

YEAR I, SEMESTER I

COURSE CODE	COURSE TITLE	COURSE CATEGORY	HOURS			EVALUATION SCHEME		SUBJECT TOTAL	CREDIT
			L	T	P	CA	EE		
FST101	Introduction to Forensic Science	CORE	3	1	0	30	70	100	4
FST102	Crime and Society	CORE	3	1	0	30	70	100	4
FST103	Chemistry-I	CORE	3	1	0	30	70	100	4
FST104	Environmental Science	AECC	2	0	0	15	35	50	2
FST105	Physics- I	GE	3	1	0	30	70	100	4
FST106	Zoology- I								
FST107	Computer Science- I	GE	3	1	0	30	70	100	4
FST108	Botany- I								
FST153	Chemistry Lab-I	PRACTICAL	0	0	4	15	35	50	2
FST155	Physics Lab- I	PRACTICAL	0	0	4	15	35	50	2
FST156	Zoology Lab- I								
FST157	Computer Lab- I	PRACTICAL	0	0	4	15	35	50	2
FST158	Botany Lab- I								
Total			17	5	12	210	490	700	28

L - Lecture, T - Tutorial, P - Practical, GE- Generic Elective; AECC-Ability Enhancement Compulsory Course; DSE- Discipline Specific Elective; AECC- Ability Enhancement Elective Course (Skill Based Course)

YEAR I, SEMESTER II

COURSE CODE	COURSE TITLE	COURSE CATEGORY	HOURS			EVALUATION SCHEME		SUBJECT TOTAL	CREDIT
			L	T	P	CA	EE		
FST201	Law for Forensic Scientists	CORE	3	1	0	30	70	100	4
FST202	Forensic Psychology	CORE	3	1	0	30	70	100	4
FST203	Chemistry-II	CORE	3	1	0	30	70	100	4
FST204	English Communication	AECC	2	0	0	15	35	50	2
FST205	Physics- II	GE	3	1	0	30	70	100	4
FST206	Zoology- II								
FST207	Computer Science- II	GE	3	1	0	30	70	100	4
FST208	Botany- II								
FST253	Chemistry Lab-II	PRACTICAL	0	0	4	15	35	50	2
FST255	Physics Lab- II	PRACTICAL	0	0	4	15	35	50	2
FST256	Zoology Lab- II								
FST257	Computer Lab- II	PRACTICAL	0	0	4	15	35	50	2
FST258	Botany Lab- II								
Total			17	5	12	210	490	700	28

L - Lecture, T - Tutorial, P - Practical, GE- Generic Elective; AECC-Ability Enhancement Compulsory Course; DSE- Discipline Specific Elective; AECC- Ability Enhancement Elective Course (Skill Based Course)

B.Sc. Forensic Science: Semester-I	
FST101: Introduction to Forensic Science	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course Objective: After studying this paper the students will know –

- a. The significance of forensic science to human society.
- b. The fundamental principles and functions of forensic science.
- c. The divisions in a forensic science laboratory.
- d. The working of the forensic establishments in India and abroad.

Unit 1: History and Development of Forensic Science in India

Definitions and concepts in forensic science.
 Historical aspects of forensic science.
 Basic principles of forensic science.
 Need and Scope of forensic science. Ethics in Forensic Science

Unit 2: Role of Forensic Science in Society

Branches of forensic science.
 Forensic Science Laboratories, Teaching Institutes and Other Government and Private Bodies related to Forensic Science in India.
 Forensic science in international perspectives, including set up of INTERPOL and FBI.

Unit 3: Organizational set up of Different Government Bodies in India

Hierarchical set up of Central Forensic Science Laboratories, State Forensic Science Laboratories, Regional Forensic Science Laboratories, Mobile Forensic Unit, Government Examiners of Questioned Documents, Fingerprint Bureaus, National Crime Records Bureau, Police & Detective Training Schools, and Directorate of Forensic Science Services.

Unit 4: Forensic Scientists

Duties of forensic scientists. Code of conduct for forensic scientists in India. Eligibility and Qualifications of forensic scientist. Data depiction. Report writing.

Unit 5: Police Organization and Other Armed Forces

Organizational Setup of POLICE at Central and State Levels. Organizational Setup of CBI, IB, CAPF, BSF, CRPF, ITBP, Assam Rifles, CISF, RAF, BPRnD and MHA. Relationship between POLICE and Forensic Scientist.

Suggested Readings

1. B.B. Nanda and R.K. Tiwari, *Forensic Science in India: A Vision for the Twenty First Century*, Select Publishers, New Delhi (2001).
2. B. S. Nabar, *Forensic Science in Crime Investigation*, 3rd Edition, Asia Law House (2019)
3. B. R. Sharma, *Forensic Science in Criminal Investigation and Trials*, 4th Edition, Universal Law Publishing - An imprint of LexisNexis (2014)
4. R. Saferstein, *Criminalistics*, 8th Edition, Prentice Hall, New Jersey (2004).
6. James E. Girard, *Criminalistics*, 4th Edition, Jones and Bartlett Publishers, Inc. (2017)

B.Sc. Forensic Science: Semester-I	
FST102: Crime and Society	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course Objective: *After studying this paper the students will know –*

- a. *The importance of criminology.*
- b. *The causes of criminal behavior.*
- c. *The significance of criminal profiling to mitigate crime.*
- d. *The consequences of crime in society.*
- e. *The elements of criminal justice system.*

Unit 1: Basics of Criminology

Definition, Aim and scope, Theories of Crime-classical, positivist, sociological, Criminal Anthropology, Understanding Modus Operandi, Investigative Strategy, Criminal Profiling, Role of Media

Unit 2: Crime

Elements, nature, causes and consequences of crime, Deviant Behavior, Hate Crimes, Organized Crimes, Public Disorder, Domestic Violence and Workplace Violence, White Collar Crimes, Juvenile Delinquency, Victimology, Social Change and Crime, Psychological Disorders and Criminality, Situational Crime Prevention

Unit 3: Criminal Behavior

Introduction to Criminal Behavior, Theories of Criminal Behavior: classical and non-classical theories, biological theories, psychological theories, social disorganization theory, labeling theory, conflict theory, anomie theory, routine activity theory, rational choice theory and differential association theory.

Unit 4: Crime Detection Agency

Crime Investigation Departments: Central Bureau of investigation, National Investigative Agency, Anti-doping Agency, National Drug Testing Laboratory, Intelligence Bureau, Bureau of Police Research and Development, Fingerprint Bureau of Investigation, Central Police Organizations.

Unit 5: Criminal Justice System

Components of Criminal Justice System: Police, Courts and Corrections, Types of Criminal Justice System, Filing of Criminal Charges, Community Policing, Correctional Measures and Rehabilitation of offenders, Human Rights and CJS in India.

Suggested Readings

1. Ahuja, R., *Criminology*, Rawat Publications, ND, 2000.
2. Paranjape, NV, *Criminology, Penology and Victimology*, Central Law Publications (CLP), 2017
3. Ellis, L. and Walsh, Anthony, *Criminology – A Global Perspective*, Allyn and Bacon, Boston, 2000.
4. Morris, E. K., and Braukman, C. J. (Eds.), *Behavioral Approaches to Crime and Delinquency- A Hand book of Application, Research and Concepts*, Plenum Press, New York, 1987.
5. Abaadinsky, H., *Organized Crime (2nd Edn.)*, Nelson – Hall, Chicago, 1998.
6. Adler, F., Mueller, G. O. W. and Laufer, W. S., *Criminology*, McGraw – Hill, Boston, 1991.
7. Maguire, M.: Morgan, R and Reiner, R., *The Oxford Handbook of Criminology (3rd Edn.)*, Oxford University Press, Oxford, 2002.
8. Bajpai, G. S., *Development without Disorders*. Vishwavidyala, Prakashan, Sagar (M. P.), 2002.
9. Ghosh & Rustamji, *Encyclopedia of Police in India 1997 Vol, 3*
10. Vimala Veeraraghavan, *Handbook of Forensic Psychology*

B.Sc. Forensic Science: Semester-I	
FST103: Chemistry-I	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course Objective

- On the completion of this course the students will be able to understand the basic concepts of inorganic chemistry
- The student will be able to describe and understand the characteristics of the periodic table, concepts of acids and bases, hybridization, and coordination chemistry.

Unit 1: Periodic trends and properties

Size, Ionization Energy, Electron Affinity, Electronegativity, Use of redox potential and reaction feasibility

Chemistry of s and p-block elements: Alkali and alkaline earth metals: Hydrides and Complexation tendencies. Structural features of hydrides, halides, oxides and oxyacids.

Chemistry of d-block elements: Salient features, characteristic properties of 3d-elements with reference to oxidation states, colour, magnetic behavior, and complex formation tendency.

Unit 2: Acids and bases

Bronsted-Lowry, Lux-Flood, Solvent System and Lewis concepts of acids and bases. Factors affecting strengths of Lewis acids and bases. HSAB theory and applications

Unit 3:

Hybridization: sp , sp^2 , sp^3 , sp^3d , & sp^3d^2 .

Coordination compounds: Nomenclature, Werner's theory. Isomerism. Valence Bond Theory. Stereochemistry of coordination compounds with coordination no. 4 and 6.

Lanthanides: Comparative study of lanthanide elements with respect to electronic configuration atomic and ionic radii, oxidation state and complex formation, lanthanide contraction. Separation of lanthanides. Application of lanthanide complexes.

Suggested Readings

1. *Chemistry for Degree Students (BSc First Year) by Dr. R L Madan; S Chand And Company Pvt Ltd*
2. *Concise Inorganic Chemistry fifth edition; J D Lee*
3. *Text book of Inorganic chemistry, P. L. Soni, 20th edition, 2001*
4. *F.A. Cotton, G. Wilkinson, C. Murillo and M. Bochman, Advanced Inorganic Chemistry, Wiley India, 6th edition, 2008*

B.Sc. Forensic Science: Semester-I FST104: Environmental Science	
Teaching Scheme	Examination Scheme
Lectures: 2 hr/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course Objective: To make the students familiar with-

1. The Environment and its components
2. Population Ecology and Movements related to Environment in India
3. Natural Resources and related Laws

Unit 1: The Environment

The Atmosphere, Hydrosphere, Lithosphere, Biosphere, Ecology, Ecosystem, Biogeochemical Cycle (Carbon Cycle, Nitrogen Cycle),
Environment Pollution: Air Pollution, Water Pollution, Soil Pollution, Radiation Pollution.

Unit 2: Population Ecology

Individuals, Species, Pollution, Community, Control Methods of Population, Urbanization and its effects on Society, Communicable Diseases and its Transmission, Non-Communicable Diseases.

Environmental Movements in India

Grassroot Environmental movements in India, Role of women, Environmental Movements in Odisha, State Pollution Control Board, Central Pollution Control Board.

Unit 3: Natural Resources

Conservation of Natural Resources, Management and Conservation of Wildlife, Soil Erosion and Conservation
Environmental Laws: Water Act, 1974, Air Act, 1981, The Wildlife (Protection) Act, 1972, Environment Protection, 1986, Natural Disasters and their Management.

Suggested Readings

1. William P. Cunningham, Mary Ann Cunningham, Barbara Woodworth Saigo, Environmental Science: A global concern, McGrawHill 2003
2. William Cunningham, Mary Cunningham, Principles of Environmental Science: Seventh Edition, McGrawHill 2014
3. Roosa SA, Sustainable Development Handbook, CRC Press 2008
4. Atkinson G., Dietz S., Neumayer E., Agarwala M, Handbook of Sustainable Development, Edward Elger, 2014
5. Robbins P., Hintz J., Moore S.A., Environment and Society: A critical introduction, Wiley Blackwel 2014
6. Rogers PP, Jalal, KF, Boyd JA, An introduction to sustainable development, Earthscan

B.Sc. Forensic Science: Semester-I	
FST105: Physics-I	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

1. Recognize the difference between scalars, vectors, pseudo-scalars and pseudo-vectors.
2. Understand the physical interpretation of gradient, divergence and curl.
3. Comprehend the difference and connection between Cartesian, spherical and cylindrical coordinate systems.
4. Know the meaning of 4-vectors, Kronecker delta and Epsilon (Levi Civita) tensors.
5. Study the origin of pseudo forces in rotating frame.
6. Study the response of the classical systems to external forces and their elastic deformation.
7. Understand the dynamics of planetary motion and the working of Global Positioning System (GPS).
8. Comprehend the different features of Simple Harmonic Motion (SHM) and wave propagation.

Unit I – Coordinate Systems
<ul style="list-style-type: none"> • 2D & 3D Cartesian, Spherical and Cylindrical coordinate systems, basis vectors, transformation equations. Expressions for displacement vector, arc length, area element, volume element, gradient, divergence and curl in different coordinate systems. Components of velocity and acceleration in different coordinate systems. Examples of non-inertial coordinate system and pseudo-acceleration.
Unit II – Introduction to Tensors
<ul style="list-style-type: none"> • Principle of invariance of physical laws w.r.t. different coordinate systems as the basis for defining tensors. Coordinate transformations for general spaces of nD, contravariant, covariant & mixed tensors and their ranks, 4-vectors. Index notation and summation convention. Symmetric and skewsymmetric tensors. Invariant tensors, Kronecker delta and Epsilon (Levi Civita) tensors. Examples of tensors in physics.
Unit III – Dynamics of a System of Particles
<ul style="list-style-type: none"> • Review of historical development of mechanics up to Newton. Background, statement and critical analysis of Newton's axioms of motion. Dynamics of a system of particles, centre of mass motion, and conservation laws & their deductions. Rotating frames of reference, general derivation of origin of pseudo forces (Euler, Coriolis & centrifugal) in rotating frame, and effects of Coriolis force.
Unit IV – Dynamics of a Rigid Body
<ul style="list-style-type: none"> • Angular momentum, Torque, Rotational energy and the inertia tensor. Rotational inertia for simple bodies (ring, disk, rod, solid and hollow sphere, solid and hollow cylinder, rectangular lamina). The combined translational and rotational motion of a rigid body on

horizontal and inclined planes. Elasticity, relations between elastic constants, bending of beam and torsion of cylinder.

Unit V – Motion of Planets & Satellites

- Two particle central force problem, reduced mass, relative and centre of mass motion. Newton's law of gravitation, gravitational field and gravitational potential. Kepler's laws of planetary motion and their deductions. Motions of geo-synchronous & geo-stationary satellites and basic idea of Global Positioning System (GPS).

Suggested Readings:

1. Murray Spiegel, Seymour Lipschutz, Dennis Spellman, "Schaum's Outline Series: Vector Analysis", McGraw Hill, 2017, 2e
2. A.W. Joshi, "Matrices and Tensors in Physics", New Age International Private Limited, 1995, 3e
3. Charles Kittel, Walter D. Knight, Malvin A. Ruderman, Carl A. Helmholz, Burton J. Moyer, "Mechanics (In SI Units): Berkeley Physics Course Vol 1", McGraw Hill, 2017, 2e
4. Richard P. Feynman, Robert B. Leighton, Matthew Sands, "The Feynman Lectures on Physics - Vol. 1", Pearson Education Limited, 2012
5. Hugh D. Young and Roger A. Freedman, "Sears & Zemansky's University Physics with Modern Physics", Pearson Education Limited, 2017, 14e
6. D.S. Mathur, P.S. Hemne, "Mechanics", S. Chand Publishing, 1981, 3e

B.Sc. Forensic Science: Semester-I	
FST106: Zoology-I	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

The student at the completion of the course will be able to:

- Understand the structure and function of all the cell organelles.
- Know about the chromatin structure and its location.
- To be familiar with the basic principle of life, how a cell divides leading to the growth of an organism and also reproduces to form new organisms.
- How one cell communicates with its neighboring cells?
- Understand the basic principles of genetics and how genes (earlier called factors) are inherited from one generation to another.
- Understand the Mendel's laws and the deviations from conventional patterns of inheritance.
- Comprehend how environment plays an important role by interacting with genetic factors.
- How to detect chromosomal aberrations in humans and study the pattern of inheritance by pedigree analysis in families.

Unit I – Structure and Function of Cell Organelles
<ul style="list-style-type: none"> • Plasma membrane: chemical structure—lipids and proteins • Cell-cell interaction: cell adhesion molecules, cellular junctions • Endomembrane system: protein targeting and sorting, endocytosis, exocytosis • Cytoskeleton: microtubules, microfilaments, intermediate filaments • Mitochondria: Structure, oxidative phosphorylation • Peroxisome and ribosome: structure and function
Unit II – Nucleus and Chromatin Structure
<ul style="list-style-type: none"> • Structure and function of nucleus in eukaryotes • Chemical structure and base composition of DNA and RNA • DNA supercoiling, chromatin organization, structure of chromosomes • Types of DNA and RNA
Unit III – Cell cycle, Cell Division and Cell Signaling
<ul style="list-style-type: none"> • Cell division: mitosis and meiosis • Cell cycle and its regulation, apoptosis • Signal transduction: intracellular signaling and cell surface receptors, via G-protein linked receptors, JAK-STAT pathway

Unit IV – Mendelism and Sex Determination

- Basic principles of heredity: Mendel's laws, monohybrid and dihybrid crosses
- Complete and Incomplete Dominance
- Penetrance and expressivity
- Sex-linked characteristics and Dosage compensation

Unit V – Infectious Diseases

- Introduction to pathogenic organisms: viruses, bacteria, fungi, protozoa, and worms.
- Structure, life cycle, pathogenicity, including diseases, causes, symptoms and control of common parasites: *Trypanosoma*, *Giardia* and *Wuchereria*

Suggested Readings:

1. Lodish et al: Molecular Cell Biology: Freeman & Co, USA (2004).
2. Alberts et al: Molecular Biology of the Cell: Garland (2002).
3. Cooper: Cell: A Molecular Approach: ASM Press (2000).
4. Karp: Cell and Molecular Biology: Wiley (2002). Pierce B. Genetics. Freeman (2004).
5. Lewin B. Genes VIII. Pearson (2004).
6. Watson et al. Molecular Biology of the Gene. Pearson (2004).
7. Thomas J. Kindt, Richard A. Goldsby, Barbara A. Osborne, Janis KubyKuby Immunology. W H Freeman (2007).
8. Delves Peter J., Martin Seamus J., Burton Dennis R., Roitt Ivan M. Roitt's Essential Immunology, 13th Edition. Wiley Blackwell (2017).
9. Shetty Nandini Immunology Introductory Textbook. New Age International. (2005)

B.Sc. Forensic Science: Semester-I	
FST107: Computer Science-I	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

- Understand hardware components of computer system such as memory system organization, input/output devices, aware of software components of computer system, and windows operating system concepts.
- Develops basic understanding of computers, the concept of algorithm and algorithmic thinking.
- Develops the ability to analyze a problem, develop an algorithm to solve it.
- Develops the use of the Python programming language to implement various algorithms, and develops the basic concepts and terminology of programming in general.
- Introduces the more advanced features of the Python language

Unit I – Computer Fundamentals

- Introduction to Computers: Characteristics of Computers, Uses of computers, Types and generations of Computers.

Unit II – Basic Computer Organization

- Units of a computer, CPU,
- ALU, memory hierarchy, registers, I/O devices. Planning the
- Computer Program: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation.
- Techniques of Problem Solving: Flowcharting, decision table, algorithms, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming.

Unit III – Overview of Programming

- Structure of a Python Program, Elements of Python, IDEs for python, Python Interpreter, Using Python as calculator, Python shell, Indentation.
- Introduction to Python: Atoms, Identifiers and keywords, Literals, Strings, Operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator).

