SHRI VAISHNAV VIDHYAPEETH VISHVAVIDHYALAYA, INDORE

M.Sc. / B.Sc.-M.Sc. (Forensic Science) CBCS

Semester-II / VIII (M.Sc. / B.Sc.-M.Sc.)
Name of Program M.Sc. / B.Sc.-M.Sc. (Forensic Science)

Subject Code	Category	Subject Name	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	Credits
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
MSCFS–201	DC	Forensic Chemistry and Toxicology	60	20	20	30	20	4	1	2	6

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment shall be based following components: Quiz /Assignment / Project/Participation in Class, given that no component shall exceed more than 10 marks.**

Learning Objectives: After studying this paper the students will know –

1. Instrumental methods of analysis, collection, preservation and transportation of drug evidences.
2. Sampling of chemical evidences
3. Forensic analysis of Fertilizers, insecticides, pesticides, biocides.

Unit 1: Forensic Chemistry

Introduction to Forensic chemistry, sampling of chemical evidences, presumptive, screening (color/ spot test), inorganic analysis. Detective dyes- cases and importance in trap cases. Arson Chemistry of fire, searching of fire scene, collection, preservation and examination of arson evidences. Adulteration in Petroleum products. Examination procedures involving standard methods and instrumental techniques,

Unit 2: Analysis of beverages

analysis of beverages- alcoholic and non- alcoholic, country made liquor and medicinal preparations containing alcohol as constituents. Significance of alcohol in breath and breath screening devices. Forensic analysis of Fertilizers/ insecticides/ pesticides/ biocides.

Unit 3: Explosives

Classification of explosives, synthesis and characteristics of Tri-nitro toluene (TNT), Pentaerythritol tetranitrate (PETN) and Research and Development Explosives (RDX). Explosion process, blast waves, searching of scene of explosion. Post blast residue collection and analysis, blast injuries and detection of hidden explosives. Improvised explosive devices.

Unit 4: Forensic Toxicology and Pharmacology

Definition, classification of poisons- organic, inorganic, metallic, non-metallic etc. Acute and chronic poisoning, Accidental, homicidal and suicidal poisoning, Extraction and identification of commonly used poisons. Dosage, Frequency, Route of administration, Absorption, distribution and metabolism and factors affecting metabolism and excretion. Toxicological techniques.

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Unit 5: Drugs of Abuse

Natural and synthetic drugs of abuse. Drug dependence, classification of drugs- Narcotics, Hallucinogens, Depressants, Stimulants, Anabolic steroids. Psychotropic and Psychedelic drugs of abuse. Field and laboratory tests of drugs of abuse. Instrumental methods of analysis, collection, preservation and transportation of drug evidences.

Practicals

1. How to trap a person while taking bribe.
2. To separate the component of ink by using paper chromatography.
3. To identify the poison in the suspected material by presumptive test and color test.
4. To identify the poison in the suspected material by presumptive test and color test.
5. To identify the poison in the suspected material by presumptive test and color test.
6. To detect the adulteration in petrol with kerosene / diesel by filter paper test.
7. Preliminary test for metallic poison.
8. Analysis of Alcohol.
9. Extraction and identification of volatile organic poison from the given tissue.
10. Spotting-
    - Cannabis sativa Bhang
    - Bhilava (*Semecarpus anacardium)*
    - Datura (*Datura stramonium*)
    - Calotropis *(Calotropis)*
    - Pesticide
    - Drug sleeping

