SHRI VAISHNAV VIDHYAPEETH VISHVAVIDHYALAYA, INDORE

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

Semester-III / IX (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–301	DC	Digital Forensic and Cyber Crime	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 fundamental and forensic examinations of digital evidence.
2. The legal and privacy issues of digital evidence.
3. The tools of cyber forensics.
4. The types of cyber crime.

Unit I: Digital Forensic I (Basics)

What is Cyber Crime and digital evidence, types of cyber crimes, digital evidence, Digital Vs Physical Evidence, Nature of Digital Evidence, Precautions while dealing with Digital Evidence. Introduction to Cyber forensic, Cyber forensic steps (Identification, Seizure, Acquisition, Authentication, Presentation, Preservation), Computer forensic expert, Cyber forensic investigation process, The goal of the forensic investigation, Theft of information, Violation of security policies or procedures, Intellectual property infractions, Electronic tampering), Determine the impact of incident, Auditing V/s Cyber forensic investigations.

Unit II: Digital Forensic II

Seizure of suspected computer. Preparation required prior to seizure. Protocol to be taken at the scene. Extraction of information from the hard disk. Treatment of exhibits. Creating bitstream of the original media. Collection and seizure of magnetic media. Legal and privacy issues. Examining forensically sterile media. Restoration of deleted files. Password cracking and E-mail tracking. Encryption and decryption methods. Tracking users.

Unit III: Cyber Forensic Tools and Utilities

Introduction, Examining a Breadth of Products, Cyber Forensic Tools Good, Better, Best: What's the Right Incident Response Tool for Your Organization? , Tool Review Forensic Toolkit, EnCase, Cyber check suites, what is disk Imaging etc. Specifications for Forensic tools Tested.

Unit IV: Evidence Collection and Analysis Tools

Volatile and Non volatile Evidences collection (Safeback, Gettime, FileList,Filecvt and Excel, Getfree, Swapfiles and Getswap ,GetSlack, Temporary Files), Detailed Procedures for Obtaining a

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bit stream backup of hard drive, File System (Details of File system, Data Structure Of File System, Data Recovery in Different file system).

Unit V: Cyber Crime

Definition and types of computer crimes. Distinction between computer crimes and conventional crimes. Reasons for commission of computer crimes. Computer virus, and computer worm – Trojan horse, trap door, super zapping, logic bombs. Types of computer crimes – computer stalking, pornography, hacking, computer terrorism. An overview of hacking, spamming, phishing and stalking.

Practicals:

1. Identification , Seizure , Search of Digital media Evidence Collection
2. Demonstration of various Forensic tools like Partition magic, Encase etc.
3. Data Recovery, Deleted File Recovery viewing small Disk.
4. Demonstration of Concealment Techniques (Cryptography PGP)
5. Demonstration of Concealment Techniques (Stenography)
6. Demonstration of other Concealment Techniques
7. To trace routes followed by e-mails and chats.
8. To identify the IP address of the sender of e-mails.
9. To demonstrate concealment techniques using cryptographic PGP
10. To acquire data from PCs/laptops/HDDs/USBs, pen drives, memory cards and SIM cards.
11. To use symmetric and asymmetric keys for protection of digital record.
12. To carry out imaging of hard disks from different software
13. Networking commands- like ping, IP config. Etc.
14. Tracing E-mail, finding senders IP address, of received email, tracing route of email received using tool available on internet,e.g. Visual Trace Route etc.

Suggested Readings:

1. Digital Forensics: Digital Evidence in Criminal Investigations by *Angus McKenzie Marshall*
2. Cyber Forensic A Field Manual for Collecting, Examining and Preserving Evidence of Compute Crimes by *Albert J Menendez.* Auerbach Publications.
3. Cyber Forensic by *Marecella Menendez.*
4. Computer Forensic by *Newman*.
5. Cyber Crime Investigation Field Guide, by *B Middleton*
6. Incident Response and Computer Forensic by *Kelvin Mandia*, TMH Publication.