Unit IV – Creating Python Programs

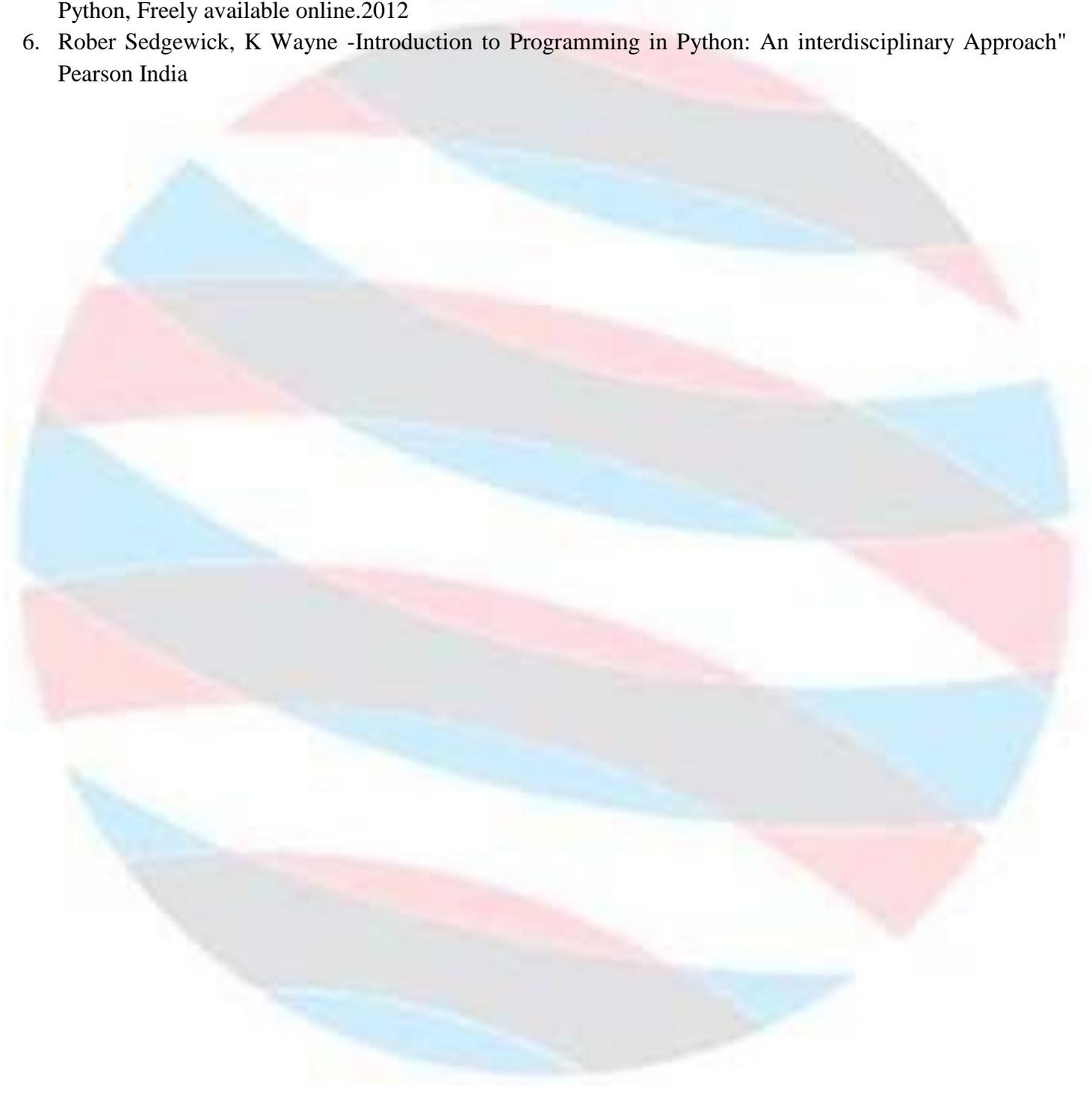
- Input and Output Statements, Control statements (Looping- while Loop, for Loop, Loop Control, Conditional Statement- if...else, Difference between break, continue and pass).

Unit V – Structures

- Numbers, Strings, Lists, Tuples, Dictionary, Date & Time, Modules, Defining Functions, Exit function, default arguments. File handling in python.
- Introduction to Advanced Python: Objects and Classes, Inheritance, Regular Expressions, Event Driven Programming, GUI Programming. Basic concepts of concepts of Package and modules

Suggested Readings:

1. P. K. Sinha & Priti Sinha , “Computer Fundamentals”, BPB Publications, 2007.
2. Dr. Anita Goel, Computer Fundamentals, Pearson Education, 2010.
3. T. Budd, Exploring Python, TMH, 1st Ed, 2011
4. Python Tutorial/Documentation www.python.org 2010
5. Allen Downey, Jeffrey Elkner, Chris Meyers , How to think like a computer scientist : learning with Python, Freely available online.2012
6. Rober Sedgewick, K Wayne -Introduction to Programming in Python: An interdisciplinary Approach" Pearson India



B.Sc. Forensic Science: Semester-I	
FST108: Botany-I	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

The student at the completion of the course will be able to:

- Develop understanding about the classification and diversity of different microbes including viruses, Algae, Fungi & Lichens & their economic importance.
- Develop conceptual skill about identifying microbes, pathogens, biofertilizers & lichens.
- Gain knowledge about developing commercial enterprise of microbial products.
- Learn host –pathogen relationship and disease management.
- Learn Presentation skills (oral & writing) in life sciences by usage of computer of computer & multimedia
- Gain Knowledge about uses of microbes in various fields.
- Understand the structure and reproduction of certain selected bacteria algae, fungi and lichens
- Gain Knowledge about the economic values of this lower group of plant community.

Unit I – Microbial world

- Cell structure of Eukaryotic and prokaryotic cells, Gram positive and Gram negative bacteria, Structure of a bacteria; Bacterial Chemotaxis and Quorum sensing, Bacterial Growth curve, factors affecting growth of microbes; measurement of growth; Batch culture, fed batch culture and continuous culture; Synchronous growth of microbes; Sporulation and reproduction and recombination in bacteria;
- Viruses, general characteristics, viral culture, Structure of viruses, Bacteriophages, Structure of T4 & λ -phage; Lytic and Lysogenic cycles, viroids, Prions & myco& phytoplasma, Actinomycetes & plasmids and their economic uses.

Unit II – Phycology

- Range of thallus organization in Algae, Pigments , Reserve food –Reproduction – Classification and life cycle of – Nostoc; Chlorella, Volvox, Oedogonium , Chara; Sargassum , Ectocarpus, Polysiphonia.
- Economic importance of algae - Role of algae in soil fertility- biofertilizer – Nitrogen fixation- Symbiosis ;Commercial products of algae –biofuel, Agar.

Unit III – Mycology

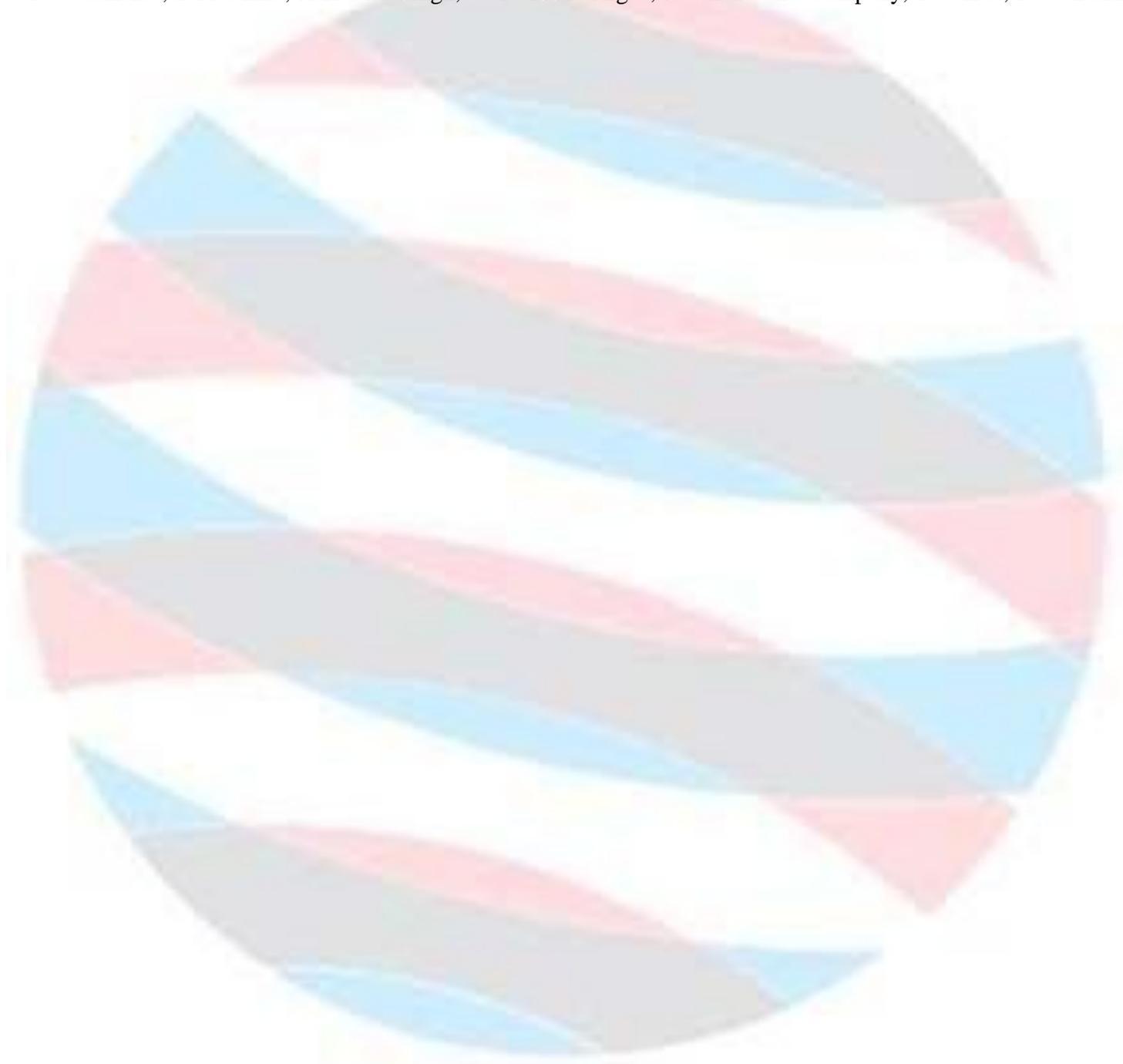
- General characteristics, nutrition, life cycle, Economic importance of Fungi, Classification upto class. Distinguishing characters of Myxomycotina -General characters. Zygomycotina – Rhizopus , Ascomycotina -Saccharomyces, Penicillium, Peziza , Basidiomycotina- Ustilago, Puccinia , Agaricus ; Deuteromycotina – Fusarium, Alternaria , Heterothallism, Physiological specialization, Heterokaryosis & Parasexuality

Unit IV – Mushroom Cultivation, Lichenology & Mycorrhiza
<ul style="list-style-type: none"> • Mushroom cultivation. • General account of lichens, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance.
Unit V – Plant Pathology
<ul style="list-style-type: none"> • Disease concept, Symptoms, Etiology & causal complex, Primary and secondary inoculum, Infection, Pathogenicity and pathogenesis, Koch's Postulates. Mechanism of infection (Brief idea about Pre-penetration, Penetration and Post-penetration), Disease cycle (monocyclic, polycyclic and polyetic). Defense mechanism with special reference to Phytoalexin, Resistance- Systemic acquired and Induced systemic..fungicides- Bordeaux mixture, Lime sulphur, Tobacco decoction, Neem cake & oil

Suggested Readings:

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
2. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.
3. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
4. Aggarwal, S. K. 2009. Foundation Course in Biology, A one books Pvt. Ltd., New Delhi.
5. Aneja, K. R. 1993. Experiments in Microbiology, Pathology and Tissue Culture, Vishwa Prakashan, NewDelhi.
6. Annie Ragland, 2012. Algae and Bryophytes, Saras Publication, Kanyakumari, India.
7. Basu, A. N. 1993. Essentials of Plant Viruses, Vectors and Plant diseases, New Age International, New Delhi.
8. Chopra. G. L. 1984. A text book of Algae, Rastogi publications, Meerut,India.
9. Desikachari, T. V. 1959. Cyanophyta, ICAR, New Delhi.
10. Dubey, R. C. and Maheshwari. D.K. 2012. Practical Microbiology, S. Chand & Company, Pvt. Ltd., NewDelhi.
11. Fritsch, R. E. 1977. Structure and Reproduction of Algae, Cambridge University Press, London.
12. Kodo, C.I. and Agarwal, H.O.1972. Principles and techniques in Plant Virology, Van Nostrand, Reinhold Company, New York.
13. Agrios, G.N. (1997). Plant Pathology, 4th edition. Cambridge, U.K.: Academic Press.
14. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, 4th edition. Singapore, Singapore: John Wiley & Sons.
15. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies. Noida, U.P.: Macmillan Publishers India Ltd.
16. Reven, F.H., Evert, R. F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Company.
17. Sharma, P.D. (2011). Plant Pathology. Meerut, U.P.: Rastogi Publication.
18. Webster, J., Weber, R. (2007). Introduction to Fungi, 3rd edition. Cambridge, U.K.: Cambridge University Press..
19. Pandey B.P. 2001. College Botany Volume 1, S Chand & Company Pvt.Ltd, New Delhi.
20. Pandey. B.P. 2014 Modern Practical Botany, (Vol-I) S. Chand and Company Pvt. Ltd., New Delhi.
21. Pelzar, 1963. Microbiology, Tata Mc Graw Hill, New Delhi
22. Rangaswamy, G. 2009, Disease of Crop Plants in India, Prientice Hall of India, New Delhi.
23. Sambamurty. A.V.S.S. 2006, A Text book of Algae, I. K. International Publishing House, Pvt. Ltd., New Delhi.

24. Sharma, P. D. 2012, Microbiology and Plant Pathology, Rastogi Publication Pvt Ltd., Meerut, India.
25. Singh, R. P. 2007. Microbial Taxonomy and Culture Techniques, Kalyani Publication, New Delhi.
26. Smith. G. M. 1996. Cryptogamic Botany Volume I, Tata Mc Graw Hill, New Delhi.
27. Sundar Rajan. S. 2010.College Botany Volume I, Himalaya Publications, Mumbai.
28. Vashishta, B.R. Sinha, A.K. and Singh, V. P. 1991. Algae, S. Chand and Company, Pvt. Ltd., New Delhi



B.Sc. Forensic Science: Semester-I FST153: Chemistry Lab-I	
Teaching Scheme	Examination Scheme
Practicals: 4 hr/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course Objective: To make the students trained in different techniques of Chemistry and Biochemistry for future applications in Forensic Science Laboratories

Experiment Details

1. Determination of acetic acid in commercial vinegar using NaOH.
2. Determination of alkali content – antacid tablet using HCl.
3. Estimation of oxalic acid by titrating it with KMnO_4
4. Qualitative Inorganic Mixture Analysis: Not containing more than 4 ions and one interfering anion
5. Chromatographic separation of metal ions.
6. Gravimetric estimation of Cations/Anions.
7. Estimation of hardness of water by EDTA

Suggested Readings

1. Concise Inorganic Chemistry, J. D. Lee, 5th Edition (1996), Chapman & Hall, London.
2. Inorganic Chemistry, J.E. Huheey, E.A. Keiter and R.L. Keiter.
3. Modern Inorganic Chemistry, R. C. Aggarwal, 1st Edition (1987), Kitab Mahal, Allahabad.
4. Basic Inorganic Chemistry, F. A Cotton, G. Wilkinson, and Paul L. Gaus, 3rd Edition (1995), John Wiley & Sons, New York.
5. Inorganic Chemistry, A. G. Sharpe, 3rd International Student Edition (1999), ELBS / Longman, U.K.
6. Inorganic Chemistry, D. F. Shriver and P. W. Atkins, 3rd Edition (1999), ELBS, London

B.Sc. Forensic Science: Semester-I	
FST155: Physics Lab-I	
Teaching Scheme	Examination Scheme
Practicals: 4 hr/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

- Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the mechanical properties. Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.

Lab Experiment List

- Moment of inertia of a flywheel
- Moment of inertia of an irregular body by inertia table
- Modulus of rigidity by statistical method (Barton’s apparatus)
- Modulus of rigidity by dynamical method (sphere / disc / Maxwell’s needle)
- Young’s modulus by bending of beam
- Young’s modulus and Poisson’s ratio by Searle’s method
- Poisson’s ratio of rubber by rubber tubing
- Surface tension of water by capillary rise method
- Surface tension of water by Jaeger’s method
- Coefficient of viscosity of water by Poiseuille’s method
- Acceleration due to gravity by bar pendulum
- Frequency of AC mains by Sonometer
- Height of a building by Sextant
- Study the wave form of an electrically maintained tuning fork / alternating current source with the help of cathode ray oscilloscope.

Suggested Readings:

1. B.L. Worsnop, H.T. Flint, “Advanced Practical Physics for Students”, Methuen & Co., Ltd., London, 1962, 9e
2. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd., 2015, 1e
3. R.K. Agrawal, G. Jain, R. Sharma, “Practical Physics”, Krishna Prakashan Media (Pvt.) Ltd., Meerut, 2019
4. S.L. Gupta, V. Kumar, “Practical Physics”, Pragati Prakashan, Meerut, 2014

B.Sc. Forensic Science: Semester-I FST156: Zoology Lab-I	
Teaching Scheme	Examination Scheme
Practicals: 4 hr/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

At the completion of the course students will learn Hands-on:

- To use simple and compound microscopes.
- To prepare slides and stain them to see the cell organelles.
- To be familiar with the basic principle of life, how a cell divides leading to the growth of an organism and also reproduces to form new organisms.
- The chromosomal aberrations by preparing karyotypes.
- How chromosomal aberrations are inherited in humans by pedigree analysis in families.
- The antigen-antibody reaction.

Unit I
<ul style="list-style-type: none"> • To study different cell types such as buccal epithelial cells, neurons, striated muscle cells using Methylene blue. • To study the different stages of Mitosis in root tip of onion. • To study the different stages of Meiosis in grasshopper testis. • To prepare molecular models of nucleotides, amino acids, dipeptides using bead and stick method. • To check the permeability of cells using salt solution of different concentrations.
Unit II
<ul style="list-style-type: none"> • Study of parasites (ex. Protozoans, helminthes etc.) from permanent slides. • To learn the procedures for preparation of temporary and permanent stained/unstained slides.
Unit III
<ul style="list-style-type: none"> • Study of mutant phenotypes of Drosophila. • Preparation of polytene chromosomes. • Study of sex chromatin (Barr bodies) in buccal smear and hair bud cells (Human). • Preparation of human karyotype and study the chromosomal aberrations with respect to number, translocation, deletion etc. from the pictures provided.

Suggested Readings:

1. Lodish et al: Molecular Cell Biology: Freeman & Co, USA (2004).
2. Alberts et al: Molecular Biology of the Cell: Garland (2002).
3. Cooper: Cell: A Molecular Approach: ASM Press (2000).
4. Karp: Cell and Molecular Biology: Wiley (2002). Pierce B. Genetics. Freeman (2004).
5. Thomas J. Kindt, Richard A. Goldsby, Barbara A. Osborne, Janis KubyKuby Immunology. W H Freeman (2007).
6. Kesar, Saroj and Vashishta N. (2007). Experimental Physiology: Comprehensive Manual. Heritage Publishers, New Delhi

B.Sc. Forensic Science: Semester-I FST157: Computer Lab-I	
Teaching Scheme	Examination Scheme
Practicals: 4 hr/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

- To learn and understand Python programming basics.
- To learn and understand python looping, control statements and string manipulations.
- Students should be made familiar with the concepts of GUI controls and designing GUI applications.
- To learn and know the concepts of file handling, exception handling and database connectivity.

