptographic techniques, Computer security and cyber forensics

Student Learning Outcomes (SLO):
Students will learn about
- Nature, composition and forensic examination of physical evidences
- Determination of adulterants by physical, chemical and instrumental methods
- Various techniques used for recognition of speaker
- Different types of crimes and encryption techniques,
- Network security and cyber-crime investigation

Unit	Syllabus	Periods
UNIT - I	**Glass:** Nature, composition, types, fractures, forensic marks and forensic examinations. **Dust and soil:** Nature, composition and forensic examinations. **Paint:** Nature, composition, types and forensic examinations. **Building material:** Types of cement and their composition, Determination of adulterants by physical, chemical and instrumental methods, Examination of brick, Analysis of Cement Mortar and Cement concrete.	12 Hrs.
UNIT - II	**Tool marks:** Types of tool marks: Compression marks, striated marks, combination of compression and striated marks, repeated marks, class characteristics and individual characteristics, tracing and lifting of marks, forensic examinations. **Restoration of erased / obliterated marks.** **Examination of wire/ cables, counterfeit coins.** **Physical matching of severed / broken objects.**	12 Hrs.

UNIT - III	**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.	12 Hrs.
UNIT - IV	**Computer forensic:** • What is computer forensic? Basic introduction to computers, hardware and accessories, operating system and software. • Cyber-crime- Definition, crimes on internet, hacking, virus, worms, cookies, obscenity and pornography. Programme manipulation. • Software piracy, intellectual property and computer security. • Encryption and decryption methods.	12 Hrs.
UNIT - V	**Computers and networking:** • Concept of network security and cybercrime investigation. • Basic of security planning: Multi layered security, intrusion triangle, removing intrusion opportunities, importance of physical security, protecting server, work station and network devices, protection of removable storage disks. • Cryptography and steganography. **Cyber-crime investigation.** **Relevant section of Information technology Act 2000**	12 Hrs.

Suggested Readings-

1. C.E. O 'Hara and J.W. Osterburg; An Introduction to Criminalistic: Indiana University Press, Blomington, (1972)
2. R. Saferstein; Forensic Science Handbook, Vols. I, II; (Ed); Prentice Hall, Eglewood Cliffs, NJ; (1988)
3. Jenkins and White; Fundamentals of Optics; Mc Graw Hill; Fourth Ed, (I n ()
4. Dennis Shaw; Physics in the Prevention and Detection of Crime, Contem Phys. Vo U7; (1976)
5. Philip Rose; Forensic Speaker Identification; Taylor and Francis Forensic Science Series, London.
6. Bengold& Nelson Moryson – Speech and Audio signal processing; John Wiley & Sons, USA,
7. Nickolls, L.C.; Scientific Investigation of Crime, Bulterwest, London (1956)
8. Raymond C Murray & John C.F. Tedrew; Forensic Geology; Prentice hall, New Jersey (1991)
9. B. Caddy; Forensic Examination of glass and paints analysis and interpretation ISBN 0784 05749
10. Philip Rose; Forensic Speaker Identification; Taylor & Francis Forensic Science series, London

School of Basic and Applied Sciences

SYLLABUS

PG				
Class				M.Sc. Forensic Science
Semester/Year				II Semester
Subject & Paper Code				Practical Forensic Science - MFOSC20S205
Paper				Instrumental Methods: Physical, Chemical and Biological– Practical
Max. Marks				60 (ETE) + 40 (IA) =100
L	T	P	Credits Total	2
0	0	2		

PRACTICALS

60 hrs.

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. To identify the given compounds using thin layer and paper chromatography.
4. To know practical working and handling of high-performance liquid chromatography.
5. To know practical working and handling of gas chromatography.
6. To know practical working and handling of low voltage and high voltage electrophoresis.
7. To know practical working and handling of compound and stereo microscope.

SYLLABUS

PG				
Class				**M.Sc. Forensic Science**
Semester/Year				**II Semester**
Subject & Paper Code				**Practical Forensic Science - MFOSC20S206**
Paper				**Forensic Physics and Cyber forensic - Practical**
Max. Marks				**60 (ETE) + 40 (IA) =100**
L	T	P	**Credits Total**	**2**
0	0	2		

PRACTICALS

60 hrs.

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. Restoration of erased punched mark on metal piece by chemical treatment.
4. To calculate the refractive index of glass.
5. Introduction of Computer, Accessories & operating Systems
6. Detection of origin of e-mails (IP address) etc.
7. Image processing and pattern Recognition framework
8. Software for protection of data & security
9. Software's in detection of various aspects of cyber crime