Suggested Readings

1. Niesink, RJM; Toxicology- Principles and Applications, CRC Press,1996.
2. Modi, JP, Textbook of Medical Jurisprudence & Toxicology, N.M. Tripathi Pub,2001.
3. Chadha, PV; Handbook of Forensic Medicine & Toxicology, Jaypee Brothers, N Delhi,2004.
4. Parikh, C.K; Text Book of Medical Jurisprudence, Forensic Medicine & Toxicology, CBS Pub. New Delhi,1999.
5. Morrison R.T and Boyd R. N;Organic Chemistry 6th Ed Prentice Hall, 2003.
6. Laboratory Procedure Manual : Petroleum Products ,Directorate of Forensic Science, MHA, Govt. of India, 2005.
7. Working Procedure Manual on Chemistry ; Directorate of Forensic Science MHA Govt. of India.
8. Bureau of Indian Standard Specifications related to Alcohols and Petroleum Products.
9. Welcher F;Standard Methods of Chemical Analysis, 6 Ed.Van Nostrand Reinhold, New York, 1969.
10. Watson C. A; Official and Standardised Methods of Analysis, Royal Society of Chemistry, UK,1994.
11. Central Excise Act ; Universal Law Publication.
12. Essential Commodity Act, 1955.
13. Feigl, F; Spot Test in Inorganic Analysis , Elsevier Publ. New Delhi, 2005.
14. Curry A.S ; Analytical Methods in Human Toxicology : Part II ,CRC Press Ohio, 1986.
15. Curry, A.S: Poison Detection in Human Organs, C Thomas Spring field, CRC Press, Costa Rica, 1976
16. Clark E.G.C; Isolation and Identification of drugs, Academic Press, London, 1986

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M.Sc. / B.Sc.-M.Sc. (Forensic Science) CBCS

Semester-II / VIII (M.Sc. / B.Sc.-M.Sc.)
Name of Program M.Sc. / B.Sc.-M.Sc. (Forensic Science)

Subject Code	Category	Subject Name	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	Credits
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
MSCFS–202	DC	Advanced Forensic Ballistics	60	20	20	30	20	4	1	2	6

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.**

Learning Objectives: After studying this paper the students will know –

1. The examination and identification of fire arms and their constructional features.
2. Ignition, shape and size of propellants.
3. Methods of measurement of wound ballistics parameters, post-mortem and antimortem fire arm injuries.

Unit 1: Forensic Ballistics-I

History and background of Firearms, their classification and characteristics, various components of small arms, smooth bore and rifled firearm, different systems and their functions, rifling – various class characteristics, types of rifling and methods to produce rifling. Trigger and firing mechanism, cartridge-firing mechanism. Projectile velocity determination, Theory of recoil, methods for measurement of recoil. Techniques of dismantling/assembling of firearm. Types of ammunitions, classification and constructional features of different types of cartridges, types of primers and priming composition, propellants and their compositions, velocity and pressure characteristics under different conditions, various types of bullets and compositional aspects, latest trends in their manufacturing and design, smooth bore firearm projectile, identification of origin, improvised ammunition and safety. Identification of origin, improvised/ country- made/ imitative firearms and their constructional features.

Unit 2: Internal and External Ballistics

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

Unit 3: Terminal Ballistics

Effect of projectile on hitting the target: function of bullet shape, striking velocity, striking angle

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and nature of target, Tumbling of bullets, effect of instability of bullet, effect of intermediate targets, influence of range, Cavitation – temporary and permanent cavities, Ricochet and its effects, stopping power, Wound Ballistics; Threshold velocity for penetration of skin/flesh/bones, preparation of gel block, penetration of projectiles in gel block and other targets, nature of wounds of entry, exit, initial track with various ranges and velocities with various types of projectiles, explosive wounds, evaluation of injuries caused due to shot-gun, rifle, handguns and country made firearms, methods of measurements of wound ballistics parameters, post-mortem and anti-mortem firearm injuries.

Unit 4: Examination and identification

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

Unit 5: GSR analysis

GSR analysis :Mechanism of formation of GSR, source and collection, spot test, chemical test, identification of shooter and instrumental methods of GSR Analysis, Management and reconstruction of crime scene; suicide, murder and accidental and self defence cases.