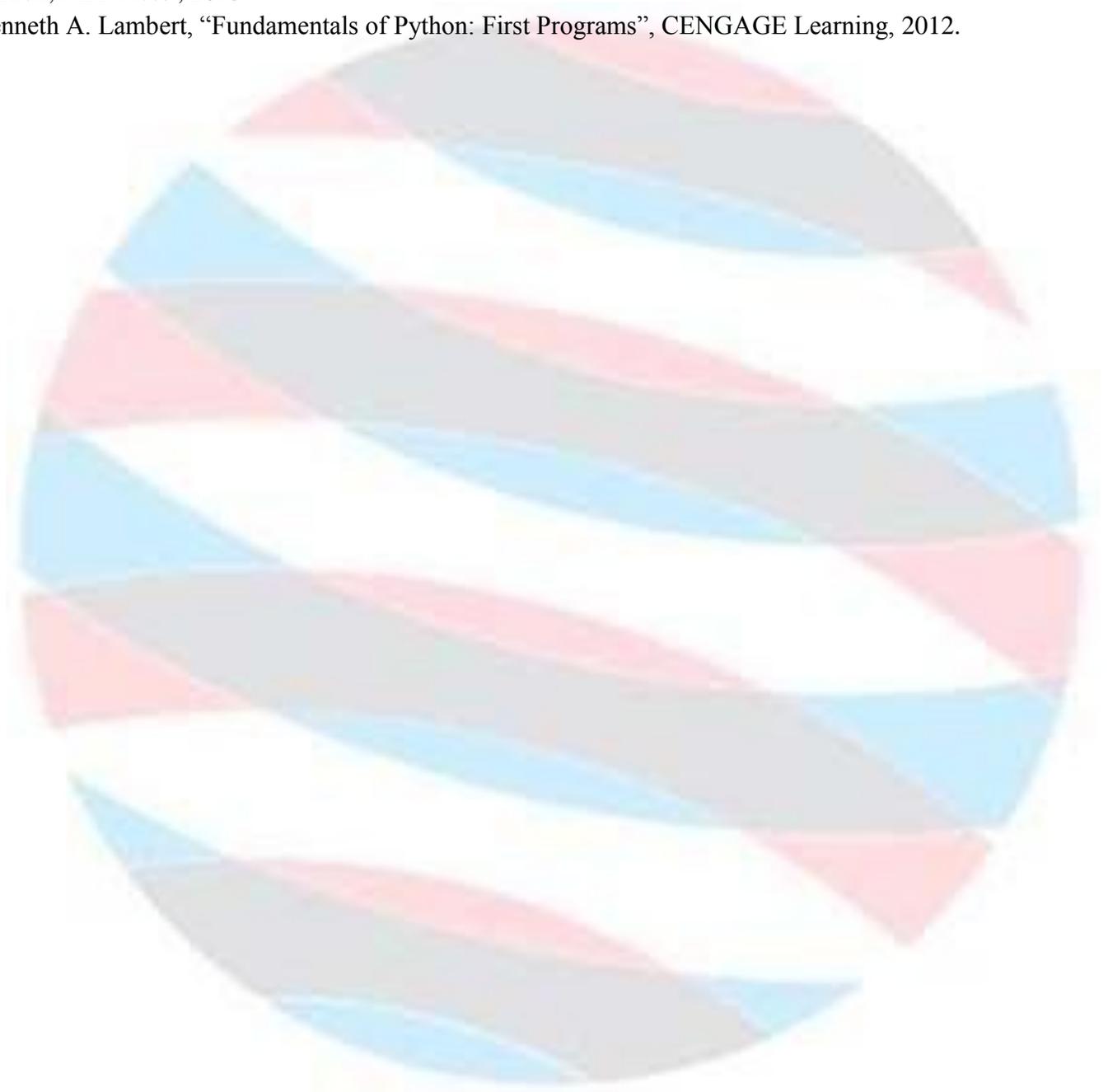
Lab Activity List

- Write a menu driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.
- WAP to calculate total marks, percentage and grade of a student. Marks obtained in each of the three subjects are to be input by the user. Assign grades according to the following criteria :
Grade A: Percentage ≥ 80
Grade B: Percentage ≥ 70 and < 80
Grade C: Percentage ≥ 60 and < 70
Grade D: Percentage ≥ 40 and < 60
Grade E: Percentage < 40
- Write a menu-driven program, using user-defined functions to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.
- WAP to display the first n terms of Fibonacci series.
- WAP to find factorial of the given number.
- WAP to find sum of the following series for n terms: $1 - 2/2! + 3/3! - \dots - n/n!$
- WAP to calculate the sum and product of two compatible matrices.
- WAP to read n integers and display them as a histogram.
- WAP to display sine, cosine, polynomial and exponential curves.
- WAP to plot a graph of people with pulse rate p vs. height h. The values of p and h are to be entered by the user.

Suggested Readings:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

3. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
4. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press , 2013
5. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.



B.Sc. Forensic Science: Semester-I	
FST158: Botany Lab-I	
Teaching Scheme	Examination Scheme
Practicals: 4 hr/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

At the completion of the course students will be able to:

- Understand the instruments, techniques, lab etiquettes and good lab practices for working in a microbiology laboratory.
- Develop skills for identifying microbes and using them for Industrial, Agriculture and Environment purposes.
- Practical skills in the field and laboratory experiments in Microbiology & Pathology. learn to identify Algae, Lichens and plant pathogens along with their Symbiotic and Parasitic associations.

Unit I
<ul style="list-style-type: none"> • Laboratory safety and good laboratory practices • Principles and application of Laboratory instruments-microscope, incubator, autoclave, centrifuge, LAF, filtration unit, shaker, pH meter. • Buffer preparation & titration • Cleaning and Sterilization of glasswares • Preparation of media- Nutrient Agar and Broth
Unit II
<ul style="list-style-type: none"> • Identification of bacteria. • Staining techniques: Gram's, Negative, Endospore, Capsule and Cell Wall.
Unit III
<ul style="list-style-type: none"> • Type study of algae and Cyanobacteria –Spirullina, Nostoc. Chlorophyceae - Chlorella, Volvox, Oedogonium, Cladophora, and Chara; Xanthophyceae – Vaucheria ;Bacillariophyceae – Pinnularia Phaeophyceae – Sargassum Rhodophyceae - Polysiphonia

Suggested Readings:

1. Aneja, K. R. 1993. Experiments in Microbiology, Pathology and Tissue Culture, Vishwa Prakashan, New Delhi.
2. Dubey, R. C. and Maheshwari. D.K. 2012. Practical Microbiology, S. Chand & Company, Pvt. Ltd., New Delhi.
3. Kodo, C.I. and Agarwal, H.O.1972. Principles and techniques in Plant Virology, Van Nostrand, Reinhold Company, New York.
4. Madhavee Latha, P. 2012, A Textbook of Immunology, S. Chand & Company Pvt. Ltd., New Delhi.
5. Pandey. B.P. 2014 Modern Practical Botany, (Vol-I) S. Chand and Company Pvt. Ltd., New Delhi.
6. Sambamurty. A.V.S.S. 2006, A Text book of Algae, I. K. International Publishing House, Pvt. Ltd.,
7. Singh, R. P. 2007. Microbial Taxonomy and Culture Techniques, Kalyani Publication, New Delhi.

B.Sc. Forensic Science: Semester-II	
FST 201: Law for Forensic Scientists	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

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

1. Elements of Criminal Procedure Code related to forensic science.
2. Acts and provisions of the Constitution of India related to forensic science.
3. Acts governing socio-economic crimes.
4. Acts governing environmental crimes.

Unit 1: Introduction to criminal law

Offence – Definition and its types. Classification – civil, criminal cases.

Essential elements of criminal laws. Constitution and hierarchy of criminal courts.

Criminal Procedure Code – Cognizable and non-cognizable offences. Bailable and non-bailable offences and other relevant sections. Section 291, 292 and 293.

Unit 2: Indian Penal Code

Offences against persons – Sections 121A, 299, 300, 302, 304, 304A, 304B, 306, 307, 309, 319, 320, 324, 326, 351, 354, 359, 362.

Sections 375 & 377 and their amendments.

Offences against property – Sections 378, 383, 390, 391, 405, 415, 420, 441, 463, 489A, 497, 499, 503, 511.

POCSO

Unit 3: Indian Evidence Act

Evidence and rules of relevancy in brief. Expert witness. Cross examination and re-examination of witnesses. Examination in Chief.

Sections 32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137, 138, 141.

Unit 4: Constitution Of India

Preamble, Fundamental Rights, Directive Principles of State Policy. – Articles 14, 15, 20, 21, 22, 51A.

Unit 5: Acts Pertaining to Socio-economic and Environmental Crimes

Narcotic Drugs and Psychotropic Substances Act. Essential Commodity Act. Drugs and Cosmetics Act. Explosive Substances Act. Arms Act. Dowry Prohibition Act. Prevention of Food Adulteration Act. Prevention of Corruption Act. Wildlife Protection Act. I.T. Act. Environment Protection Act.

Suggested Readings

1. D.A. Bronstein, *Law for the Expert Witness*, CRC Press, Boca Raton (1999).
2. Vipa P. Sarthi, *Law of Evidence*, 6th Edition, Eastern Book Co., Lucknow (2006).
3. A.S. Pillia, *Criminal Law*, 6th Edition, N.M. Tripathi Pvt Ltd., Mumbai (1983).
4. R.C. Nigam, *Law of Crimes in India*, Volume I, Asia Publishing House, New Delhi (1965).
5. (Chief Justice) M. Monir, *Law of Evidence*, 6th Edition, Universal Law Publishing Co. Pvt. Ltd., New Delhi (2002).
6. Constitution of India, Bare Act

B.Sc. Forensic Science: Semester-II FST 202: Forensic Psychology	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

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

1. The overview of forensic psychology and its applications.
2. The legal aspects of forensic psychology.
3. The significance of criminal profiling.
4. The importance of psychological assessment in gauging criminal behavior.
5. The tools and techniques required for detection of deception.
6. The critical assessment of advanced forensic techniques like polygraphy, narco analysis, etc.

Unit 1: Introduction

Introduction to forensic Psychology, Nature, History and its Scope. Fundamental distinctions between Psychology and Law, Police Psychology, Forensic Psychology in India and its sub-fields. Ethical and Legal issues in Forensic Practice, Psychologist as Expert Witnesses.

Unit 2: Crime and the Victim

Crime: Causes, impact of crime on victim, Victimization, Factors affecting victimization: Bystander Effect, Forensic Mental Health. Psychological explanations of specific crime types: Arson, terrorism, homicides, sexual offences, burglary, robbery, theft, white collar crimes.

Unit 3: Psychology in Investigation, Court-Room & Corrections

Criminal Profiling, Eyewitness Testimony, Competence to stand trial, Roles of correctional psychologist, Treatment and Rehabilitation in Correctional facilities, Risk Assessment, Treatment of Special population: Violent Offenders, Women Prisoners, Juvenile Justice.

Unit 4: Assessment and Evaluation in Forensic Psychology

Psychological Tests used in forensic psychology, Forensic methods in detection of crime: Brain Electrical Oscillation Signature Profiling (BEOS). Lie Detections: Polygraph, Brain Mapping, Narco-analysis.

Unit 5: Professional Practice

Forensic consultancy and supervision, core competences, Cognitive interviewing techniques, psychologist as a consultant, Family law issues, custody and adoptions, Psychology and the legal process interaction, Presentation of evidences and providing feedback, Psychotherapy with Criminal Offenders.

Suggested Readings

1. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, *Scientific Evidence in Civil and Criminal Cases*, 4th Edition, The Foundation Press, Inc., New York (1995).
2. R. Saferstein, *Criminalistics*, 8th Edition, Prentice Hall, New Jersey (2004).
3. J.C. DeLadurantey and D.R. Sullivan, *Criminal Investigation Standards*, Harper & Row, New York (1980).
4. J. Niehaus, *Investigative Forensic Hypnosis*, CRC Press, Boca Raton (1999).
5. E. Elaad in *Encyclopedia of Forensic Science, Volume 2*, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).

B.Sc. Forensic Science: Semester-II	
FST 203: Chemistry-II	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course Objective:

- a. *On the completion of this course the students will be able to understand the properties of transition elements.*
- b. *The student will be able to describe and understand the characteristics of the periodic table, metal complexes, bioinorganic chemistry, and organometallic chemistry.*

Unit 1: Magnetic Properties of Transition Metal Complexes

Types of magnetic behavior, methods of determining magnetic susceptibility, L-S and J-J coupling, orbital contribution to magnetic moments. Correlation of magnetic moment data and stereochemistry of Co(II) and Ni(II) complexes; anomalous magnetic moments.

Unit 2: Electronic Spectra of Transition Metal Complexes

Types of electronic transitions, selection rule for dd transitions, spectroscopic ground states. Explanation of electronic spectra on the basis of Orgel energy level diagrams for d1, d4, d6 and d9 states.

Unit 3: Chemistry of f-block Elements

Comparative study of actinide elements with respect to electronic configuration, atomic and ionic radii, oxidation states and complex formation; occurrence and principles of separation. General features and chemistry of actinides, principles of separation of Np, Pu and Am from U. Trans-Uranium elements.

Unit 4: Bioinorganic Chemistry

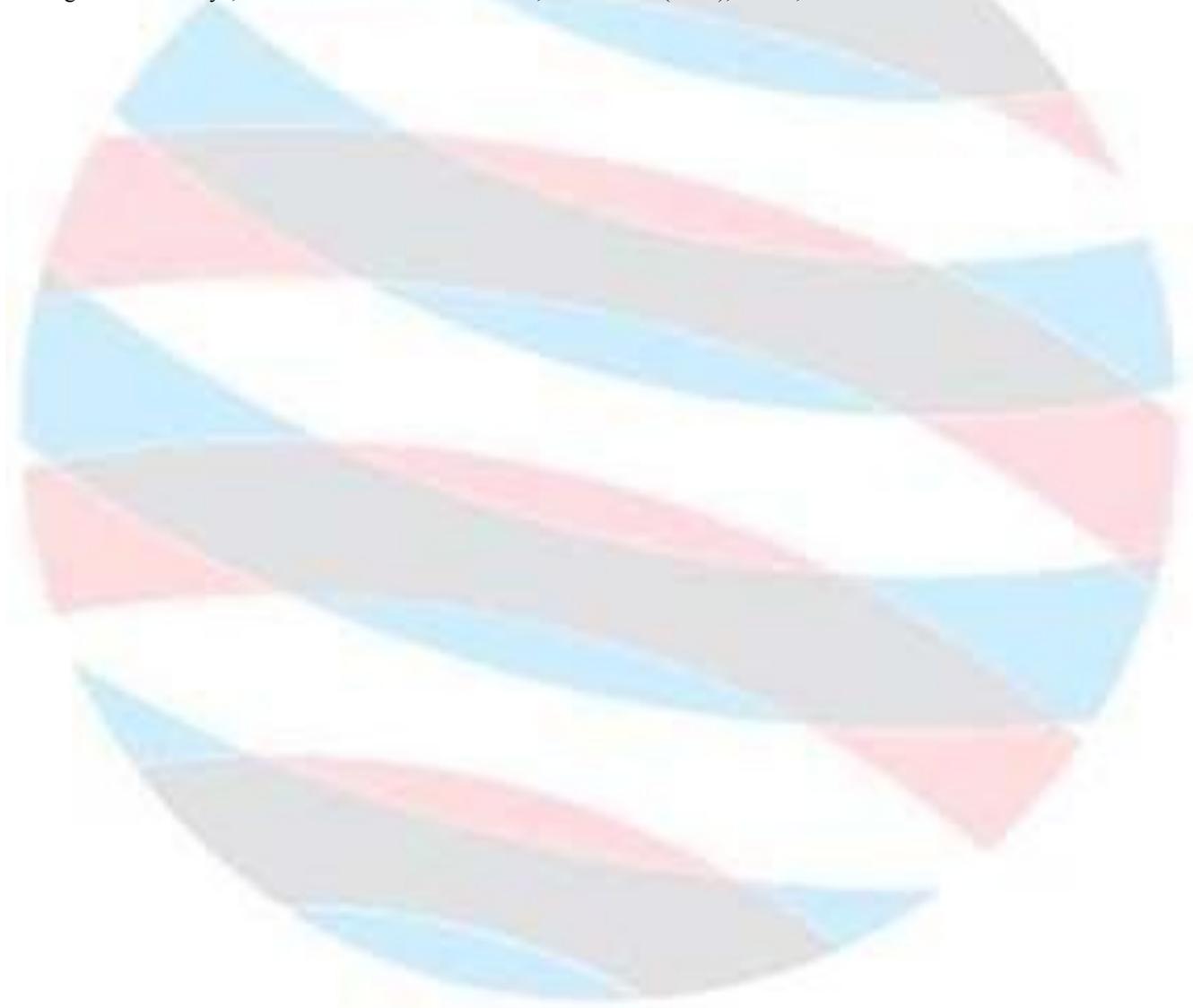
Essential and trace element in biological process, oxygen transport with reference to hemoglobin; synthetic models of O₂ carriers., Biological role of alkali metals ions. Vitamin B-12

Unit 5: Organometallic Chemistry

Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyl and aryls of Li, Al, Hg, Sn, Ti. A brief account of metal-ethylene complexes and homogeneous hydrogenation

Suggested Readings:

1. "Concise Inorganic Chemistry", J. D. Lee, 5th Edition (1996), Chapman & Hall, London.
2. "Inorganic Chemistry", J.E. Huheey, E.A. Keiter and R.L. Keiter.
3. "Modern Inorganic Chemistry", R. C. Aggarwal, 1st Edition (1987), Kitab Mahal, Allahabad.
4. "Basic Inorganic Chemistry", F. A Cotton, G. Wilkinson, and Paul L. Gaus, 3rd Edition (1995), John Wiley & Sons, New York.
5. "Inorganic Chemistry", A. G. Sharpe, 3rd International Student Edition (1999), ELBS / Longman, U.K.
6. "Inorganic Chemistry", D. F. Shriver and P. W. Atkins, 3rd Edition (1999), ELBS, London.



B.Sc.: Semester-II	
FST 204: English Communication	
Teaching Scheme	Examination Scheme
Lectures: 2 hr/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course objectives:

1. To provide an overview of Prerequisites to Business Communication.
2. To put in use the basic mechanics of Grammar.
3. To impart the correct practices of the strategies of Effective Business writing.

Unit 1: Basics of Communication
Fundamentals of Communication: Introduction, Definition, Process, Importance, Different Forms and Purpose of Communication, Barriers to Communication, Organization and Interpersonal Communication.
Unit 2: English Grammar
Grammar and Vocabulary: Tenses, Verb Types, Active and Passive Voice, Narration, Prepositions, Conditionals, Conjunctions, One word substitutions, Synonyms and Antonyms
Unit 3: Speaking Skills
Speaking Skills: Introduction, Purpose, Features, Delivering Speeches – Welcome and Introductory, Vote of Thanks. Farewell Speech.
Unit 4: Writing Skills
Professional Writing: Official Communication: Drafting Emails, Letter drafting, Notices, Minutes of Meeting, Circulars Technical Writing: Summer reports, Live Project reports, Field Visit Reports, Resume writing.
Unit 5: Presentation Skills
Presentation: Fundamentals of Presentation, Audience Analysis, Question–Answer Session. Report Writing: General and Technical, Definition, Types, structure, Technical proposals-Definitions, Types and Format. Group Discussion: Introduction to Group Discussion, Difference between GD and Debate, Preparation Strategy.

Suggested Readings:

1. Communication Skills, PushpLata, Sanjay Kumar, Oxford Higher Education/Oxford University Press , 2011.
2. Technical Communication, Principles and Practice, Meenakshi Raman & Sangita Sharma, Oxford University Press.
3. Effective Technical Communication, M Ashraf Rizvi, Tata McGraw –Hill Education.
4. Basic Communication Skills for Technology, Andre J Rutherford , Pearson Education Asia.

B.Sc. Forensic Science: Semester-II	
FST 205: Physics-II	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

- Recognize the difference between reversible and irreversible processes.
- Understand the physical significance of thermodynamical potentials.
- Comprehend the kinetic model of gases w.r.t. various gas laws.
- Study the implementations and limitations of fundamental radiation laws.
- Utility of AC bridges.
- Recognize the basic components of electronic devices.
- Design simple electronic circuits.
- Understand the applications of various electronic instruments.