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			THEORY			PRACTICAL		L	T	P	Credits
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
MSCFS–302	DC	Forensic Medicine	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 legal procedure of court.
2. The several parameters of personal identification.
3. The different modes and sign of death.
4. The classification, identification and medico legal aspects of wound

Unit I:

Medical Jurisprudence: Definition of Forensic Medicine and Medical Jurisprudence, Brief knowledge about legal procedure in court, inquest, Criminal court and their powers, Subpoena & oath of medical expert. Recording of medical expert evidence in courts. Types of medical evidence. Kinds of witness and rules for giving evidence.

Unit II:

Personal Identity : Definition and importance, parameters contributing to personal identity- Race, Sex, Age, complexion, Features & Photographs, Anthropometry, Fingerprints, Footprints, Tattoo marks, Occupational Marks, Handwriting, Clothes and Ornaments, Voice & Speech, DNA, Superimposition techniques for skull. Disputed paternity.

Unit III:

Thanatology: Definition and concept of death, Modes of death (Coma, Syncope, Asphyxia), Causes of sudden Natural deaths.

Changes after death (Sign of death): cessation of vital functions, changes in the Eye & Skin, Cooling, Hypostasis, Muscle changes, Postmortem lividity, Putrefaction, Adipocere, Mummification. Estimation of time since death.

Unit IV:

Medico-legal Autopsy : Objectives, Facilities, Rules and Basic techniques, Proforma for reporting medico-legal autopsy, Viscera & its preservation.

Exhumation, examination of mutilated remains, Obscure autopsy and post-mortem artifacts

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Unit V:

Traumatology: Definition and classification of injuries.

Blunt force Trauma: Abrasions, Contusions and Lacerations

Sharp force Trauma: Incised, Stab and Chop wounds

Thermal injuries: Injuries due to heat and cold, Frostbite, Burns, Scalds and Bride burning, Injuries due to Electricity, Lightening.

Firearm injuries and Explosive injuries.

Medico-legal aspect of injury/hurt: simple and grievous hurts Ante- mortem & Postmortem Wounds, Age of the injury, Causative Weapon and appearance of Suicidal, Accidental and Homicidal injuries.

Practicals:

1. To know the legal procedure of court
2. To maintain medical evidences.
3. To determine cephalic index of unknown skull.
4. To prepare a occupational marks data from different source for personal identification.
5. To study the life cycle of insect and explain its role in determining time since death
6. To prepare post-mortem report format.
7. Practical aspects of collection, preservation and dispatch of viscera for chemical analysis
8. To give the demonstration of postmortem and ante-mortem wound.
9. Examination of certification of injuries.

Suggested Reading :

1. Modi J. S. : Medical Jurisprudence and Toxicology.
2. Taylor : Medical Jurisprudence
3. Parikh C.K. : Chikitsa Nyaya Shastra Aur Vish Vigyan.
4. Kieth Simpsen & Bernard Knight : Forensic Medicine
5. Poison : CJ, DJ, Gee, B. Knight : Forensic Medicine
6. Reddy : Forensic Medicine.

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			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
MSCFS–303	DC	Forensic Biology and DNA Profiling	60	20	20	30	20	4	1	2	6

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;

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

1. To understand the significance of blood, semen, saliva hairs etc
2. To understand the importance of bones in personal identification
3. To identify different blood groups and other biochemical markers of individuality
4. Role of insects, microbial and diatoms in forensic investigation
5. DNA structure analysis and DNA typing

Unit- I:

Blood: Composition, histology, examination of blood and blood stains, Identification of lochial and menstrual stains by various methods.

Semen: Composition, St. of spermatozoa, Forensic method of detection and identification of semen and seminal stain examination. Identification and examination of other body fluids/ stains- vaginal, saliva, urine, pus, faeces, vomit, milk, sweat and tears.

- **Hair:** Structure, Forensic examination of Hair including determination of origin race, sex, site, etc.
- **Fibers:** Type and Forensic aspects of fiber examination – fluorescent, optical properties, refractive index, birefringence, dye analysis etc and natural fiber.

Unit- II

Forensic Odontology: Detinition pattern, structure of teeth, age determination- identification of person, role in mass disaster, disease of teeth and their significance in personal identification.

Determination of Stature and sex from bones, Identification of burnt bones, recovery and identification of skeletal remains in accidental cases and mass disasters. Facial reconstruction.