Suggested Readings

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

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M.Sc. / B.Sc.-M.Sc. (Forensic Science) CBCS

Semester-II / VIII (M.Sc. / B.Sc.-M.Sc.)
Name of Program M.Sc. / B.Sc.-M.Sc. (Forensic Science)

Subject Code	Category	Subject Name	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	Credits
			End Semester University Exam	Two Term Exam	Teachers Assessment*	End Semester University Exam	Teachers Assessment*				
MSCFS–203	DC	Instrumental Techniques (Physical, Chemical, Biological)	60	20	20	30	20	4	1	2	6

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.**

Learning Objectives: After studying this paper the students will know –
1. Above all physical, chemical and biological Instrumental techniques.
2. Isolation and instrumental analysis of different toxic substances and drugs.
3. UV- visible spectroscopic analysis of drugs.

Unit 1: 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.

Unit 2: 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.

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Unit 3: Radiochemical 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 colorimetry and differential analysis, thermogravimetry.

Unit 4: Nuclear techniques

Nuclear Magnetic Resonance spectroscopy: Basic principles, theory and instrum, Mass Spectrometry, GCMS, LCMS, Secondary Mass Spectrometry, Laser Mass spectrometry, Fast Atom bombardment and liquid secondary Ion Mass spectrometry, High performance liquid chromatrography, Electrospray Ionization mass spectrometry

Unit 5: 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, Immuno- electrophoresis, complement fixation, Radio Immuno Assay (RIA), Enzyme-linked Immuno Sorbent Assay (ELISA), Fluorescence immune assay. Chromatographic Techniques, Electrophoretic Technique: General principles, Factors affecting electrophoresis, Low voltage thin sheet electrophoresis, High voltage electrophoresis, Sodium dodecylsulphate (SDS) polyacrylamide gel electrophoresis, Isoelectric focusing (IEF), Isoelectrophoresis, Preparative electrophoresis, Horizontal and Vertical Electrophoresis.

Practicals

1. To determine molarity of HCl pH metrically provided N\10 NaOH .
2. To find refractive index of the given liquid sample and find molar refraction and specific refraction
3. To verify Beer Lambert's law by colorimetric measurements.
4. Detailed study of the basic principle of Gas Chromatography and study its various parts.
5. Detailed study of Mass Spectrometer.
6. To study the principle fundamental law and application of UV – Visible Spectrometer.
7. To find the amount of dissolved oxygen in sample using DO meter.

Suggested Readings

1. Robinson, J.W; Atomic Spectroscopy, 2nd Ed. Revised & Expanded, Marcel Dekkar, Inc, New York, 1996.
2. Workman, J; Art Springsteen; Applied Spectroscopy- A compact reference for Practitioners, Academic Press, London, 1997.
3. Subrahmanyam, N. & Lal B; A text Book of Optics, S. Chand & Company, New Delhi, 2004.
4. Willard, H.H. Lynne L. Merrett, J. Dean, A. Frank, A. Settle. J; Instrumental Methods of Analysis, 7th Edn. CBS pub. & Distributors, New Delhi, 1986.
5. Khandpur, R.S; Handbook of Analytical Instruments, Tata McGraw Hill Pub. Co. New Delhi, 2004.
6. Thomson, K.C. & Renolds, R.J; Atomic Absorption Fluorescence & Flame Emission Spectroscopy, A Practical Approach, 2nd Edn. Charles Griffith & Company, New South Wales, 1978.

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Semester-II / VIII (M.Sc. / B.Sc.-M.Sc.)
Name of Program M.Sc. / B.Sc.-M.Sc. (Forensic Science)

Subject Code	Category	Subject Name	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	Credits
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
MSCFS–204	DC	Questioned Documents and Counterfeit Currency	60	20	20	30	20	4	1	2	6

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.**

Learning Objectives: After studying this paper the students will know –

1. Forensic identification of class and individual characteristics of handwriting.
2. Examination of fake credit cards, e-documents, digital signature..
3. Automated finger print identification system.
4. Analysis of signature forgery.

Unit 1: Introduction to Document Examination
Nature and problems of document examination, classification of forensic documents, Specimen/Admitted writings/type writings etc: handling, preservation and marking of documents, importance of natural variations and disguise in writing, various types of forensic documents-genuine and forged documents, holographic documents, principles of handwriting identification, basic tools needed for Forensic Document Examination & their use, analysis of paper and inks.