Unit I – Laws of Thermodynamics

- **0th & 1st Law**
State functions and terminology of thermodynamics. Zeroth law and temperature. First law, internal energy, heat and work done. Work done in various thermodynamical processes. Enthalpy, relation between CP and CV. Carnot’s engine, efficiency and Carnot’s theorem. Efficiency of internal combustion engines (Otto and diesel).
- **2nd & 3rd Law**
Different statements of second law, Clausius inequality, entropy and its physical significance. Entropy changes in various thermodynamical processes. Third law of thermodynamics and unattainability of absolute zero. Thermodynamical potentials, Maxwell’s relations, conditions for feasibility of a process and equilibrium of a system. Clausius- Clapeyron equation, Joule-Thompson effect.

Unit II – Kinetic Theory of Gases

- Kinetic model and deduction of gas laws. Derivation of Maxwell’s law of distribution of velocities and its experimental verification. Degrees of freedom, law of equipartition of energy (no derivation) and its application to specific heat of gases (mono, di and poly atomic).

Unit III – Theory of Radiation

- Blackbody radiation, spectral distribution, concept of energy density and pressure of radiation. Derivation of Planck's law, deduction of Wien’s distribution law, Rayleigh-Jeans law, Stefan-Boltzmann law and Wien’s displacement law from Planck’s law.

Unit IV – DC & AC Circuits

- Growth and decay of currents in RL circuit. Charging and discharging of capacitor in RC, LC and RCL circuits. Network Analysis - Superposition, Reciprocity, Thevenin’s and Norton’s theorems. AC Bridges - measurement of inductance (Maxwell’s, Owen’s and Anderson’s bridges) and measurement of capacitance (Schering’s, Wein’s and de Sauty’s bridges).

Unit V – Semiconductors & Diodes

- P and N type semiconductors, qualitative idea of Fermi level. Formation of depletion layer in PN junction diode, field & potential at the depletion layer. Qualitative idea of current flow mechanism in forward & reverse biased diode. Diode fabrication. PN junction diode and its characteristics, static and dynamic resistance. Principle, structure, characteristics and applications of Zener, Tunnel, Light Emitting, Point Contact and Photo diodes. Half and Full wave rectifiers, calculation of ripple factor, rectification efficiency and voltage regulation. Basic idea about filter circuits and voltage regulated power supply.

Suggested Readings:

1. M.W. Zemansky, R. Dittman, “Heat and Thermodynamics”, McGraw Hill, 1997, 7e
2. F.W. Sears, G.L. Salinger, “Thermodynamics, Kinetic theory & Statistical thermodynamics”, Narosa Publishing House, 1998
3. Enrico Fermi, “Thermodynamics”, Dover Publications, 1956
4. S. Garg, R. Bansal, C. Ghosh, “Thermal Physics”, McGraw Hill, 2012, 2e
5. Meghnad Saha, B.N. Srivastava, “A Treatise on Heat”, Indian Press, 1973, 5e
6. R.L. Boylestad, L. Nashelsky, “Electronic Devices and Circuit Theory”, Prentice-Hall of India Pvt. Ltd., 2015, 11e
7. J. Millman, C.C. Halkias, Satyabrata Jit, “Electronic Devices and Circuits”, McGraw Hill, 2015, 4e
8. B.G. Streetman, S.K. Banerjee, “Solid State Electronic Devices”, Pearson Education India, 2015, 7e
9. J.D. Ryder, “Electronic Fundamentals and Applications”, Prentice-Hall of India Private Limited, 1975, 5e
10. A. Sudhakar, S.S. Palli, “Circuits and Networks: Analysis and Synthesis”, McGraw Hill, 2015, 5e
11. S.L. Gupta, V. Kumar, “Hand Book of Electronics”, Pragati Prakashan, Meerut, 2016, 43e

B.Sc. Forensic Science: Semester-II	
FST 206: Zoology-II	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

The student at the completion of the course will learn:

- To develop a deep understanding of structure of biomolecules like proteins, lipids and carbohydrates
- How simple molecules together form complex macromolecules.
- To understand the thermodynamics of enzyme catalyzed reactions.
- Mechanisms of energy production at cellular and molecular levels.
- To understand systems biology and various functional components of an organism.
- To explore the complex network of these functional components.
- To comprehend the regulatory mechanisms for maintenance of function in the body.

Unit I – Structure and Function of Biomolecules
<ul style="list-style-type: none"> • Classification, Structure and function of Carbohydrates, Lipids, Protein, Enzyme, Nucleic Acid.
Unit II – Digestion and Respiration
<ul style="list-style-type: none"> • Structural organization and functions of gastrointestinal tract and associated glands • Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins; Histology of trachea and lung • Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood Respiratory pigments, Dissociation curves and the factors influencing it; Control of respiration
Unit III – Circulation and Excretion
<ul style="list-style-type: none"> • Components of blood and their functions • Haemostasis: Blood clotting system, Blood groups: Rh factor, and ABO. • Structure of mammalian heart, Double circulation. • Cardiac cycle; Cardiac output and its regulation, Electrocardiogram, Blood pressure and its regulation • Structure of kidney and its functional unit; Mechanism of urine formation
Unit IV – Muscular System
<ul style="list-style-type: none"> • Histology of different types of muscle; Ultra structure of skeletal muscle; • Molecular and chemical basis of muscle contraction.
Unit V – Nervous System
<ul style="list-style-type: none"> • Structure of neuron, and its types • Structure and Types of synapse. • Nerve impulse in myelinated and Non-myelinated neuron

Suggested Readings:

- Nelson & Cox: Lehninger's Principles of Biochemistry: McMillan (2000)
- Zubayet al: Principles of Biochemistry: WCB (1995)
- Voet&Voet: Biochemistry Vols 1 & 2: Wiley (2004)
- Murray et al: Harper's Illustrated Biochemistry: McGraw Hill (2003) Elliott and Elliott: Biochemistry and Molecular Biology: Oxford University Press
- Guyton, A.C. & Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. /W.B. Saunders Company. (2006).
- Tortora, G.J. & Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons (2006).
- Christopher D. Moyes, Patricia M. Schulte. Principles of Animal Physiology. 3rd Edition, Pearson Education (2016).
- Hill, Richard W., et al. Animal physiology. Vol. 2. Sunderland, MA: Sinauer Associates, (2004).
- Chatterjee C C Human Physiology Volume 1 & 2. 11th edition. CBS Publishers(2016).

B.Sc. Forensic Science: Semester-II	
FST 207: Computer Science-II	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

After the completion of the course the students will be able to:

- Understands the basic concepts of data base management systems.
- Design E-R diagrams for real world applications.
- Formulate relational algebraic expressions using relational data models and languages.
- Apply normalization transaction properties and concurrency control to design database.
- Analyze the security algorithms for database protection.

Unit I – Database Management System
<ul style="list-style-type: none"> • Introduction: Database System Concepts, File system vs. database system, Database system architecture, Data models and their types, Data base scheme and instances, Data independence, Database Languages and Interfaces.
Unit II – Data Modeling Concepts
<ul style="list-style-type: none"> • ER model concepts: Notations for ER diagram, Extended E-R diagram, Extended E-R model, E-R model design issues, constraints, and keys: Weak entity set strong entity set, Relationships of higher degree. • Relational model concepts: code rules, constraints, Relational Algebra operations, Extended relational algebra operations, Relational Calculus, Tuple and Domain relational calculus.
Unit III – Database Design
<ul style="list-style-type: none"> • Functional dependencies, Normal forms, First, second, and third normal forms, BCNF, Multi-valued dependencies and Fourth Normal form, Join Dependencies and Fifth Normal form. • Transaction, Query Processing: Transaction and system concepts: transaction states, ACID properties of transactions, concurrent execution schedules and Recoverability, Serializability of schedules. Query Processing and Optimization: Measures of Query cost, Cost, Evaluation of expression. Optimization: Transformation of relational expression, Choice of evaluation plan.
Unit IV – Concurrency Control
<ul style="list-style-type: none"> • Concurrency Control Techniques: Two phase Locking Techniques for Concurrency Control; Time stamping in Concurrency control. • Introduction to SQL: Basic Structure of SQL Query, Set operators, SELECT, UNION, INTERSECT, and EXCEPT, Nested queries, Aggregate function, Null values, Derived Relations, Modification of the Database, Joined relations and up-dates in SQL.
Unit V – Database Security
<ul style="list-style-type: none"> • Importance of data, Threats and risks, Users and database privileges, Access Control, Security for Internet Applications, Role of Database Administrator.

Suggested Readings:

1. Henry F. Korth and Abraham Silberschatz, "Database System Concepts," Second Edition, McGraw Hill, 1991.
2. AtulKahate, "Introduction to Database Management Systems," Pearson India, 2004.
3. Raghu Ramakrishnan and Johannes Gehrike, "Database Management Systems," Third McGraw Hill, Edition, 2003.
4. R. Elmasri, S.B. Navathe Database Systems Models, Languages, Design and application Programming, 6 Edition, Pearson Education,2013.
5. A. Silberschatz, H.F. Korth, S. Sudarshan, Database System Concepts 6th Edition, McGraw Hill, 2010.
6. C.J Date " An Introduction to Database Systems", Addison Wesley

B.Sc. Forensic Science: Semester-II	
FST 208: Botany-II	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

After the completion of the course the students will be able to:

- Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms
- Understanding of plant evolution and their transition to land habitat.
- Understand morphology, anatomy, reproduction and developmental changes therein through typological study and create a knowledge base in understanding the basis of plant diversity, economic values & taxonomy of plants
- Understand the details of external and internal structures of flowering plants

Unit I – Introduction to Archegoniates, Bryophytes & Pteridophytes
<ul style="list-style-type: none"> • Unique features of archegoniates, Bryophytes: General characteristics, adaptations to land habit, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of Riccia, Marchantia , Anthoceros and Sphagnum. (Developmental details not to be included). economic importance of bryophytes. • Pteridophytes General characteristics, Early land plants (Rhynia). Classification (up to family)with examples, Heterospory and seed habit, stelar evolution, economic importance of Pteridophytes.
Unit II – Gymnosperms & Palaeobotany
<ul style="list-style-type: none"> • Classification and distribution of gymnosperms; Salient features of Cycadales, Ginkgoales, Coniferales and Gnetales, their examples, structure and reproduction; economic importance • General account of Cycadofilicales, Bennettitales and Cordaitales; Geological time scale; Brief account of process of fossilization &types of fossils and study techniques ; Contribution of Birbal Sahni
Unit III – Angiosperm Morphology (Stem, Roots, Leaves & Flowers, Inflorescence)
<ul style="list-style-type: none"> • Morphology and modifications of roots; Stem, leaf and bud. Types of inflorescences; flowers, flower parts, fruits and types of placentation; Definition and types of seeds.
Unit IV – Plant Anatomy
<ul style="list-style-type: none"> • Meristematic and permanent tissues, Organs (root, stem and leaf). Apical meristems & theories on apical organization - Apical cell theory, Histogen theory, Tunica - Corpus theory. Secondary growth - Root and stem- cambium (structure and function) annular rings, Anomalous secondary growth - Bignonia, Boerhaavia, Dracaena, Nyctanthus
Unit V – Reproductive Botany
<ul style="list-style-type: none"> • Plant Embryology, Structure of microsporangium, microsporogenesis, , Structure of megasporangium and its types, megasporogenesis, Structure and types of female gametophyte, types of pollination, Methods of pollination, Germination of pollen grain, structure of male gametophyte, Fertilization, structure of dicot and monocot embryo, Endosperm, Double fertilization, Apomixis and polyembryony.

Suggested Readings:

1. Gangulee H. S. and K. Kar 1992. College Botany Vol. I and II. (New Central Book Agency)
2. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
3. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.
4. Rashid A (1999) An Introduction to Pteridophyta, Vikas Publishing House Pvt. Ltd. New Delhi.
5. Sharma OP (1990) Textbook of Pteridophyta. MacMillan India Ltd. Delhi.
6. Vashishtha BR, Sinha AK and Kumar A (2010) Botany for Degree Students – Pteridophyta, S. Chand and Company,
7. Vashishtha BR, Sinha AK and Kumar A (2010) Botany for Degree Students – Gymnosperms, S. Chand and
8. Parihar NS (1976) Biology and Morphology of Pteridophytes. Central Book Depot.
9. Bhatnagar SP (1996) Gymnosperms, New Age International Publisher.
10. Pandey BP (2010) College Botany Vol II S. Chand and Company, New Delhi

B.Sc. Forensic Science: Semester-II FST253: Chemistry Lab- II	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course Objectives: To make the students trained in different techniques of Inorganic Chemistry for future applications in Forensic Science Laboratories

1. Detection of elements (X, N, S)
2. Preparation of Inorganic Compounds:
 - (i) Potassium trioxalato chromate (III);
 - (ii) Double salts (Chrome alum/ Mohr's salt)
3. Preparation of coordination compounds.
4. Spectral and magnetic characterization of compounds

Suggested Reading

1. Concise Inorganic Chemistry, J. D. Lee, 5th Edition (1996), Chapman & Hall, London.
2. Inorganic Chemistry, J.E. Huheey, E.A. Keiter and R.L. Keiter.
3. Modern Inorganic Chemistry, R. C. Aggarwal, 1st Edition (1987), Kitab Mahal, Allahabad.
4. Basic Inorganic Chemistry, F. A Cotton, G. Wilkinson, and Paul L. Gaus, 3rd Edition (1995), John Wiley & Sons, New York.
5. Inorganic Chemistry, A. G. Sharpe, 3rd International Student Edition (1999), ELBS / Longman, U.K.
6. Inorganic Chemistry, D. F. Shriver and P. W. Atkins, 3rd Edition (1999), ELBS, London

B.Sc. Forensic Science: Semester-II	
FST255: Physics Lab- II	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

- Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the thermal and electronic properties. Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.

Lab Experiment List

- Mechanical Equivalent of Heat by Callender and Barne’s method
- Coefficient of thermal conductivity of copper by Searle’s apparatus
- Coefficient of thermal conductivity of rubber
- Coefficient of thermal conductivity of a bad conductor by Lee and Charlton’s disc method
- Value of Stefan’s constant
- Verification of Stefan’s law
- Variation of thermo-emf across two junctions of a thermocouple with temperature
- Temperature coefficient of resistance by Platinum resistance thermometer
- Charging and discharging in RC and RCL circuits
- A.C. Bridges: Various experiments based on measurement of L and C
- Resonance in series and parallel RCL circuit
- Characteristics of PN Junction, Zener, Tunnel, Light Emitting and Photo diode
- Characteristics of a transistor (PNP and NPN) in CE, CB and CC configurations
- Half wave & full wave rectifiers and Filter circuits
- Unregulated and Regulated power supply
- Various measurements with Cathode Ray Oscilloscope (CRO)

Suggested Readings:

1. B.L. Worsnop, H.T. Flint, “Advanced Practical Physics for Students”, Methuen & Co., Ltd., London, 1962, 9e
2. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd., 2015, 1e
3. R.L. Boylestad, L. Nashelsky, “Electronic Devices and Circuit Theory”, Prentice-Hall of India Pvt. Ltd., 2015, 11e
4. A. Sudhakar, S.S. Palli, “Circuits and Networks: Analysis and Synthesis”, McGraw Hill, 2015, 5e

B.Sc. Forensic Science: Semester-II FST256: Zoology Lab- II	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

The student at the completion of the course will be able to:

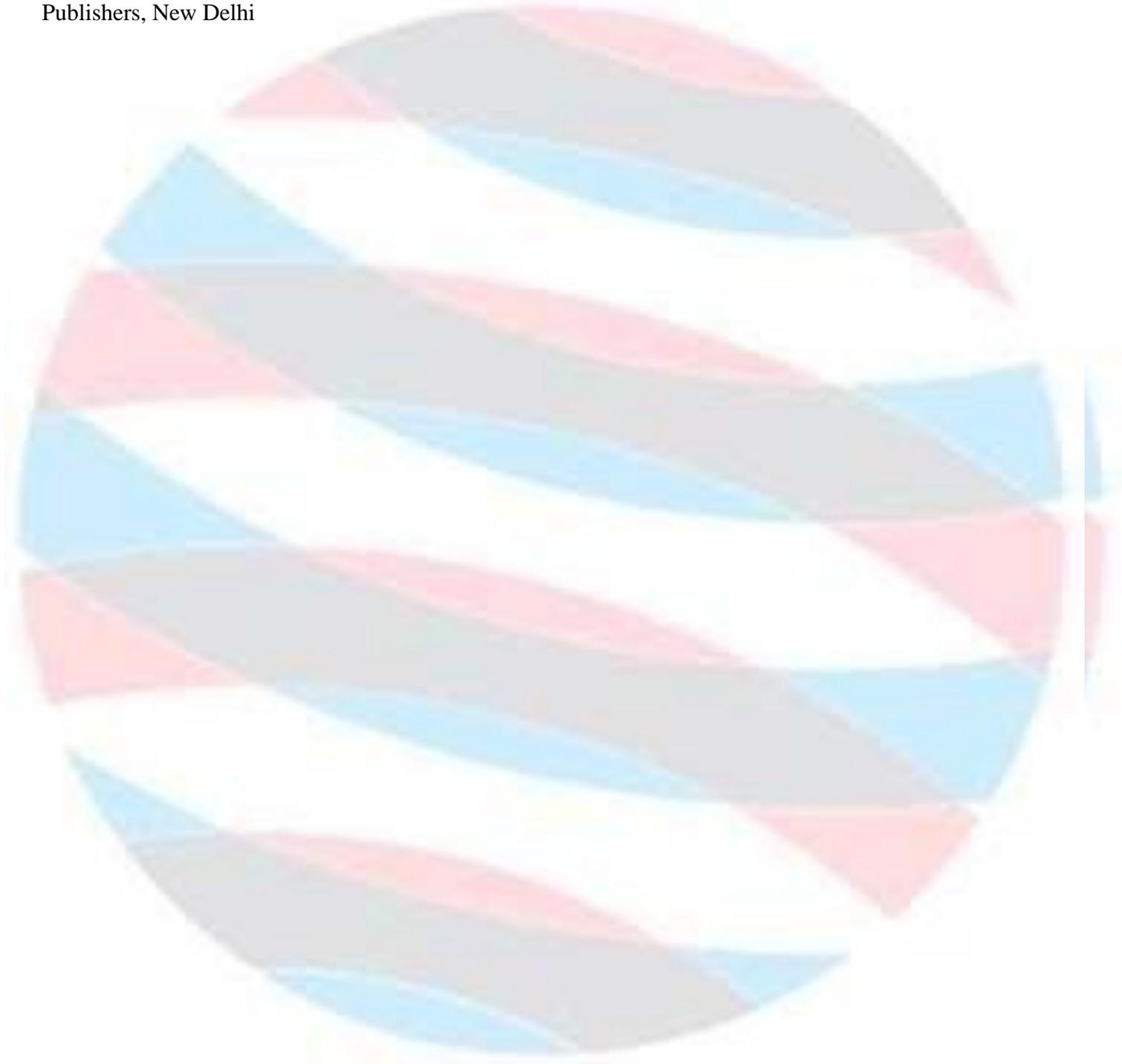
- Understand the structure of biomolecules like proteins, lipids and carbohydrates
- Perform basic hematological laboratory testing,
- Distinguish normal and abnormal hematological laboratory findings to predict the diagnosis of hematological disorders and diseases.

Unit I
<ul style="list-style-type: none"> • Preparation of haemin and haemochromogen crystals • To study different mammalian blood cell types.
Unit II
Study of permanent slides of <ul style="list-style-type: none"> • Mammalian skin, • Cartilage, • Bone, • Spinal cord, • Nerve cell, • Pituitary, • Pancreas, • Testis, • Ovary, • Adrenal, • Thyroid • Parathyroid
Unit III
<ul style="list-style-type: none"> • Ninhydrin test for α-amino acids. • Benedict's test for reducing sugar and iodine test for starch. • Test for sugar in urine. • Action of salivary amylase under optimum conditions.

Suggested Readings:

1. Cox, M.M and Nelson, D.L. (2008). Lehninger's Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.
2. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.

3. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Herculourt Asia PTE Ltd. /W.B. Saunders Company.
4. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons
5. Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
6. Arey, L.B. (1974). Human Histology. IV Edition. W.B. Saunders.
7. Kesar, Saroj and Vashishta N. (2007). Experimental Physiology: Comprehensive Manual. Heritage Publishers, New Delhi



B.Sc. Forensic Science: Semester-II	
FST257: Computer Lab- II	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

Ability to:

- Understand, analyze and apply common SQL statements including DDL, DML and DCL statements to perform different operations.
- Design and implement a database schema for a given problem.
- Do connectivity of PHP and MySQL to develop applications.

Lab Experiment List

- Creation of databases and execution of SQL queries.
- Creation of Tables using MySQL: Data types, Creating Tables (along with Primary and Foreign keys), Altering Tables and Dropping Tables.
- Practicing DML commands- Insert, Select, Update, Delete.
- Practicing Queries using ANY, ALL, IN, EXISTS, NOT, EXISTS, UNION, INTERSECT, and CONSTRAINTS, etc.
- Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation and Dropping.
- Use of COMMIT, ROLLBACK and SAVEPOINT.
- Practicing on Triggers - creation of trigger, Insertion using trigger, Deletion using trigger, Updating using trigger.
- To remove the redundancies and anomalies in the above relational tables, Normalize up to Third Normal Form.

Suggested Readings:

1. Paul DuBois, "MySQL Cookbook: Solutions for Database Developers and Administrators," Third Edition, O'Reilly Media, 2014.
2. Frank M. Kromann, "Beginning PHP and MySQL: From Novice to Professional," Fifth Edition, Apress, 2018.
3. Joel Murach and Ray Harris, "Murach's PHP and MySQL," First Edition, Mike Murach & Associates, 2010.
4. Luke Welling, Laura Thomson, "PHP and MySQL Web Development," Fourth Edition, Addison-Wesley, 2008.

B.Sc. Forensic Science: Semester-II FST258: Botany Lab- II	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

- The students will be made aware of the group of plants that have given rise to land habit and the flowering plants. Through field study they will be able to see these plants grow in nature and become familiar with the biodiversity.
- Understand morphology, anatomy, reproduction and developmental changes therein through typological study and create a knowledge base in understanding plant diversity, economic values & taxonomy of lower group of plants
- Understand the composition, modifications, internal structure & architecture of flowering plants for becoming a Botanist.

Unit I

- Structure of anther, microsporogenesis and pollen grains
- Structure of ovule and embryo sac development (through slides).
- Study of embryo development in monocots and dicots.
- Vegetative propagation by means of cutting, budding and grafting exercises.
- Study of seed germination.
- Study of pollen morphology of the following plants –Hibiscus, Vinca, Balsam, Ixora,
- Crotalaria, Bougainvillea by microscopic observation.
- Calculation of pollen viability percentage using in vitro pollen germination techniques

Unit II

- Study of primary and secondary growth in root and stem of monocots and dicots by section cutting and permanent slides.
- Study of internal structure of dicot and monocot leaves.
- Study of structure of stomata.

Suggested Readings:

1. Pandey, BP and Trivedi, P.S. 1997. Botany Vol. I(10th edition). Vikas Publishing House.
2. Pandey, BP; Misra; Trivedi, P.S. 1997. Botany Vol. II. Vikas Publishing House.
3. Pandey, BP and Chadha. 1997. Botany Vol. III. Vikas Publishing House.
4. Santra, SC and Chatterjee. 2005. College Botany Practical Vol. I. New Central Book Agency (P) Ltd.
5. Kumar, S and Kashyap. 2003. Manual of Practical Algae. Campus Books International, New Delhi
6. Bendre and Kumar A text book of Practical Botany. Vol I,II., Rastogi Pub. Meerut.

YEAR II, SEMESTER III

COURSE CODE	COURSE TITLE	COURSE CATEGORY	HOURS			EVALUATION SCHEME		SUBJECT TOTAL	CREDIT
			L	T	P	CA	EE		
FST301	Tools & Techniques in Forensic Science	CORE	3	1	0	30	70	100	4
FST302	Criminalistics	CORE	3	1	0	30	70	100	4
FST303	Chemistry-III	CORE	3	1	0	30	70	100	4
FST304	Physics-III	GE	3	1	0	30	70	100	4
FST305	Zoology-III								
FST306	Computer Science-III	GE	3	1	0	30	70	100	4
FST307	Botany-III								
FST351	Instrumentation Lab	PRACTICAL	0	0	4	15	35	50	2
FST352	Crime Scene Management	PRACTICAL	0	0	4	15	35	50	2
FST353	Chemistry Lab-III	PRACTICAL	0	0	4	15	35	50	2
FST354	Physics Lab-III	PRACTICAL	0	0	4	15	35	50	2
FST355	Zoology Lab-III								
FST356	Computer Lab-III	PRACTICAL	0	0	4	15	35	50	2
FST357	Botany Lab-III								
Total			15	5	20	225	525	750	30

L - Lecture, T - Tutorial, P - Practical, GE- Generic Elective; AECC-Ability Enhancement Compulsory Course; DSE- Discipline Specific Elective; AECC- Ability Enhancement Elective Course (Skill Based Course)

COURSE CODE	COURSE TITLE	COURSE CATEGORY	HOURS			EVALUATION SCHEME		SUBJECT TOTAL	CREDIT
			L	T	P	CA	EE		
FST401	Forensic Ballistics	CORE	3	1	0	30	70	100	4
FST402	Forensic Biology and Serology	CORE	3	1	0	30	70	100	4
FST403	Chemistry- IV	CORE	3	1	0	30	70	100	4
FST404	Physics- IV	GE	3	1	0	30	70	100	4
FST405	Zoology- IV								
FST406	Computer Science- IV	GE	3	1	0	30	70	100	4
FST407	Botany- IV								
FST451	Examination of Firearms and GSR	PRACTICAL	0	0	4	15	35	50	2
FST452	Examination of Biological Evidences	PRACTICAL	0	0	4	15	35	50	2
FST453	Chemistry Lab-IV	PRACTICAL	0	0	4	15	35	50	2
FST454	Physics Lab- IV	PRACTICAL	0	0	4	15	35	50	2
FST455	Zoology Lab- IV								
FST456	Computer Lab-IV	PRACTICAL	0	0	4	15	35	50	2
FST457	Botany Lab- IV								
Total			15	5	20	225	525	750	30
L - Lecture, T - Tutorial, P - Practical, GE- Generic Elective; AECC-Ability Enhancement Compulsory Course; DSE- Discipline Specific Elective; AEEC- Ability Enhancement Elective Course (Skill Based Course)									

B.Sc. Forensic Science: Semester-III	
FST301: Tools & Techniques in Forensic Science	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

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

- a. The importance of chromatographic and spectroscopic techniques in processing crime scene evidence.
- b. The utility of electrophoresis and Centrifugation in analysis of chemical and biological materials.
- c. The significance of microscopy in visualizing trace evidence and comparing it with control samples.
- d. The usefulness of photography and videography for recording the crime scenes.

Unit 1: Chromatography
Fundamental principles, instrumentation and forensic application of Paper Chromatography, TLC, GC and LC.
Unit 2: Spectroscopy
Fundamental principles, instrumentation and forensic applications of Ultraviolet- Visible spectroscopy, Infrared spectroscopy, Atomic Absorption spectroscopy, Atomic Emission spectroscopy and Mass spectroscopy. X-ray spectrometry. Raman spectroscopy.
Unit 3: Microscopy
Fundamental principles, Instrumentation and forensic application of different types of microscopes – Optical and Electron microscopes.
Unit 4: Electrophoresis and Centrifugation
Fundamental principles, Instrumentation and forensic applications of Electrophoresis. Fundamental principles, Instrumentation and forensic applications of Centrifuge.
Unit 5: Photography
Basic principles and applications of photography in forensic science. 3D photography. Infrared and ultraviolet photography. Digital photography. Videography. Crime scene photography. Functioning of DSLR

Suggested Readings :

1. D.A. Skoog, D.M. West and F.J. Holler, *Fundamentals of Analytical Chemistry*, 6th Edition, Saunders College Publishing, Fort Worth (1992).
2. W. Kemp, *Organic Spectroscopy*, 3rd Edition, Macmillan, Hampshire (1991).
3. J.W. Robinson, *Undergraduate Instrumental Analysis*, 5th Edition, Marcel Dekker, Inc., New York (1995).
4. D.R. Redsicker, *The Practical Methodology of Forensic Photography*, 2nd Edition, CRC Press, Boca Raton (2000).

B.Sc. Forensic Science: Semester-III	
FST302: Criminalistics	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

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

- a. The methods of securing, searching and documenting crime scenes.
- b. The art of collecting, packaging and preserving different types of physical and trace evidence at crime scenes.
- c. The legal importance of chain of custody.
- d. The tools and techniques for analysis of different types of crime scene evidence

Unit 1: Crime Scene Management

Types of crime scenes – indoor and outdoor, primary and secondary. Securing and isolating the crime scene. Crime scene search methods. Legal considerations at crime scenes. Documentation of crime scenes – photography, videography, sketching and recording notes.

Unit 2: Crime Scene Evidence

Classification of crime scene evidence – physical, biological and trace evidence. Locard's principle. Collection, labeling, sealing of evidence. Hazardous evidence. Preservation of evidence.

Unit 3: Investigation

Duties of first responding officer at crime scenes. Coordination between police personnel and forensic scientists at crime scenes. The evaluation of 5Ws (who?, what?, when?, where?, why?) and 1H (how?). Chain of custody. Reconstruction of crime scene.

Unit 4: Forensic Physics

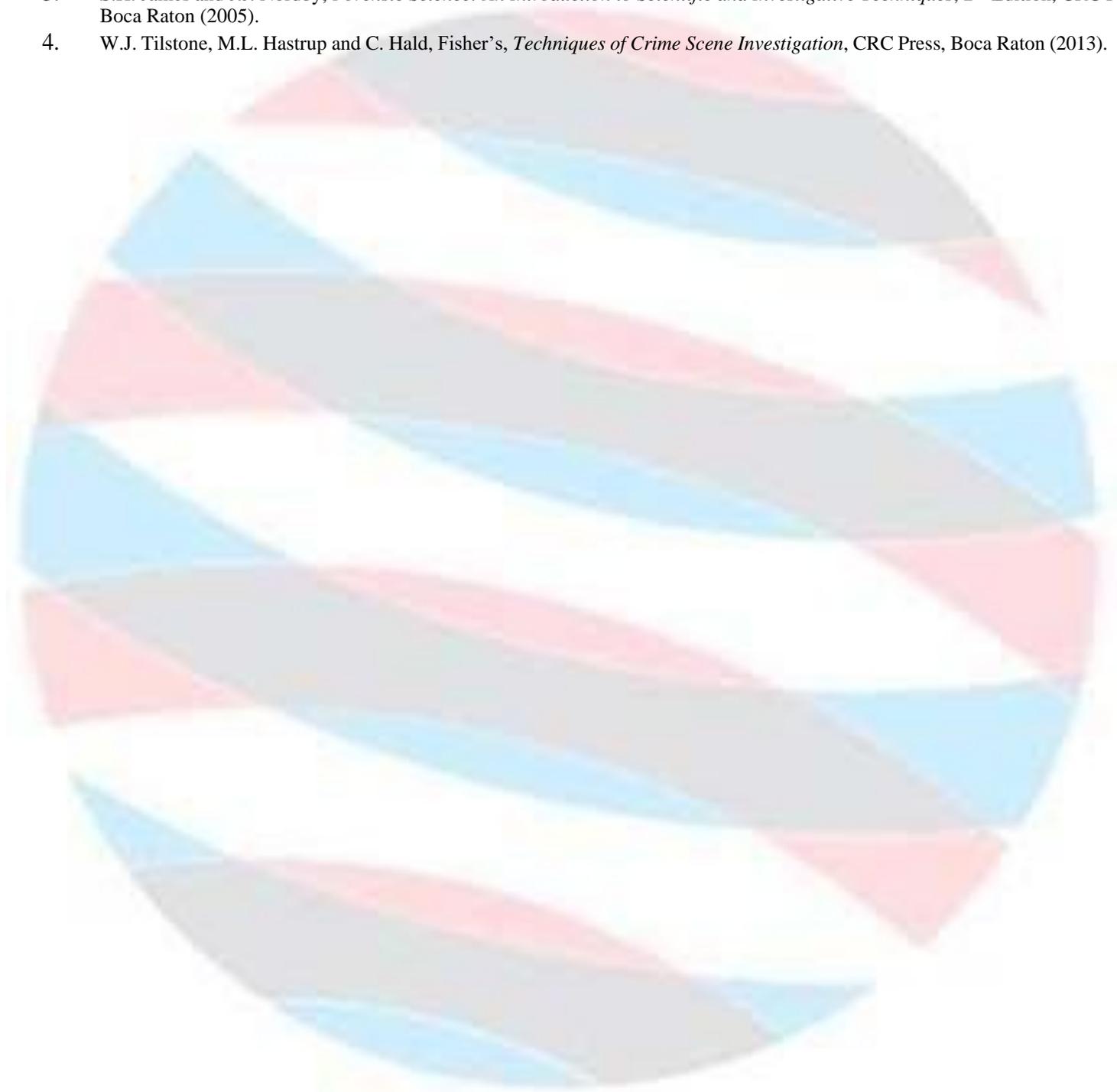
Glass evidence – collection, packaging, analysis. Matching of glass samples by mechanical fit and refractive index measurements. Analysis by spectroscopic methods. Fracture analysis and direction of impact. Paint evidence – collection, packaging and preservation. Analysis by destructive and non-destructive methods. Importance of paint evidence in hit and run cases. Fiber evidence – artificial and natural fibers. Collection of fiber evidence. Identification and comparison of fibers. Soil evidence – importance, location, collection and comparison of soil samples. Cloth evidence – importance, collection, analysis of adhering material. Matching of pieces.

Unit 5: Tool marks

Classification of tool marks. Forensic importance of tool marks. Collection, preservation and matching of tool marks. Restoration of erased serial numbers and engraved marks.

Suggested Readings:

1. M. Byrd, *Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence*, CRC Press, Boca Raton (2001).
2. T.J. Gardener and T.M. Anderson, *Criminal Evidence*, 4th Ed., Wadsworth, Belmont (2001).
3. S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2nd Edition, CRC Press, Boca Raton (2005).
4. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, *Techniques of Crime Scene Investigation*, CRC Press, Boca Raton (2013).



B.Sc. Forensic Science: Semester-III	
FST303: Chemistry-III	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course Objective

- a. On the completion of this course the students will be able to understand the basic concepts of organic chemistry
- b. The student will be able to describe and understand the Atomic orbitals and their properties, hybridization.
- c. Students will gain knowledge about the hydrocarbons

Unit 1: Concepts

Atomic orbitals, hybridization, orbital representation of methane, ethane, ethyne and benzene. Polarity of bonds: Inductive, resonance and steric effects hyper conjugation, and their influence on acidity and basicity of organic compounds.

Unit 2: Hydrocarbons

Alkanes: Chlorination of methane, Alkenes: Addition reactions (Electrophilic and Free radical), Hydration, hydroxylation, hydroboration, epoxidation and ozonolysis. Alkynes: Reduction, Electrophilic addition, acidity and metal acetylides. Conjugated and isolated Dienes: 1,2- versus 1,4-addition. Diels - Alder reaction.

Unit 3: Alkyl Halides

Nucleophilic substitution: SN1, SN2 mechanisms; Eliminations reactions: E1 and E2 mechanisms, Elimination versus substitution reactions; energy profile diagrams-transition states (general considerations). Grignard reagents: Preparation and synthetic applications.

Unit 4: Alcohols

Comparative study of substitution, dehydration, oxidation, and esterification of primary, secondary and tertiary alcohols

Unit 5: Stereochemistry

Fischer, Saw-horse and Newman projection formulae, Chirality-optical activity, enantiomers and diastereoisomerism involving one and two chiral centres. Configuration; D/L, erythrose, threose and R/S nomenclatures. Geometrical isomerism and E/Z nomenclatures. Conformations of n-butane.

Suggested Readings

1. Organic Chemistry, Paula Y. Bruice, 2nd Edition, Prentice-Hall, International Edition (1998).
2. Organic Chemistry, I. L. Finar, Vol. I, 6th Edition (1973), ELBS and Longman Ltd., New Delhi.
3. Organic Chemistry, R. T. Morrison and R. N. Boyd, 6th Edition (1992), Prentice-Hall of India (P) Ltd., New Delhi.
4. Organic Chemistry, Paula Y. Bruice, 2nd Edition, Prentice-Hall, International Edition (1998).
5. Organic Chemistry, I. L. Finar, Vol. I, 6th Edition (1973), ELBS and Longman Ltd., New Delhi.
6. Organic Chemistry, R. T. Morrison and R. N. Boyd, 6th Edition (1992), Prentice-Hall of India (P) Ltd., New Delhi.
7. Organic Chemistry, J. Clayden, N. Greeves, S. Warren, and E. Wothers, , Oxford Univ. Press, Oxford (2001).

B.Sc. Forensic Science: Semester-III	
FST304: Physics-III	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

- Better understanding of electrical and magnetic phenomenon in daily life.
- To troubleshoot simple problems related to electrical devices.
- Comprehend the powerful applications of ballistic galvanometer.
- Study the fundamental physics behind reflection and refraction of light (electromagnetic waves).
- Study the working and applications of Michelson and Fabry-Perot interferometers.
- Recognize the difference between Fresnel's and Fraunhofer's class of diffraction.
- Comprehend the use of polarimeters.
- Study the characteristics and uses of lasers.

Unit I – Electrostatics
<ul style="list-style-type: none"> • Electric charge & charge densities, electric force between two charges. General expression for Electric field in terms of volume charge density (divergence & curl of Electric field), general expression for Electric potential in terms of volume charge density and Gauss law (applications included). Study of electric dipole. Electric fields in matter, polarization, auxiliary field D (Electric displacement), electric susceptibility and permittivity.
Unit II – Magnetostatics
<ul style="list-style-type: none"> • Electric current & current densities, magnetic force between two current elements. General expression for Magnetic field in terms of volume current density (divergence and curl of Magnetic field), General expression for Magnetic potential in terms of volume current density and Ampere's circuital law (applications included). Study of magnetic dipole (Gilbert & Ampere model). Magnetic fields in matter, magnetization, auxiliary field H, magnetic susceptibility and permeability.
Unit III – Time Varying Electromagnetic Fields
<ul style="list-style-type: none"> • Faraday's laws of electromagnetic induction and Lenz's law. Displacement current, equation of continuity and Maxwell-Ampere's circuital law. Self and mutual induction (applications included). Derivation and physical significance of Maxwell's equations. Theory and working of moving coil ballistic galvanometer (applications included).
Unit IV – Electromagnetic Waves
<ul style="list-style-type: none"> • Electromagnetic energy density and Poynting vector. Plane electromagnetic waves in linear infinite dielectrics, homogeneous & inhomogeneous plane waves and dispersive & non-dispersive media. Reflection and refraction of homogeneous plane electromagnetic waves, law of reflection, Snell's law, Fresnel's formulae (only for normal incidence & optical frequencies) and Stoke's law.

Unit V – Interference

- Conditions for interference and spatial & temporal coherence. Division of Wavefront - Fresnel's Biprism and Lloyd's Mirror. Division of Amplitude - Parallel thin film, wedge shaped film and Newton's Ring experiment. Interferometer - Michelson and Fabry-Perot.