Unit- III: Forensic Serology

Basic Concept of Genetics : Mendelian genetics, genotypes, phenotypes, mutation, multiple alleles , Expression of Gene and Gene Mapping. Analysis of protein by electrophoretic methods

Immunology: Immuno System, Immuno response, Antigens, haptens and adjuvant, Immunoglobulin's, Structure and function, raising of anti-sera, Antigen-Antibody reaction. Lectins and their forensic significance.

Serogenetic markers:

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- **Blood group**: History, Biochemistry and genetics of ABO, Rh, Mn and other systems, method of ABO blood grouping (absorption-inhibition. Mixed agglutination and absorption elution) from blood stains and other body fluids/stains viz. menstrual blood, semen, saliva, sweat, tear pus, vomit, hair, bone, nail, etc. blood group specific ABH substance, determination of secretors/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.

Unit IV:

Forensic Botany: Various types of wood, timber varieties, seeds and leaves – their identification and matching. Diatoms – morphology, types, methods of isolation, and forensic importance
Identification of pollen grains, starch grains, powder and stains of spices etc, Isolation, classification and identification of microbial organism.

Forensic 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:

Structure of DNA, Damage to DNA, variation in DNA, DNA as excellent polymorphic markers

Legal perspective: Legal standard for admissibility of DNA profiling – procedural & ethical concerns, status of development of DNA profiling in India & abroad.

DNA typing technique – RFLP, PCR, Amplification, PCR based typing methods such as HLA DQ_{A1} Amply- type $^{(R)}$ PM Polymarkers, D 1580, STR, Gender ID, mt- DNA methods with their merits and demerits. Comparison of RFLP and PCR based method, Forensic Significance of DNA Profiling

Practicals:

1. Preliminary examination of Blood
2. Confirmatory examination (Crystal test) of blood
3. To Determine Species of Origin from Blood by Gel diffusion method
4. To determine the ABO and Rh factor of human blood.
5. Morphological examination of human and animal hairs
6. Preparation of slide for scale pattern study of hairs
7. Identification of species from the given hair sample.
8. Examination of given fibre by physical and chemical method.
9. Detection of salivary stains.
10. Draw and label and identify the bones of human body.
11. Determine age and sex from long bones and skull.
12. To isolate and examine diatoms and classify them.
13. Isolation of microbial from air.

Suggested Reading:

1. Albert's, B, Bray, D, Lewis, J, Roberts K & Watson, J.D; Molecular Biology of cell, 2nd ed. Garland Pub. New York (1989)
2. Biology Methods manual; Metropolitan Police Forensic Science Laboratory, London; (1978)

3. Daniel L. Hartl & Elizabeth W. Jones; Genetics- Principle & Analysis, 4th Ed., Jones & Bartlet Pub. 1998.
4. E.J. Gardner, M.I. Simmons and D.P. Snustad; Principles of Genetics; John Wiley, New York; (1991)
5. Edwin, H. Mc Caney-Human Genetics, The Molecular Revolution, Jones & Bartlett Pub. London; (1993)
6. H.G. Greenish & E. Collin; An anatomical Atlas of vegetable Powders; J&A Churchill, London; (1904)
7. Herbert R. Mauersberger; Mathews Textile Fibers – their physical, Microscopic and chemical properties; John Wiley, New York; (1954)
8. Jaiprakash G. Shewale, Ray H. Liu Forensic DNA Analysis: Current Practices and Emerging Technologies, CRC Press, 2013
9. John M Butler: Forensic DNA Typing. Elsevier Academic Press.
10. Keith Immen and Norah Rudus, 1997. An introduction to Forensic DNA Analysis. CRC Press, New York.
11. Kimball, John W; Biology; Arvind Publishing Co. New Delhi (1974)
12. Lee M.C. and Gaenesten, R.E: DNA and other Polymorphism in Forensic Science. Year book Medical Published.
13. P.L. Williams and R. Warwick; Gray's anatomy; Churchill Livingston, London; (1980)
14. R.P. Pandey, Plant Anatomy; S. Chand, new Delhi; (1998)
15. Richard Saferstein; Forensic Hand Book; Ed.; Prentic Hall, Englewood Cliff, New Jersey; (1982)

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			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
MSCFS–304	DC	Forensic Psychology	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. Different interrogation techniques
2. Deception Detection Techniques.
3. Legal aspects of Psychology.