Unit 2: Handwriting examination
Various writing features and their estimation, general characteristics of handwriting, individual characteristics of handwriting, ethnic and gender variability of handwriting, various types of forgeries and their detection.

Unit 3: Signature examination
Examination of signatures – characteristics of genuine and forged signatures, identification of forger, identification of writer of anonymous letters and application of Forensic Stylistics/Linguistics in the identification of writer, examination of built-up documents and determination of sequence of strokes.

Unit 4: Typewritten and Printed Documents
Identification of typescripts-identification of typist, various types of printing processes, identification of printed matter including printing of security documents and currency notes, identification of electronic typewriters, dot matrix, inkjet and laser jet printers, examination of

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black and white and color photocopies, fax messages and carbon copies.

Unit 5: Forgery Detection

Determination of age of documents by examination of signatures, paper, ink etc., Examination of alterations, erasures, over writings, additions and obliterations, decipherment of secret writings, indentations & charred documents, physical matching of documents, examination of seal, rubber and other mechanical impressions, examination of counterfeit currency notes, Indian passport/visas, stamp papers, postal stamps etc., examination of fake credit cards, e-documents, digital signatures, an introduction of computer forensics, preliminary examination of documents, opinion writings and reasons for opinion.

Practicals

1. Forensic identification of class and individual characteristics of handwriting.
2. Analysis of signature forgery.
3. Examination of anonymous letters and disguised writing.
4. To detect and decipher alterations in a document.
5. To decipher secret writings, indentations and charred documents.
6. To study the handwriting of ethnic and population groups.
7. To examine forgery in currency notes.
8. To examine security features of Indian passports.
9. To examine credit cards under Visual Spectral Comparator.
10. Rubber seal examination
11. Document opinion Report writing.

Suggested reading:

1. Hilton, O; Scientific Examination of Questioned Documents. Revised Edition, Elsevier, New York, 1982.
2. Osborn, A.S; Questioned Documents, 2nd Ed., universal Law Publications, Delhi, 1998.
3. Osborn, A.S; The Problem of Proof, 2nd Ed., Universal Law Pub. Delhi, 1998.
4. Thomas, C.C; Identification System for Questioned Documents, Billy Prior Bates Springfield, Illinois, USA, 1971.
5. Harrison, W.R; Suspect Documents Their Scientific Examination, Universal Law Publication, Delhi, 2001.
6. Morris, R.N; Forensic Handwriting Identification, Academy Press, London, 2001.
7. Sheila, K; Graphotypes a new Plant on Handwriting Analysis, Crown Pub. Inc., USA, 1983.
8. Lerinson, J; Questioned Documents, Academy Press, London, 2001.
9. Katherine, M. K; CDE-Forensic Document Examination-Humana Press, New Jersey, 2007.

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Semester-II / VIII (M.Sc. / B.Sc.-M.Sc.)
Name of Program M.Sc. / B.Sc.-M.Sc. (Forensic Science)

Subject Code	Category	Subject Name	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	Credits
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
MSCFS–205 (1)	DC	Introduction to Biometric Technologies in Forensic Science	60	20	20	30	20	3	1	0	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.**

Objective

1. Importance of biometric analysis
2. The significance of voice identification.
3. The information and working procedure in brain fingerprinting narco analysis.

Unit 1: Introduction of Biometric systems

Introduction, Biometric systems: Enrollment and recognition phases, sensor module, feature extraction module, database module, matching module, Biometrics Functionality: Verification & Identification, Biometrics system errors performance measures, Design cycle of biometric System: Nature of the application, Choice of biometric trait, Data collection, Choice of features and matching, Application of biometric system, Security and privacy issues

Unit 2: Security of Biometric

Introduction to Security of Biometric System, Adversary attacks: Insider Attacks, Infrastructure attacks, Attacks on user Interface: Impersonation, Obfuscation, Spoofing, Countermeasure of spoof detection, Attacks on biometrics processing : On system modules & at interconnections, Attack on template database & Countermeasures in biometric template security.