Suggested Readings:

1. D.J. Griffiths, –Introduction to Electrodynamics, Prentice-Hall of India Private Limited, 2002, 3e
2. E.M. Purcell, –Electricity and Magnetism (In SI Units): Berkeley Physics Course Vol 2, McGraw Hill, 2017, 2e
3. Richard P. Feynman, Robert B. Leighton, Matthew Sands, –The Feynman Lectures on Physics - Vol. 2, Pearson Education Limited, 2012
4. D.C. Tayal, —Electricity and Magnetism, Himalaya Publishing House Pvt. Ltd., 2019, 4e
5. Francis A. Jenkins, Harvey E. White, –Fundamentals of Optics, McGraw Hill, 2017, 4e
6. Samuel Tolansky, —An Introduction to Interferometry, John Wiley & Sons Inc., 1973, 2e
7. A. Ghatak, –Optics, McGraw Hill, 2017, 6e

B.Sc. Forensic Science: Semester-III	
FST305: Zoology-III	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

The student at the completion of the course will be able to have:

- A detailed and conceptual understanding of molecular processes viz. DNA to trait.
- A clear understanding of the processes of central dogma viz. transcription, translation etc. underlying survival and propagation of life at molecular level.
- Understanding of how genes are ultimately expressed as proteins which are responsible for the structure and function of all organisms.
- Learn how four sequences (3 letter codons) generate the transcripts of life and determine the phenotypes of organisms.

Unit I – Process of Transcription and Translation

- Fine structure of gene
- RNA polymerases
- Transcription factors and machinery
- Formation of initiation complex
- Initiation, elongation and termination of transcription in prokaryotes and eukaryotes
- The Genetic code
- Ribosome
- Factors involved in translation
- Aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase
- Initiation, elongation and termination of translation in prokaryotes and eukaryotes

Unit II – Principle and Types of Microscopes

- Principle of Microscopy and Applications
- Types of Microscopes: light microscopy, dark field microscopy, phase-contrast microscopy, Fluorescence microscopy, confocal microscopy, electron microscopy

Unit III – Centrifugation and Chromatography

- Principle of Centrifugation
- Types of Centrifuges: high speed and ultracentrifuge
- Types of rotors: Vertical, Swing-out, Fixed-angle etc.
- Principle and Types of Chromatography: paper, ion exchange, gel filtration, HPLC, affinity

Unit IV – Spectrophotometry and Biochemical Techniques

- Biochemical techniques: Measurement of pH, Preparation of buffers and solutions
- Principle of Colorimetry/Spectrophotometry: Beer-Lambert law
- Measurement, applications and safety measures of radio-tracer techniques

Unit V – Molecular Techniques

- Detection of nucleic acid by gel electrophoresis
- DNA sequencing DNA fingerprinting, RFLP
- Polymerase Chain Reaction (PCR)
- Detection of proteins, PAGE, ELISA, Western blotting

Suggested Readings:

1. Lodish et al: Molecular Cell Biology: Freeman & Co, USA (2004).
2. Alberts et al: Molecular Biology of the Cell: Garland (2002).
3. Cooper: Cell: A Molecular Approach: ASM Press (2000).
4. Karp: Cell and Molecular Biology: Wiley (2002).
5. Watson et al. Molecular Biology of the Gene. Pearson (2004).
6. Lewin. Genes VIII. Pearson (2004).
7. Pierce B. Genetics. Freeman (2004).
8. Sambrook et al .Molecular Cloning Vols I, II, III. CSHL (2001).
9. Primrose. Molecular Biotechnology. Panima (2001).
10. Clark & Switzer. Experimental Biochemistry. Freeman (2000)

B.Sc. Forensic Science: Semester-III	
FST306: Computer Science-III	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test – 12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
	Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Course outcomes:

- After the completion of the course the students will be able:
- Understand role, responsibilities, features, and design of operating system.
- Analyze memory management schemes and process scheduling algorithms.
- Apply process synchronization techniques to formulate solution for critical section problems.
- Illustrate concept of disk scheduling.
- Evaluate process deadlock handling techniques.

<p>Unit I – Introduction to Operating System</p> <ul style="list-style-type: none"> • Operating system and functions, Classification of Operating systems: Batch, Interactive, Time-sharing, Real-Time System, Multiprocessor Systems, Multiuser Systems, Multithreaded Systems, Operating System Structure, System Components, Operating System Services, Kernels, Monolithic and Microkernel Systems.
<p>Unit II – Process Management</p> <ul style="list-style-type: none"> • Process Concept, Process States, Process Synchronization, Critical Section, Mutual Exclusion, Classical Synchronization Problems, Process Scheduling, Process States, Process Transitions, Scheduling Algorithms Interprocess Communication, Threads and their management, Security Issues.
<p>Unit III – CPU Scheduling</p> <ul style="list-style-type: none"> • Scheduling Concepts, Techniques of Scheduling, Preemptive and Non- Preemptive Scheduling: First-Come-First-Serve, Shortest Request Next, Highest Response Ration Next, Round Robin, Least Complete Next, Shortest Time to Go, Long, Medium, Short Scheduling, Priority Scheduling. Deadlock: System model, Deadlock characterization, Prevention, Avoidance and detection, Recovery from deadlock.
<p>Unit IV – The Internet</p> <ul style="list-style-type: none"> • Introduction to cyber-crimes and their classifications, Spamming, Web Jacking, Phishing, Spoofing, • Types of Virus and Worms • Cyber Criminals and their Targets • Tools for Cyber Forensic Analysis
<p>Unit V – Memory Management</p> <ul style="list-style-type: none"> • Memory allocation, Relocation, Protection, Sharing, Paging, Segmentation, Virtual Memory, Demand Paging, Page Replacement Algorithms, Thrashing. <p>I/O Management and Disk Scheduling</p> <ul style="list-style-type: none"> • I/O devices, and I/O subsystems, I/O buffering, Disk storage and disk scheduling, RAID.

Suggested Readings:

1. Andrew S. Tanenbaum and Herbert Bos, "Modern Operating Systems," Fourth Edition, Pearson, 2014.
2. Abraham Silberschatz, Greg Gagne, and Peter B. Galvin, "Operating System Concepts," Tenth Edition, Wiley, 2018.
3. William Stallings, "Operating Systems: Internals and Design Principles," Seventh Edition, Prentice Hall, 2011.
4. Dhanjay Dhamdhare, "Operating Systems," First Edition, McGraw-Hill, 2008
5. Milan Milankovic "Operating systems, Concepts and Design" McGraw Hill

B.Sc. Forensic Science: Semester-III	
FST307: Botany-III	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

After the completion of the course the students will be able to:

- To gain an understanding of the history and concepts underlying various approaches to plant taxonomy and classification.
- To learn the major patterns of diversity among plants, and the characters and types of data used to classify plants.
- To compare the different approaches to classification with regard to the analysis of data.
- To become familiar with major taxa and their identifying characteristics, and to develop in depth knowledge of the current taxonomy of a major plant family.
- To discover and use diverse taxonomic resources, reference materials, herbarium collections, publications.
- For the entrepreneur career in plants, one can establish a nursery, Start a landscaping business, Set up a farm Or Run a plantation consultancy firm

Unit I – Flowering Plants Identification & Aesthetic Characteristics

- Taxonomic Resources & Nomenclature
- Components of taxonomy (identification, nomenclature, classification); Taxonomic resources: Herbarium- functions& important herbaria, Botanical gardens, Flora, Keys- single access and multi-access. Botanical Nomenclature- Principles and rules of ICN (ranks and names; principle of priority, binomial system; type method, author citation, valid-publication).

Unit II – Types of classification & Evidences

- Artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series) angiosperm phylogeny group (APG III) classification.
- Taxonomic evidences from palynology, cytology , phytochemistry &Molecular biology data (Protein and Nucleic acid homology).

Unit III – Identification of Angiospermic families –I

- A study of the following families with emphasis on the morphological peculiarities and economic importance of its members (based on Bentham & Hooker’s system) -- Ranunculaceae, Malvaceae , Rutaceae , Fabaceae, Myrtaceae , Cucurbitaceae , Rubiaceae Asteraceae , Apocynaceae , Acanthaceae, Asclepiadiaceae, Solanaceae

Unit IV – Identification of Angiospermic families -II

- A study of the following families with emphasis on the morphological peculiarities and economic importance of its members (based on Bentham & Hooker’s system)- Amaranthaceae, Euphorbiaceae, Papaveraceae, Scrophulariaceae , Orchidaceae, Liliaceae Arecaceae, Poaceae

Unit V – Modern trends in Plant taxonomy

- Phenetics and Cladistics: Brief idea on Phenetics, Numerical taxonomy- methods, Operational Taxonomic Units, Cladistics- construction of dendrogram and primary analysis; Monophyletic, polyphyletic and paraphyletic groups; Plesiomorphy and apomorphy.

Suggested Readings:

1. Singh, G. 1999. Plant Systematics: Theory and Practice. Oxford and IBH, New Delhi.
2. Dutta A.C. 2016. Botany for Degree Students. Oxford University Press.
3. Davis, P. H. and V. H. Heywood. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London.
4. Heywood, V. H. and D. M. Moore (Eds). 1984. Current Concepts in Plant Taxonomy. Academic Press, London.
5. Austin, R. 2002. Elements of planting design. New York: John Wiley & Sons.
6. Bertauski, T. 2005. Designing the landscape: An introductory guide for the landscape designer. Upper Saddle River, NJ: Pearson Prentice Hall.
7. Thomas, H., and S. Wooster. 2008. The complete planting design course: Plans and styles for every garden. London: Octopus Publishing Group.
8. Scarfone, S. 2007. Professional planting design: An architectural and horticultural approach for creating mixed bed plantings. New York: John Wiley & Sons.
9. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

B.Sc. Forensic Science: Semester-III FST351: Instrumentation Lab	
Teaching Scheme	Examination Scheme
Practicals: 4 hr/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

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

- a. The importance of chromatographic and spectroscopic techniques in processing crime scene evidence.
- b. The utility of electrophoresis and Centrifugation in analysis of chemical and biological materials.
- c. The significance of microscopy in visualizing trace evidence and comparing it with control samples.
- d. The usefulness of photography and videography for recording the crime scenes.

Experiment Details

1. To determine the concentration of a colored compound by colorimetry analysis.
2. To carry out thin layer chromatography of ink samples.
3. To carry out separation of organic compounds by paper chromatography.
4. To identify drug samples using UV-Visible spectroscopy.
5. To take photographs using different filters.
6. To take photographs of crime scene exhibits at different angles.
7. To record videography of a crime scene

Suggested Readings

1. D.A. Skoog, D.M. West and F.J. Holler, Fundamentals of Analytical Chemistry, 6th Edition, Saunders College Publishing, Fort Worth (1992).
2. W. Kemp, Organic Spectroscopy, 3rd Edition, Macmillan, Hampshire (1991).
3. J.W. Robinson, Undergraduate Instrumental Analysis, 5th Edition, Marcel Dekker, Inc., New York (1995).
4. D.R. Redsicker, The Practical Methodology of Forensic Photography, 2nd Edition, CRC Press, Boca Raton (2000).

B.Sc. Forensic Science: Semester-III FST352: Crime Scene Management	
Teaching Scheme	Examination Scheme
Practical: 4 hr/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

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

- a. The methods of securing, searching and documenting crime scenes.
- b. The art of collecting, packaging and preserving different types of physical and trace evidence at crime scenes.
- c. The legal importance of chain of custody.
- d. The tools and techniques for analysis of different types of crime scene evidence.

Experiment Details

1. To investigate an indoor crime scene.
2. To investigate an outdoor crime scene.
3. To prepare a report on evaluation of crime scene.
4. To reconstruct a crime scene (outdoor and indoor).
5. To compare soil samples by density gradient method.
6. To compare paint samples by physical matching method.
7. To compare paint samples by thin layer chromatography method.
8. To compare glass samples by refractive index method.
9. To identify and compare tool marks.
10. To compare cloth samples by physical matching.

Suggested Readings

1. M. Byrd, Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence, CRC Press, Boca Raton (2001).
2. T.J. Gardener and T.M. Anderson, Criminal Evidence, 4th Ed., Wadsworth, Belmont (2001).
3. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
4. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).
5. M.S. Rao, Crime Scene Management, SSP, New Delhi

B.Sc. Forensic Science: Semester-III FST353: Chemistry Lab - III	
Teaching Scheme	Examination Scheme
Practicals: 4 hr/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

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

- a. The methods of detection of elements in exhibits
- b. How to detect different functional groups
- c. The process of identification of organic compounds

Experiment Details

1. Detection of elements (X, N, S)
2. Detection of functional groups: PhOH, -COOH, C=O, -CHO, Ar-NH₂, Ar-NO₂, -CONH₂
3. Identification of simple organic compounds.
4. Systematic identification of organic compounds (monofunctional and bi-functional) and preparation of their derivatives

Suggested Readings

1. Organic Chemistry, Paula Y. Bruice, 2nd Edition, Prentice-Hall, International Edition (1998).
2. Organic Chemistry, I. L. Finar, Vol. I, 6th Edition (1973), ELBS and Longman Ltd., New Delhi.
3. Organic Chemistry, R. T. Morrison and R. N. Boyd, 6th Edition (1992), Prentice-Hall of India (P) Ltd., New Delhi.
4. Organic Chemistry, Paula Y. Bruice, 2nd Edition, Prentice-Hall, International Edition (1998).
5. Organic Chemistry, I. L. Finar, Vol. I, 6th Edition (1973), ELBS and Longman Ltd., New Delhi.
6. Organic Chemistry, R. T. Morrison and R. N. Boyd, 6th Edition (1992), Prentice-Hall of India (P) Ltd., New Delhi.
7. Organic Chemistry, J. Clayden, N. Greeves, S. Warren, and E. Wothers, , Oxford Univ. Press, Oxford (2001).

B.Sc. Forensic Science: Semester-III	
FST354: Physics Lab - III	
Teaching Scheme	Examination Scheme
Practicals: 4 hr/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

- Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the electric and magnetic properties. Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.

Lab Experiment List

- Variation of magnetic field along the axis of single coil
- Variation of magnetic field along the axis of Helmholtz coil
- Ballistic Galvanometer: Ballistic constant, current sensitivity and voltage sensitivity
- Ballistic Galvanometer: High resistance by Leakage method
- Ballistic Galvanometer: Low resistance by Kelvin's double bridge method
- Ballistic Galvanometer: Self-inductance of a coil by Rayleigh's method
- Ballistic Galvanometer: Comparison of capacitances
- Carey Foster Bridge: Resistance per unit length and low resistance
- Deflection and Vibration Magnetometer: Magnetic moment of a magnet and horizontal component of earth's magnetic field
- Earth Inductor: Horizontal component of earth's magnetic field

Suggested Readings:

1. B.L. Worsnop, H.T. Flint, –Advanced Practical Physics for Students, Methuen & Co., Ltd., London, 1962, 9e
2. S. Panigrahi, B. Mallick, –Engineering Practical Physics, Cengage Learning India Pvt. Ltd., 2015, 1e
3. R.K. Agrawal, G. Jain, R. Sharma, –Practical Physics, Krishna Prakashan Media (Pvt.) Ltd., Meerut, 2019
4. S.L. Gupta, V. Kumar, –Practical Physics, Pragati Prakashan, Meerut, 2014, 2e

B.Sc. Forensic Science: Semester-III FST355: Zoology Lab - III	
Teaching Scheme	Examination Scheme
Practicals: 4 hr/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

The student at the completion of the course will be able to:

- Understand the basic principles of microscopy, working of different types of microscopes
- Understand the basic techniques of centrifugation and chromatography for studying cells and separation of biomolecules
- Understand the principle of measuring the concentrations of macromolecules in solutions by colorimeter and spectrophotometer and use them in Biochemistry.
- Learn about some of the commonly used advance DNA testing methods.

Unit I
<ul style="list-style-type: none"> • To study the working principle and Simple, Compound and Binocular microscopes. • To study the working principle of various lab equipment such as pH Meter, Electronic balance, use of glass and micropipettes, Laminar flow, Incubator, Waterbath, Centrifuge, Chromatography apparatus, etc.
Unit II
<ul style="list-style-type: none"> • To prepare solutions and buffers. • To measure absorbance in Colorimeter or Spectrophotometer. • Demonstration of differential centrifugation to fractionate different components in a mixture.
Unit III
<ul style="list-style-type: none"> • To prepare dilutions of Riboflavin and verify the principle of spectrophotometry. • To identify different amino acids in a mixture using paper chromatography. • Demonstration of DNA extraction from blood or tissue samples. • To estimate amount of DNA using spectrophotometer.

Suggested Readings:

1. Sambrook et al .Molecular Cloning Vols I, II, III. CSHL (2001).
2. Primrose. Molecular Biotechnology. Panima (2001).
3. Clark & Switzer. Experimental Biochemistry. Freeman (2000)

B.Sc. Forensic Science: Semester-III	
FST356: Computer Lab - III	
Teaching Scheme	Examination Scheme
Practicals: 4 hr/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

Ability to:

- Use of Linux operating system and able to write shell programs.
- Simulate and demonstrate the concepts of operating systems..

Lab Experiment List

- Usage of following commands: ls, pwd, tty, cat, who, who am I, rm, mkdir, rmdir, touch, cd.
- Usage of following commands: cal, cat(append), cat(concatenate), mv, cp, man, date.
- Usage of following commands: chmod, grep, tput (clear, highlight), bc.
- Write a shell script to check if the number entered at the command line is prime or not.
- Write a shell script to modify -call command to display calendars of the specified months.
- Write a shell script to modify -call command to display calendars of the specified range of months.
- Write a shell script to accept a login name. If not a valid login name display message – –Entered login name is invalid.
- Write a shell script to display date in the mm/dd/yy format.
- Write a shell script to display on the screen sorted output of -wholl command along with the total number of users.
- Write a shell script to display the multiplication table any number,

Suggested Readings:

1. Sumitabh Das, —Your Unix/Linux: The Ultimate Guide,|| McGraw Hill, 2012.
2. Richard Blum and Christine Bresnahan, –Linux Command Line and Shell Scripting Bible,|| Wiley, 2015.
3. Stroustrup, Bjarne, Programming: Principles and Practice Using C++, Addison Wesley, USA, 2014, 2nd ed.
4. E Balagurusamy, Object Oriented Programming with C++, McGraw Hill Education (India) Pvt. Ltd., India, 2013, 6th ed.

B.Sc. Forensic Science: Semester-III FST357: Botany Lab - III	
Teaching Scheme	Examination Scheme
Practicals: 4 hr/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

After the completion of the course the students will be able:

1. To learn how plant specimens are collected, documented, and curated for a permanent record.
2. To observe, record, and employ plant morphological variation and the accompanying descriptive terminology.
3. To gain experience with the various tools and means available to identify plants.
4. To develop observational skills and field experience.
5. To identify a taxonomically diverse array of native plants.
6. To recognize common and major plant families.
7. To Understand aesthetic characters of flowering plants by making-landscapes, gardens, bonsai, miniatures
8. Comprehend the concepts of plant taxonomy and classification of Angiosperms.

Unit I – Taxonomic Identification using plant structure
<ul style="list-style-type: none"> • Classify 25 plants on the basis of Taxonomic description (Plant Morphology, Anatomy, Reproductive parts, Habit, adaptation anomalies) according to Bentham Hooker system of classification in the following families: Malvaceae, Fabaceae (Papilionaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Labiatae (Lamiaceae), Rubiaceae.
Unit II -
<ul style="list-style-type: none"> • Conducting Spot identification (Binomial, Family) of common wild plants from families included in the theoretical syllabus (list to be provided) and making FIELD NOTE BOOK and filling Sample of a page of field-book, used in Botanical Survey of India.
Unit III
<ul style="list-style-type: none"> • Describe/compare flowers in semi-technical language giving V.S. of flowers, T.S. of ovaries, floral diagrams and Floral Formulae. Identify and assign them to their respective families giving reasons.

Suggested Readings:

1. Day, S.C. (2003) Complete Home Gardening. (2003) Agrobias, Jodhpur, India.
2. Dhopte, A.M. (2003) Principles and Techniques for Plant Scientists. - Agrobios, Jodhpur, India.
3. Khan, M.R. (1995) Horticulture and Gardening. - Nirali Prakashan, Pune. India.
4. Pramila Mehra Gardening for every one-. Hind pocket book private limited, New Delhi.
5. Kumarsen V. Horticulture, Saras Publication
6. Ramesh Bangia Learning Computer Fundamentals.,., Khanna Book Publishers
7. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
8. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
9. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

B.Sc. Forensic Science: Semester-IV	
FST401: Forensic Ballistics	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

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

- a. The classification of firearms and their firing mechanisms.
- b. The methods of identifying firearms.
- c. The characteristics of ammunition.
- d. The importance of firearm evidence.
- e. The nature of firearm injuries.
- f. The methods for characterization of gunshot residue.