Unit I:

Interviewing and Interrogation Techniques: Importance of Investigative Interviewing, Influence of Psychology, P.E.A.C.E Model of Interviewing, Cognitive Interviewing, Ethical Interviewing, Other Interview Techniques.

Unit II:

Interrogation and the related Techniques, Brain Electrical Oscillation Signature Profiling (BEOS), Voice-Stress Analysis/ Layered Voice Analysis, reliability, Limitations, NHRC Guidelines, Admissibility on the Court, Case Studies.

Unit III:

Polygraph/Lie Detector Test: Objectives, theoretical basis, stages of examination (Pre-test, In-test, post-test), Questioning techniques, Stim test, Limitations, Admissibility in the court of law, NHRC guidelines, case studies, etc.

Unit IV:

Brain Fingerprinting/Brain-Mapping: Principle**,** Importance**,** History, process, brain waves (P300, delta, theta, gamma, alpha), reliability, case studies, admissibility, etc..**Narco-analysis:** Principle, History, drugs used, procedure, reliability, admissibility, limitations, Indian scenario, case studies, etc.

Unit V:

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

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Practicals:

1. NEO-PI
2. Minnesota Multiphasic Personality Inventory-2/A (MMPI-2/A)
3. Rorschach Test
4. Bhatia's Battery for Intelligence
5. Thematic Apperception Test
6. Word Association Test

Suggested Readings:

Forensic & Correctional Psychology

1. 'Criminology' by Larry Siegel
2. 'Introduction to Forensic Psychology' by Bruce Arrigo
3. 'Forensic & Criminal Psychology' by Dennis Howitt.
4. 'Abnormal Psychology' by Halgin&Whitbourne.
5. 'Abnormal Psychology', by Robert C. Carson, James N. Butcher, Susan Mineka, Jill M. Hooley thirteenth Edition, Thirteenth Edition.
6. 'Encyclopedia of Forensic Science' by Jay A. Siegel, PekkaJ. Saukko, Geoffey C. Knupfer, Volume-1 to Volume-5.
7. 'Mental Disorders and Treatment' by Katherine Marsland.
8. 'Handbook of Forensic Psychology' by Prof. Dr.VimalaVeeraraghavan.
9. 'Handbook of Polygraph Testing' by Murray Kleine.
10. 'Brain Mapping-The Methods' by Arthur W. Toga & John C. Mazziotta, Second Edition.
11. 'Criminal Profiling and Introduction to Behavioural Evidence Analysis' by Brent Turve, Second Edition.
12. Krishnamurthy, R., Introduction to Forensic Science in Crime Investigation, 2011, Selective & Scientific Books, New Delhi.
13. 'Forensic Psychology' by Graham Towel& David Crighton
14. Serial Crime, Theoretical & Practical issues in Behavioural Profiling, Petherick, Woodworth Publication.
15. 'Introduction to Forensic Psychology', by Bruce Arrigo.
16. Diagnostic & Statistical Manual-IV TR, American Psychological Association
17. DSM-IV Mental Disorders Diagnostics, Etiology and Treatment, by Michaen, Allan.
18. 'Psychological Testing' by Anne Anastasi, Susana Urbina, Seventh Edition.
19. 'Psychological Testing' by Robert J. Gregory, Fourth Edition.

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			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
MSCFS–305 (1)	DC	Advance Criminilistics	60	20	20	00	00	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.**

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

1. The different types of physical evidences.
2. The management of different crime scene.
3. The evaluation of evidence report
4. The advancement in fingerprint.
5. The identification and individualization of impression i.e Tyre marks, Lip print etc.

Unit I :

Crime Scene Investigation (CSI): Types of crime scenes: indoor, outdoor, mobile, & hydro. Physical evidences, Crime scene search methods, Recovery & packaging of evidences, Crime scene documentation: Notes taking, Sketching, Photography & Videography. Preservation of evidences.