Unit 3: An Introduction to Statistical Measures of Biometrics

Recommended Biometric for Network Security: Introduction, Implementation of Biometrics for Network Security. Finger Biometrics, Voice Biometric, Definition & applications of FAR, FRR, FTE, EER. Biometric Transaction: User, Biometric reader, Matching location, Biometric Reader: Trusted, Non-Trusted.

Unit 4: Types of Biometric Technology and Verification Systems

Introduction, Biometric verification, Use of Biometric, Biometric Technologies for Personal Identification, Retina recognition, Signature Dynamics or Recognition, Keystroke Dynamics, Speaker recognition, RFID Chip implant Business and Federal

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Unit 5: Applications of Biometric Technologies

Applications of Biometric Technologies, Challenges and Issues in Using Biometrics, Risk Management Is the Foundation of Effective Strategy, Barriers to Future Growth, Biometric technologies under development: Blood pulse, Nailbed Identification, Body salinity Identification, Palm print, Palm print, vein Pattern, Facial thermography, Skin Luminescence, Brain Wave Pattern, Electronic Nose Identification, Foot Dynamics.

Suggested Readings

1. S. Nanavati, M. Thieme and R. Nanavati, Biometrics, Wiley India Pvt. Ltd. (2002).
2. P. Reid, Biometrics for Network Security, New Delhi (2004).
3. J.R. Vacca, Biometric Technologies and Verification Systems, Butterworth-Heinemann, Oxford (2007).

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSCFS–205 (2)	DC	Microscopy in Forensic Science	60	20	20	00	00	3	1	0	4

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Objectives:

1. The use microscopy in different branch of forensic science.
2. The principle applications and working process of light microscope.
3. The working process and types of electron microscope and their importance.
4. The different photo micrographic methods their instrumentation application, etc.

Unit 1: Introduction to Microscopy:
History, Electromagnetic radiation, Properties of light, Magnification, Resolution, Resolving Power, Depth of field, Depth of Focus, Numerical aperture, Lens, Aberration of lenses.
Simple Microscope: Image formation.

Unit 2: Light Microscopy I:
Principle of bright field and dark field microscopy,
Theory, Principle & Working of Compound Microscope, Comparison microscope, Stereo Microscope, Fluorescence Microscope, Polarizing Microscope, Phase Contrast Microscope.

Unit 3: Light Microscopy II:
Theory, Principle & Working of Interference Microscope, Confocal Microscope, Oil Immersion Microscope, Ultraviolet Microscope, Infra-red Microscope, X-ray Microscope.

Unit 4: Electron Microscopy:
Introduction, Historical review, Types of Electron Microscopy
Scanning electron microscopy (SEM): Theory & Principle, Specific feature, instrumentation, sample preparation, specimen interaction, specimen interaction volume, signal produced by specimen & Forensic applications.
Transmission electron microscopy (TEM): Theory and basic principles, Instrumentation & Forensic applications.

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Comparison of SEM and TEM
Comparison of Light Microscopy and Electron Microscopy.

Unit 5: Miscellaneous Microscopy:

Photomicrography: Introduction, Principles & procedure of photomicrography, Ultra- Violet Photography Infra-red Photography, Microphotography, Comparison of Light Microscopy and Photomicrography.

Principle and applications of Magnetic Resonance Microscope, Scanning Probe Microscope, Ultrasonic Microscope (Scanning acoustic microscope**)**.

Suggested Readings:

1. An Introduction to Microscopy, Suzanne Bell : Keith Morris
2. Forensic Science Handbook Volume I : Richard Saferstein
3. Light Microscopy, R. G. E. Murray : Carl F. Robinow
4. Fundamentals of Light Microscopy and Electronic Imaging : Douglas B. Murphy, Michael W. Davidson.
5. Physical Principles of Electron Microscopy An Introduction to TEM, SEM, and AEM: Ray F. Egerton.
6. The History of Photomicrography : Normand Overney and Gregor Overney