Unit 1: Introduction to Forensic Ballistics

Definition, Scope, and Significance of Forensic Ballistics.

Gun powder – Definition, History and Development.

Firearms – Definition according to Indian Arms Act. History and Development.

Improvised & country made firearms.

Formation of gunshot residues. Methods of analysis of gunshot residues from shooting hands and targets, with special reference to clothing.

Unit 2: Classification of Small Firearms and Ammunition

Weapon types and their operation. Firing mechanisms of different firearms.

Types of ammunition. Constructional features and characteristics of different types of cartridges and bullets. Primers and priming compounds. Projectiles. Headstamp markings on ammunitions. Different types of marks produced during firing process on cartridge – firing pin marks, breech face marks, chamber marks, extractor and ejector marks.

Unit 3: Internal ballistics

Definition, ignition of propellants, shape and size of propellants, manner of burning, and various factors affecting the internal ballistics: lock time, ignition time, barrel time, erosion, corrosion and gas cutting

Unit 4: External Ballistics

Vacuum trajectory, effect of air resistance on trajectory, base drag, drop, drift, yaw, shape of projectile and stability, trajectory computation, ballistics coefficient and limiting velocity, Measurements of trajectory parameters, introduction to automated system of trajectory computation and automated management of ballistic data.

Unit 5: Terminal Ballistics

Effect of projectile on hitting the target: function of bullet shape, striking velocity, striking angle and nature of target, tumbling of bullets, effect of instability of bullet, effect of intermediate targets, influence of range. Ricochet and its effects. Stopping power. Identification and nature of firearms injuries.

Suggested Readings

1. B R Sharma, *Firearms in Criminal Investigation and Trials*, Universal Law Publishing - An imprint of LexisNexis
2. K Kumar, *Forensic Ballistics in Criminal Justice*, Eastern Book Company, Lucknow
3. B.J. Heard, *Handbook of Firearms and Ballistics*, Wiley and Sons, Chichester (1997).
4. W.F. Rowe, Firearms identification, *Forensic Science Handbook*, Vol. 2, R. Saferstein (Ed.), Prentice Hall, New Jersey (1988).
5. A.J. Schwoeble and D.L. Exline, *Current Methods in Forensic Gunshot Residue Analysis*, CRC Press, Boca Raton (2000).

B.Sc. Forensic Science: Semester-IV	
FST402: Forensic Biology & Serology	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

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

- a. The significance of biological evidence.
- b. The forensic importance of hair evidence.
- c. The importance of biological fluids – blood, urine, semen, saliva, sweat and milk – in crime investigations.
- d. How wildlife forensics aid in conserving natural resources.
- e. How forensic entomology assists in death investigations.

Unit 1: Biological Evidence

Nature and importance of biological evidence. Types of biological evidence. Significance of hair evidence. Transfer, persistence and recovery of hair evidence. Structure of human hair. Comparison of hair samples. Morphology and biochemistry of human hair. Comparison of human and animal hair.

Identification and examination of human body fluids like blood, semen, saliva, urine, etc.

Bloodstain characteristics. Impact bloodstain patterns. Cast-off bloodstain patterns. Projected bloodstain patterns. Contact bloodstain patterns. Blood trails. Bloodstain drying times. Documentation of bloodstain pattern evidence. Crime scene reconstruction with the aid of bloodstain pattern analysis.

Unit 2: Microbial Forensics

Introduction. Types and identification of microbial organisms of forensic significance.

Unit 3: Botanical Evidences

Identification of wood, leaves, pollens and juices as botanical evidence. Diatoms and their forensic significance.

Unit 4: Wildlife Forensics

Introduction and Significance of wildlife forensic. Protected and endangered species of animals and plants. Illegal trading in wildlife items, such as skin, fur, bone, horn, teeth, tusk, claws, flowers and plants. Identification of physical evidence pertaining to wildlife forensics. Identification of pug marks of various animals.

Unit 5: Forensic Entomology

Introduction to forensic entomology. Insects of forensic importance. Collection of entomological evidence during death investigations.

Suggested Readings:

1. L. Stryer, Biochemistry, 3rd Edition, W.H. Freeman and Company, New York (1988).
2. R.K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, Harper's Biochemistry, APPLETON & Lange, Norwalk (1993).
3. S. Chowdhuri, Forensic Biology, BPRD, New Delhi (1971).
4. R. Saferstein, Forensic Science Handbook, Vol. III, Prentice Hall, New Jersey (1993).
5. G.T. Duncan and M.I. Tracey, Serology and DNA typing in, Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).

B.Sc. Forensic Science: Semester-IV	
FST 403: Chemistry- IV	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

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

- a. The methods of analyzing trace amounts of petroleum products in crime scene evidence.
- b. The methods of analyzing contaminants in petroleum products.
- c. The method of searching, collecting, preserving and analyzing arson evidence.
- d. The classification of explosives, including the synthesis and characterization of representative analogs.
- e. The significance of explosion scene management.
- f. The techniques of locating hidden explosives.

Unit 1: Petroleum and Petroleum Products

Distillation and fractionation of petroleum. Commercial uses of different petroleum fractions. Analysis of petroleum products. Analysis of traces of petroleum products in forensic exhibits. Comparison of petroleum products. Adulteration of petroleum products.

Unit 2: Arson

Chemistry of fire. Conditions for fire. Fire scene patterns. Location of point of ignition. Recognition of type of fire. Searching the fire scene. Collection and preservation of arson evidence.

Unit 3: Analysis of Fire Debris

Analysis of ignitable liquid residue. Post-flashover burning. Scientific investigation and evaluation of clue materials. Information from smoke staining.

Unit 4: Explosives

Classification of explosives – low explosives and high explosives. Homemade explosives. Military explosives. Detonators. Synthesis and characteristics of TNT, PETN and RDX. Explosion process. Shock waves.

Unit 5: Explosion Scene Management

Searching the scene of explosion. Mechanism of explosion. Post blast residue collection and analysis. Blast injuries. Detection of hidden explosives.

Suggested Readings

1. J.D. DeHaan, Kirk's Fire Investigation, 3rd Edition, Prentice Hall, New Jersey (1991).
2. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, The Foundation Press, Inc., New York (1995).
3. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
4. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).
5. S. Ballou, M. Houck, J.A. Siegel, C.A. Crouse, J.J. Lentini and S. Palenik in Forensic Science, D.H. Ubelaker (Ed.), Wiley-Blackwell, Chichester (2013).

B.Sc. Forensic Science: Semester-IV	
FST 404: Physics- IV	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

- Recognize the difference between the structure of space & time in Newtonian & Relativistic mechanics.
- Understand the physical significance of consequences of Lorentz transformation equations.
- Comprehend the wave-particle duality.
- Develop an understanding of the foundational aspects of Quantum Mechanics.
- Study the comparison between various biasing techniques.
- Study the classification of amplifiers.
- Comprehend the use of feedback and oscillators.
- Comprehend the theory and working of optical fibers along with its applications.

Unit I – Relativity-Experimental Background

- Structure of space & time in Newtonian mechanics and inertial & non-inertial frames. Galilean transformations. Newtonian relativity. Galilean transformation and Electromagnetism. Attempts to locate the Absolute Frame: Michelson-Morley experiment and significance of the null result. Einstein’s postulates of special theory of relativity.

Unit II – Relativity-Relativistic Kinematics

- Structure of space & time in Relativistic mechanics and derivation of Lorentz transformation equations (4-vector formulation included). Consequences of Lorentz Transformation Equations (derivations & examples included): Transformation of Simultaneity (Relativity of simultaneity); Transformation of Length (Length contraction); Transformation of Time (Time dilation); Transformation of Velocity (Relativistic velocity addition); Transformation of Acceleration; Transformation of Mass (Variation of mass with velocity). Relation between Energy & Mass (Einstein’s mass & energy relation) and Energy & Momentum.

Unit III – Inadequacies of Classical Mechanics

- Particle Properties of Waves: Spectrum of Black Body radiation, Photoelectric effect, Compton effect and their explanations based on Max Planck’s Quantum hypothesis. Wave Properties of Particles: Louis de Broglie’s hypothesis of matter waves and their experimental verification by Davisson-Germer’s experiment and Thomson’s experiment.

Unit IV – Introduction to Quantum Mechanics

- Matter Waves: Mathematical representation, Wavelength, Concept of Wave group, Group (particle) velocity, Phase (wave) velocity and relation between Group & Phase velocities. Wave Function: Functional form, Normalization of wave function, Orthogonal & Orthonormal wave functions and Probabilistic interpretation of wave function based on Born Rule.

Unit V – Transistor Biasing

- Faithful amplification & need for biasing. Stability Factors and its calculation for transistor biasing circuits for CE configuration: Fixed Bias (Base Resistor Method), Emitter Bias (Fixed Bias with

Suggested Readings:

1. A. Beiser, Shobhit Mahajan, –Concepts of Modern Physics: Special Indian Edition, McGraw Hill, 2009, 6e
2. John R. Taylor, Chris D. Zafiratos, Michael A. Dubson, –Modern Physics for Scientists and Engineers, Prentice-Hall of India Private Limited, 2003, 2e
3. R.A. Serway, C.J. Moses, and C.A. Moyer, –Modern Physics, Cengage Learning India Pvt. Ltd, 2004, 3e
4. R. Resnick, –Introduction to Special Relativity, Wiley India Private Limited, 2007
5. R. Murugesan, Kiruthiga Sivaprasath, —Modern Physics, S. Chand Publishing, 2019, 18e
6. R.L. Boylestad, L. Nashelsky, –Electronic Devices and Circuit Theory, Prentice-Hall of India Pvt. Ltd., 2015, 11e
7. J. Millman, C.C. Halkias, Satyabrata Jit, –Electronic Devices and Circuits, McGraw Hill, 2015, 4e
8. B.G. Streetman, S.K. Banerjee, –Solid State Electronic Devices, Pearson Education India, 2015, 7e
9. J.D. Ryder, –Electronic Fundamentals and Applications, Prentice-Hall of India Private Limited, 1975, 5e
10. John M. Senior, –Optical Fiber Communications: Principles and Practice, Pearson Education Limited, 2010, 3e
11. John Wilson, John Hawkes, —Optoelectronics: Principles and Practice, Pearson Education Limited, 2018, 3e
12. S.L. Gupta, V. Kumar, –Hand Book of Electronics, Pragati Prakashan, Meerut, 2016, 43e

B.Sc. Forensic Science: Semester-IV	
FST 405: Zoology- IV	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

The student at the completion of the course will be able to:

- Understand the principles of genetic engineering, how genes can be cloned in bacteria and the various technologies involved in it.
- Know the applications of biotechnology in various fields like agriculture, industry and human health.
- To have an in depth understanding about Immune System & its mechanisms.
- Get introduced to DNA testing and utility of genetic engineering in forensic sciences.
- Get introduced to computers and use of bioinformatics tools.
- Enable students to get employment in pathology/Hospital.
- Take up research in biological sciences.

Unit I – Principles of Gene Manipulation

- Recombinant DNA Technology
- Selection and identification of recombinant cells
- Restriction Enzymes, DNA modifying enzymes, Cloning Vectors, Ligation
- Gene transfer techniques, Gene therapy

Unit II – Applications of Genetic Engineering

- Single cell proteins
- Biosensors, Biochips
- Crop and livestock improvement, development of transgenics
- Development of DNA drugs and vaccines

Unit III – DNA Diagnostics

- Genetic analysis of human diseases, detection of known and unknown mutations
- Concept of pharmacogenomics and pharmacogenetics

Unit IV – Immune System and its Components

- Historical perspective of Immunology, Innate and Adaptive Immunity, clonal selection, complement system
- Structure and functions of different classes of immunoglobulins, Hypersensitivity
- Humoral immunity and cell mediated immunity
- HLA complex: organization, class I and II HLA molecules

Unit V – Biostatistics

- Calculations of mean, median, mode, variance, standard deviation
- Concepts of coefficient of variation, Skewness, Kurtosis
- Elementary idea of probability and application
- Data summarizing: frequency distribution, graphical presentation—bar, pie diagram, histogram
- Tests of significance: one and two sample tests, t-test and Chisquare test

Suggested Readings:

1. Primrose & Twyman. Principles of Genome Analysis and Genomics. Blackwell (2003)
2. Hartl & Jones. Genetics: principles & Analysis of Genes & Genomes. Jones & Bartlett (1998)
3. Sambrook et al .Molecular Cloning Vols I, II, III. CSHL (2001).
4. Primrose. Molecular Biotechnology. Panima (2001).
5. Clark & Switzer. Experimental Biochemistry. Freeman (2000)
6. Sudbery. Human Molecular Genetics. Prentice-Hall (2002).
7. Wilson. Clinical Genetics-A Short Course, Wiley (2000).
8. Pasternak. An Introduction to Molecular Human Genetics. Fitzgerald (2000).
9. Biostatistical Analysis (Fourth Edition) by Jerrold H. Zarr, Pearson Education Inc., Delhi.
10. Statistical Methods (Eighth Edition) by G. W. Snedecor and W. G. Cochran, Willey Blackwell
11. Biostatistics (Tenth Edition) by W.W. Daniel and C. L. Cross, Wiley
12. Introductory Biological Statistics (Fourth Edition) by John E. Havel, Raymond E. Hampton and Scott J. Meiners
13. Westhead et al Bioinformatics: Instant Notes. Viva Books (2003).

B.Sc. Forensic Science: Semester-IV	
FST 406: Computer Science- IV	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

The student will be able to understand

- the basic arithmetic of a Computer System;
- how the data is represented,
- how the various operation are performed on the data, the basic circuits to perform these operations,
- how instructions are formatted and how these instructions are executed to accomplish a particular operation.
- Student can also learn the organization of the peripheral devices, the interface between these devices to the system.
- Student can also understand the architecture of a basic computer, its registers, bus system and the interaction flow among them.

Unit I – Data Representation and basic Computer Arithmetic

- Number systems, complements, fixed and floating point representation, character representation, addition, subtraction, magnitude comparison.
- Logic gates and circuits: logic gates, boolean algebra, combinational circuits, circuit simplification, introduction to flip-flops and sequential circuits, decoders, multiplexers, registers, counters.

Unit II – Basic Computer Organization and Design

- Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input-output and interrupt.
- Central Processing Unit: Register organization, arithmetic and logical micro-operations, stack organization, Hardwired vs. micro programmed control. Pipeline control: Instruction pipelines, pipeline performance, super scalar processing, Pipelining, RISC & CISC

Unit III – Programming the Basic Computer

- Instruction formats, addressing modes, instruction codes, assembly language
- Memory Organization: Memory device characteristics, random access memories, serial access memories, Multilevel memories, address translation, memory allocation, Main features, address mapping, structure versus performance.

Unit IV – Input-output Organization

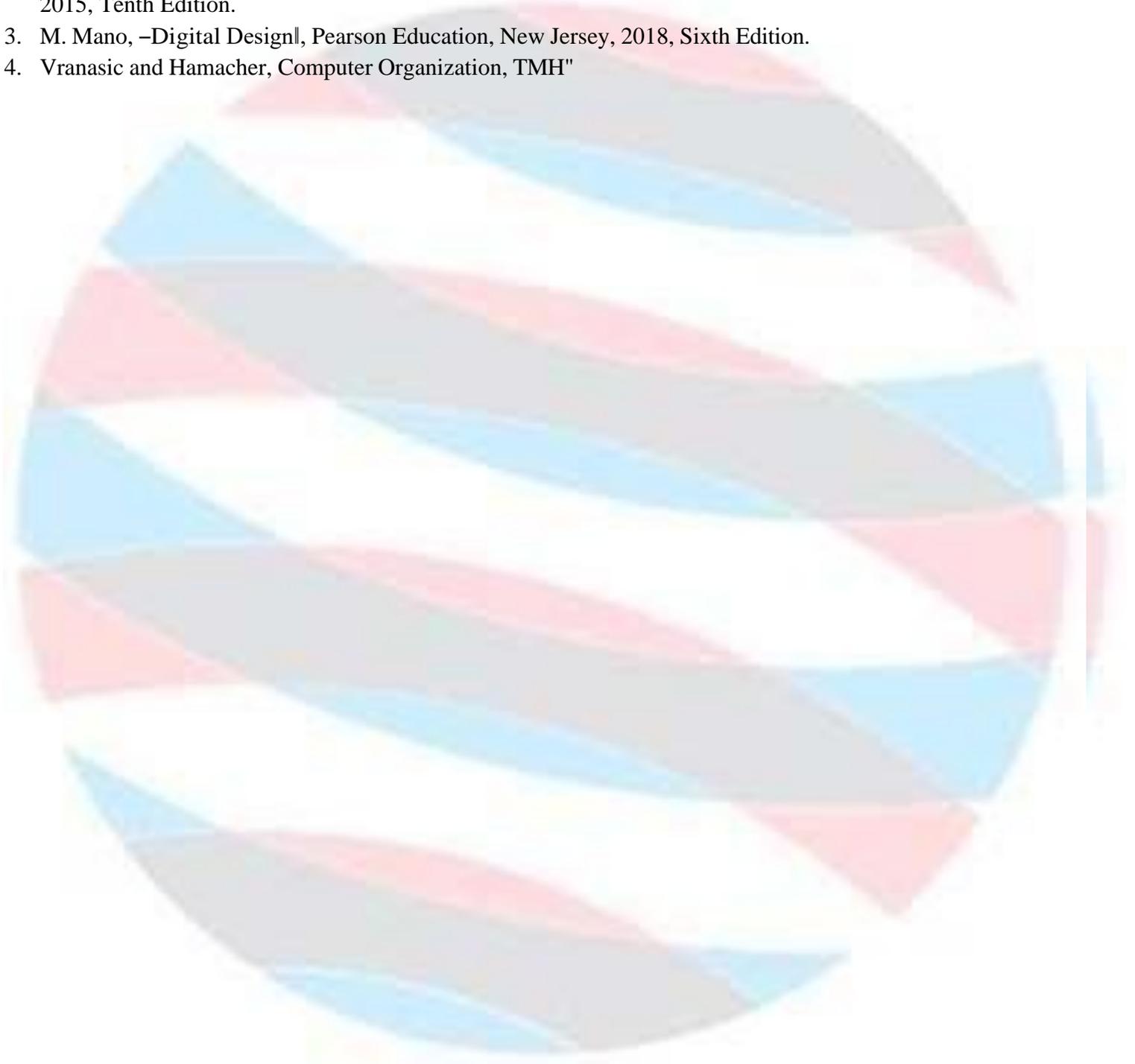
- Peripheral devices, I/O interface, Modes of data transfer: Programmed, Interrupt Driven and Direct Memory Access.

Unit V – Parallel processing

- Processor-level parallelism, multiprocessor architecture

Suggested Readings:

1. M. Mano, –Computer System Architecture, Pearson Education, New Jersey, 2017, Third Edition.
2. W. Stallings, –Computer Organization and Architecture Designing for Performance, Prentice Hall of India, 2015, Tenth Edition.
3. M. Mano, –Digital Design, Pearson Education, New Jersey, 2018, Sixth Edition.
4. Vranasic and Hamacher, Computer Organization, TMH"



B.Sc. Forensic Science: Semester-IV	
FST 407: Botany- IV	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

The student at the completion of the course will be able to:

- Understand the principles of genetic engineering, how genes can be cloned in bacteria and the various technologies involved in it.
- Know the applications of biotechnology in various fields like agriculture, industry and human health.
- To have an in depth understanding about Immune System & its mechanisms.
- Get introduced to DNA testing and utility of genetic engineering in forensic sciences.
- Get introduced to computers and use of bioinformatics tools.
- Enable students to get employment in pathology/Hospital.
- Take up research in biological sciences.