Unit II:

Various Crime Scenes: Homicide, Suicide, Accidents (Vehicular, Train, Air-crash, Industrial etc), Mass Murders, House Breaking and Theft (HBT), Dacoity, Cybercrimes, Terrorism, etc. Crime Scene Management (CSM): Introduction & Components: Information, Manpower, Technology & Equipment and Logistics Management. Role of various experts at crime scene. Security, safety and preservation of crime scene. Contamination control. Scene Survey and initial documentation.

Unit III:

Report and Evidence Evaluation: Components of reports and Report formats in Crime Scene and findings. Constitutional validity of Forensic Evidence, Expert Testimony: Admissibility in of law, Pre-Court preparations & Court appearance.

Unit IV:

Recent techniques of development of latent fingerprint: Digital imaging and enhancement, Laser and other radiation based techniques, Metal deposition method. Development and preservation of latent print on skin: Living and Dead. Photography and image processing of fingerprints. Comparison of fingerprints: Class characteristics, individual characteristics, ridge tracing and ridge counting. Automated fingerprint identification system

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AFIS: History, developments and components, Latent print and high quality image processing. Types of AFIS searches and reports.
Footprints: Importance, Gait pattern analysis, Evaluation and analysis of various casts. Electrostatic lifting of latent footprints and comparison with reference sample.

Unit V:
Tyre marks / prints and skid marks and comparison with control samples.
Cheiloscopy: Nature, location, collection and evaluation of lip print.
Ear prints: Introduction, growth & development, evaluation and analysis of ear print. Tool marks & Mechanical fits.

Suggested Readings:

1. Bevel, T., Gardner, M. R., Bloodstain Pattern Analysis with an Introduction to Crime
1. Scene Reconstruction, Third Edition.
2. Bevel, T., Gardner, M. R., Practical Crime Scene Analysis and Reconstruction
3. Lee, C. H., Palmbach, T., Miller, T. M., Henry Lee's Crime Scene Handbook
4. Moenssens : Finger Prints Techniques, 1975, Chitton Book Co., Philadelphia, New York.
5. Mehta, M. K. : Identification of Thumb Impression & Cross Examination of Finger
6. Prints, 1980 N. M. Tripathi (P) Ltd. Bombay.
7. Bridges : Practical Finger Printing, 1942, Funk and Washalls Co. New York.
8. Holt : Genetics of Dermal Ridges.
9. William J. Bodziak (1989) Footwear Impression Evidence Elsevier Science Publishing
10. Co. New York, 1989.
10. James, S.H and Nordby, J.J.. (2003) Forensic Science : An introduction to scientific and
11. investigative techniques CRC Press, USA.
11. Saferstien : Forensic Science, Handbook, Vol. I, II & III, Prentice Hall Inc. USA.
12. Kirk : Criminal Investigation, 1953, Interscience Publisher Inc. New York.
13. Cummins & Midlo : Finger Prints, Palms and Soles, 1943, The Blakiston office London.
14. O'Hara & Osterburg : Introduction to Criminalistics, 1949, The MacMillan Co., 1964

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MSCFS–305 (2)	DC	Biochemical & Molecular aspects of cell	60	20	20	00	00	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.**

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

1. Molecular composition of Cell
2. Cell cycle and components in cell cycle control
3. Biochemical and molecular aspects of cell

Unit I: Dynamics of the eukaryotic cell

Molecules of life- Cellular evolution assembly of macromolecules and Origin of life- integrated structural organization of prokaryotic and eukaryotic cells- Concept of a composite cell and Molecular composition of cells. Biomembranes- Structural organization- Models of a plasma membrane, Membrane permeability- Transport across cell membranes- Trans membrane signals- Artificial membranes- liposome.

Unit II: Micro bodies-Peroxisomes, Glyoxysomes and Lysosomes and their functions. The Cytoskeleton-microtubules and microfilaments. The extracellular matrix-collagen, elastin, fibrillin, fibronectin, laminin and proteoglycans.

Unit III: Molecular organization and function of mitochondria- components of respiratory chain- Chemiosmotic theory- Kinetics of electron transport, ATP formation- uncouplers of oxidative – phosphorylation- mitochondrial DNA and Semiautonomy.

Unit IV: Endomembrane system- Endoplasmic reticulum- protein segregationmicrosomes- functions of endoplasmic reticulum- Golgi complex and cell secretion- Protein glycosylation. Ribosomes- Structural organization. Nucleus- Internal organization- Nuclear pore complex- Nucleosomes, Chromatin.

Unit V:

Cell cycle - Different stages of mitosis – significance of meiosis - Cohesins and condensins in chromosome segregation, Microtubules in spindle assembly, Structure of kinetoshore, centrosomes and its functions, Components in cell cycle control - Cyclin, CDKs, Check points in cell cycle, phase dependent cyclic CDK complexes.

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Suggested Reading:

1. Campbell NA and Reece JB. Biology, 8th edition, Pearson Benjamin Cummings, San Francisco. 2008.
2. Essential Cell Biology, 3rd edition, by Alberts et al., Garland. Publishing Co., 2009.
3. Raven, P.H et al, Biology, 7th edition Tata McGrawHill publications, New Delhi, 2006.

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MSCFS–305 (3)	DC	Microbial Forensics	60	20	20	00	00	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.**

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

1. The emerging microbial technique.
2. The handling of microbial samples.
3. The forensic importance of microbes.
4. Role of microbes in investigation of suspicious disease

Unit I:

Microbial Forensics: Defining the microbial forensics program, epidemiology, Microbial forensic tools. Dynamics of disease transmission, Outbreak Investigation. Deliberate introduction of a biological agent. Emerging Microbial Forensic Techniques- PCR, Terminal Restriction Fragment Length Polymorphism (TRFLP), Amplified Fragment Length Polymorphism (AFLP)

Unit II:

Single Stranded Conformation Polymorphism Analysis (SSCP), Thermal and Denaturizing Gradient Gel Electrophoresis (TGGE, DGGE), Amplified Ribosomal DNA Restriction Analysis (ARDRA), Randomly Amplified Polymorphic DNA (RAPD). Non-PCR DNA Fingerprinting Techniques with Applicability in Forensic Studies-Restriction Fragment Length Polymorphisms (RFLP) and Ribotyping. Forensic Interpretation of DNA Data, Isotopic Testing and Correlation to Contaminant Source, etc.

Microbes of Forensic Importance: Bacillus anthracis, Yersinia pestis, Francisella tularensis, Brucella spp., Burkholderia Pseudomallei, Clostridium botulinum, Listeria monocytogenes and their morphological & biochemical studies. DNA of microbes in soil for crime detection.

UNIT III:

Fungi of forensic importance: Opportunistic mycoses, Chytridiomycotazygomycota, Aspergillusfumigates, Microsporidum, Pneumocytosis jiroveci, Asp.flavus & Candida sp, epidemiology, Antifungal agents. Food borne shigella, salmonella. Etc. Forensic Aspects o**f Biological Toxins**: Microbial Forensic Analysis of Trace and unculturable specimens etc

Unit IV:

Collection, transportation and preservation of microbial forensic samples, Categories of biological weapons, study of potential bacteria, fungi, viruses, and their toxins, mode of action, identification,

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preventive measures during handling, laboratory setup, epidemiologic investigation for public health.

Unit V:

Investigation of suspicious disease outbreak, Biosafety and biosecurity, Bio surveillance, documentation, and case studies, Toxin analysis using mass spectrometry, Non-DNA methods for Biological Signatures, Electron beam based methods for bio-forensic investigations, proteomics development and application for bio-forensics, design of genomics, and design of nucleic acid signature for pathogen identification and characterization.

Suggested Readings:

1. Microbial Forensics : Roger G Breeze, Bruce Budowle, Steven E Schutzer
2. Handbook of computational molecular biology: Edt by SrinivasAluru
3. S.C. Rastogi, N. Mendiratta & P. Rastogi; Bio-informatics- Methods & Applications, PHI learning pvt. Ltd., (2009)
4. Dr. Westhead, J.H. Parish & R.M. Twyman, Bio-informatics, Viva Books Pvt Ltd., (2003)