Unit I – Origin and domestication of cultivated plants

- Centers of diversity of plants, origin of crop plants. Domestication and introduction of crop plants. Concepts of sustainable development; cultivation, production and uses of Cereals, legumes, Spices & beverages.
- **Botany of oils, Fibers, timber yielding plants & dyes**
Study of the plants with Botanical names, Family, part used, and economic uses yielding Edible & essential oils; Sugar , Starch; Fibers; Paper, Fumitories & Masticatories, Rubber ,Dyes, Timber, biofuel crops

Unit II – Commercial production of Flowers, Vegetables, and fruits

- Commercial greenhouse cultivation of rose, Gerbera, Gladiolus, Anthurium/lilium/lily, tomato, bell pepper, cucumber, strawberry & Exotic leafy vegetables using Hydroponics.

Unit III – Medicinal aspects

- Study of common plants used by tribes (*Aegle marmelos*, *Ficus religiosa*, *Cynadon dactylon*, *Eclipta alba*, *Oxalis*, *Ocimum sanctum* and *Trichopus zeylanicus*) Ethnobotanical aspect of conservation and management of plant resources, Preservation of primeval forests in the form of sacred groves of individual species and Botanical uses depicted in our epics. Plants in primary health care: common medicinal plants: Tinospora, Acorus, Ocimum, Turmeric and Aloe..Indian Pharmacopeia, Quality Evaluation of crude drugs & adulteration

Unit IV – Pharmacognosy

- Preparation of drugs for commercial market - Organoleptic evaluation of drugs – Microscopic evaluation of drugs - Physical evaluation of drugs - Active and inert constituents of drugs – Classification of drug plants - individual drugs - drug adulteration. Sources of crude drugs – roots, rhizome, bulb, corm, leaves, stems, flowers, fruits and seeds ; organoleptic study of *Adhatoda vasica*, *Andrographis paniculata*, *Azadirachta indica*, *Coriandrum sativum*, *Datura metal*, *Eclipta alba*, *Embllica officinalis*, *Ocimum sanctum*, *Phyllanthus amarus*, *Ricinus communis*, *Vinca rosea* and *Zingiber officinale*.

Unit V – Herbal Preparations & Phytochemistry

- Collection of wild herbs - Capsules - compresses - Elixirs - Glycerites - Hydrotherapy or Herbal bath - Herbal oils - Liquid extracts or Tincture - Poultices - Salves - Slippery elm slurry and gruel - Suppositories - Teas. Plant natural products , general detection, extraction and characterization procedures. Glycosides and Flavonoids and therapeutic applications. Anthocyanins and Coumarins and therapeutic applications, Lignans, Terpenes, Volatile oils and Saponins, Carotenoids and Alkaloids Carotenoids and pharmacological activities.

Suggested Readings:

1. Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.
2. Sambamurthy, AVSS & Subrahmanyam, NS (2000). Economic Botany of Crop Plants. Asiatech Publishers. New Delhi.
3. Singh, D.K and K.V. Peter. 2014. Protected cultivation of horticultural crops. New India Publishing Agency, India.
4. Reddy P. Parvatha. 2016. Sustainable crop protection under protected cultivation. Springer, Singapore.
5. Amit Deogirikar. 2019. A Text Book on Protected Cultivation and Secondary Agriculture. Rajlaxmi Prakashan, Aurangabad, India.
6. Singh, B., B. Singh, N. Sabir and M Hasan. 2014. Advances in protected cultivation. New India Publishing Agency, India.

B.Sc. Forensic Science: Semester-IV FST451: Examination of Firearms and GSR	
Teaching Scheme	Examination Scheme
Lectures: 4 hr/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

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

- a. The classification of firearms and their firing mechanisms.
- b. The methods of identifying firearms.
- c. The characteristics of ammunition.
- d. The importance of firearm evidence.
- e. The nature of firearm injuries.
- f. The methods for characterization of gunshot residue.

Experiment Details

1. To describe, with the aid of diagrams, the firing mechanisms of different types of firearms.
2. To correlate the velocity of bullet with the impact it produces on the target.
3. To correlate the striking angle of the bullet with the impact on the target.
4. To estimate the range of fired bullets.
5. To carry out the comparison of fired bullets.
6. To carry out the comparison of fired cartridge cases.
7. To identify gunshot residue.
8. To correlate the nature of injuries with distance from which the bullet was fired.
9. To differentiate, with the aid of diagram, contact wounds, close range wounds and distant wounds.

Suggested Readings

1. B R Sharma, *Firearms in Criminal Investigation and Trials*, Universal Law Publishing - An imprint of LexisNexis
2. K Kumar, *Forensic Ballistics in Criminal Justice*, Eastern Book Company, Lucknow
3. B.J. Heard, *Handbook of Firearms and Ballistics*, Wiley and Sons, Chichester (1997).
4. W.F. Rowe, Firearm identification, *Forensic Science Handbook*, Vol. 2, R. Saferstein (Ed.), Prentice Hall, New Jersey (1988).
5. A.J. Schwoeble and D.L. Exline, *Current Methods in Forensic Gunshot Residue Analysis*, CRC Press, Boca Raton (2000).

B.Sc. Forensic Science: Semester-IV FST452: Examination of Biological Evidences	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

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

- a. The significance of biological evidence.
- b. The forensic importance of hair evidence.
- c. The importance of biological fluids – blood, urine, semen, saliva, sweat and milk – in crime investigations.
- d. How wildlife forensics aid in conserving natural resources.
- e. How forensic entomology assists in death investigations.

Experiment Details

1. To examine hair morphology and determine the species to which the hair belongs.
2. To prepare slides of scale pattern of human hair.
3. To examine human hair for cortex and medulla.
4. To carry out microscopic examination of pollen grains.
5. To carry out microscopic examination of diatoms.
6. To cite a crime case in which diatoms have served as forensic evidence.
7. To prepare a case report on forensic entomology.
8. To prepare a case report on problems of wildlife forensics.
9. Examination of blood.
10. Examination of various body fluids.

Suggested Reading

1. L. Stryer, *Biochemistry*, 3rd Edition, W.H. Freeman and Company, New York (1988).
2. R.K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, *Harper's Biochemistry*, APPLETON & Lange, Norwalk (1993).
3. S. Chowdhuri, *Forensic Biology*, BPRD, New Delhi (1971).
4. R. Saferstein, *Forensic Science Handbook*, Vol. III, Prentice Hall, New Jersey (1993).
5. G.T. Duncan and M.I. Tracey, Serology and DNA typing in, *Introduction to Forensic Sciences*, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).

B.Sc. Forensic Science: Semester-IV FST453: Chemistry Lab - IV	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

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

- a. *The methods of analyzing trace amounts of petroleum products in crime scene evidence.*
- b. *The methods of analyzing contaminants in petroleum products.*
- c. *The method of searching, collecting, preserving and analyzing arson evidence.*
- d. *The classification of explosives, including the synthesis and characterization of representative analogs.*
- e. *The significance of explosion scene management.*
- f. *The techniques of locating hidden explosives.*

Experiment Details:

1. To carry out analysis of gasoline.
2. To carry out analysis of diesel.
3. To carry out analysis of kerosene oil.
4. To analyze arson accelerators.
5. To prepare a case report on a case involving arson.
6. To carry out analysis of explosive substances.
7. To separate explosive substances using thin layer chromatography.
8. To prepare a case report on bomb scene management.

Suggested Readings

1. J.D. DeHaan, *Kirk's Fire Investigation*, 3rd Edition, Prentice Hall, New Jersey (1991).
2. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, *Scientific Evidence in Civil and Criminal Cases*, 4th Edition, The Foundation Press, Inc., New York (1995).
3. R. Saferstein, *Criminalistics*, 8th Edition, Prentice Hall, New Jersey (2004).
4. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, *Techniques of Crime Scene Investigation*, CRC Press, Boca Raton (2013).
5. S. Ballou, M. Houck, J.A. Siegel, C.A. Crouse, J.J. Lentini and S. Palenik in *Forensic Science*, D.H. Ubelaker (Ed.), Wiley-Blackwell, Chichester (2013).

B.Sc. Forensic Science: Semester-IV	
FST454: Physics Lab - IV	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

- Basic Electronics instrumentation has the most striking impact on the industry wherever the components / instruments are used to study and determine the electronic properties. Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.

List of Experiments

- Transistor Bias Stability
- Comparative Study of CE, CB and CC amplifier
- Clippers and Clampers
- Study of Emitter Follower
- Frequency response of single stage RC coupled amplifier
- Frequency response of single stage Transformer coupled amplifier
- Effect of negative feedback on frequency response of RC coupled amplifier
- Study of Schmitt Trigger
- Study of Hartley oscillator
- Study of Wein Bridge oscillator

Suggested Readings:

1. R.L. Boylestad, L. Nashelsky, –Electronic Devices and Circuit Theory, Prentice-Hall of India Pvt. Ltd., 2015, 11e
2. J. Millman, C.C. Halkias, Satyabrata Jit, –Electronic Devices and Circuits, McGraw Hill, 2015, 4e
3. B.G. Streetman, S.K. Banerjee, –Solid State Electronic Devices, Pearson Education India, 2015, 7e
4. J.D. Ryder, –Electronic Fundamentals and Applications, Prentice-Hall of India Private Limited, 1975, 5e
5. John M. Senior, –Optical Fiber Communications: Principles and Practice, Pearson Education Limited, 2010, 3e
6. John Wilson, John Hawkes, –Optoelectronics: Principles and Practice, Pearson Education Limited, 2018, 3e
7. S.L. Gupta, V. Kumar, –Hand Book of Electronics, Pragati Prakashan, Meerut, 2016, 43e

B.Sc. Forensic Science: Semester-IV FST455: Zoology Lab - IV	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

The student at the completion of the course will be able to:

- Understand the principles of genetic engineering with hands-on experiments in mutation detection, testing of infectious diseases like Covid 19.
- Get introduced to DNA testing and utility of genetic engineering in forensic sciences.
- Apply knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics existing software effectively to extract information from large databases and to use this information in computer modeling.
- Use bioinformatics tools to find out evolutionary/phylogenetic relationship of organisms using gene sequences.
- Get employment in Hospitals/Diagnostic and forensic labs/Counsel families with genetic disorders.
- Enable students to take up research in biological sciences.

Unit I

- Measure the pre and post clitellar lengths of earthworms and calculate mean, median, mode, standard deviation etc.
- Measure the height and weight of all students in the class and apply statistical measures.

Unit II

- Determination of ABO Blood group
- To perform bacterial culture and calculate generation time of bacteria.
- To study Restriction enzyme digestion using teaching kits.
- To detect genetic mutations by Polymerase Chain Reaction (PCR) using teaching kits.
- Demonstration of agarose gel electrophoresis for detection of DNA.
- Demonstration of Polyacrylamide Gel Electrophoresis (PAGE) for detection of proteins.
- To calculate molecular weight of unknown DNA and protein fragments from gel pictures.

Suggested Readings:

1. Primrose & Twyman. Principles of Genome Analysis and Genomics. Blackwell (2003).
2. Hartl & Jones. Genetics: principles & Analysis of Genes & Genomes. Jones & Bartlett (1998).
3. Sambrook et al. Molecular Cloning Vols I, II, III. CSHL (2001).
4. Primrose. Molecular Biotechnology. Panima (2001)

B.Sc. Forensic Science: Semester-IV	
FST456: Computer Lab - IV	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

An ability to understand:

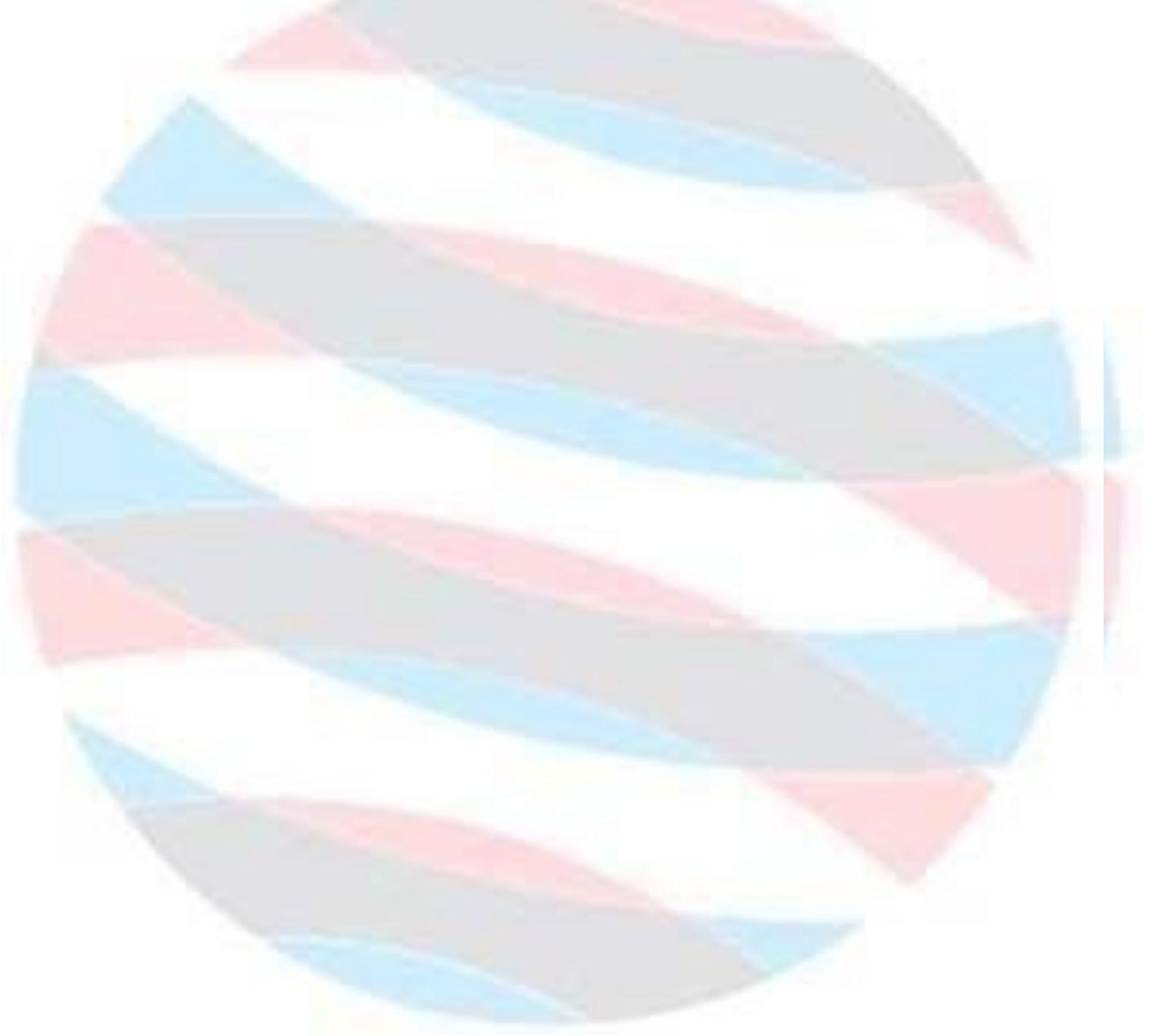
- The functions of various hardware components and their building blocks
- Boolean algebraic expressions to digital design
- And implementation of different sequential and Combinational circuits
- computer buses and input/output peripherals
- memory hierarchy and design of primary memory

Unit

- Create the micro operations and associate with instructions as given in the chapter (except interrupts). Design the register set, memory and the instruction set. Use this machine for the assignments of this section.
- Create a Fetch routine of the instruction cycle.
- Simulate the machine to determine the contents of AC, E, PC, AR and IR registers in hexadecimal after the execution of each of following register reference instructions:
 - a. CLA e. CIR i. SNA
 - b. CLE f. CIL j. SZA
 - c. CMA g. INC k. SZE
 - d. CME h. SPA l. HLT
 Initialize the contents of AC to (A937)₁₆, that of PC to (022)₁₆ and E to 1.
- Simulate the machine for the following memory-reference instructions with I= 0 and address part = 82. The instruction to be stored at address 022 in RAM. Initialize the memory word at address 082 with the operand B8F2 and AC with A937. Determine the contents of AC, DR, PC, AR and IR in hexadecimal after the execution.
 - a. ADD f. BSA
 - b. AND g. ISZ
 - c. LDA
 - d. STA
 - e. BUN
- Simulate the machine for the memory-reference instructions referred in above question with I= 1 and address part = 082. The instruction to be stored at address 026 in RAM. Initialize the memory word at address 082 with the value 298. Initialize the memory word at address 298 with operand B8F2 and AC with A937. Determine the contents of AC, DR, PC, AR and IR in hexadecimal after the execution.

Suggested Readings:

1. M. Mano, –Computer System Architecture, Pearson Education, New Jersey, 2017, Third Edition.
2. W. Stallings, –Computer Organization and Architecture Designing for Performance, Prentice Hall of India, 2015, Tenth Edition.
3. M. Mano, –Digital Design, Pearson Education, New Jersey, 2018, Sixth Edition.
4. Vranasic and Hamacher, Computer Organization, TMH"



B.Sc. Forensic Science: Semester-IV FST457: Botany Lab - IV	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

After the completion of the course the students will be able to:

- Know about the commercial products produced from plants.
- Gain the knowledge about cultivation practices of some economic crops.
- Understand about the ethnobotanical details of plants.
- Learn about the chemistry of plants & herbal preparations
- Can become a protected cultivator, aromatic oil producer, Pharmacologist or quality analyst in Drug Company.

Unit - Economic Botany & Microtechniques

- Cereals: Wheat (habit sketch, L.S./T.S. of grain, starch grains, micro-chemical tests); rice (habit sketch, study of paddy and grain, starch grains, micro-chemical tests)
- Legume: Pea or ground nut (habit, fruit, seed structure, micro-chemical tests)
- Source of sugars and starches: Sugarcane (habit sketch; cane juice- micro-chemical tests); potato (habit sketch, tuber morphology, T.S. of tuber to show localization of starch grains, W.M. of starch) grains, micro-chemical tests.
- Tea- tea leaves, tests for tannin
- Mustard- plant specimen, seeds, tests for fat in crushed seeds
- Timbers: section of young stem.
- Jute- specimen, transverse section of stem, tests for lignin on T.S. of stem and study off fiber following maceration technique.
- Study of specimens of economic importance.

Suggested Readings:

1. Wallis, T. E. 1946. Text book of Pharmacognosy, J & A Churchill Ltd.
2. Roseline, A. 2011. Pharmacognosy. MJP Publishers, Chennai.
3. Jain S. K. 1989. Methods and approaches in Ethnobotany, Society of Ethnobotanists, Lucknow.
4. Pal, D.C. & Jain, S.K., 1998. Tribal Medicine. Naya Prakash Publishers, Calcutta.
5. Datta & Mukerji, 1952. Pharmacognosy of Indian roots of Rhizome drugs. Bulletin No.1 Ministry of Health, Govt. of India.
6. Young Ken, H.W., 1948. Text Book of Pharmacognosy. Blakiston C., Philadelphia.
7. Shukla, R.S., 2000. Forestry for tribal development. A.H. Wheeler & Co. Ltd., India.
8. Raychudhuri, S.P., 1991. (Ed.) Recent advances in Medicinal aromatic and spice crops. Vol.1, Today & Tomorrow's printers and publishers, New Delhi.

YEAR III, SEMESTER V

COURSE CODE	COURSE TITLE	COURSE CATEGORY	HOURS			EVALUATION SCHEME		SUBJECT TOTAL	CREDIT
			L	T	P	CA	EE		
FST501	Digital Forensics	CORE	3	1	0	30	70	100	4
FST502	Questioned Document & Fingerprint	CORE	3	1	0	30	70	100	4
FST503	Chemistry-V	CORE	3	1	0	30	70	100	4
FST504	Physics- V	GE	3	1	0	30	70	100	4
FST505	Zoology- V								
FST506	Computer Science- V	GE	3	1	0	30	70	100	4
FST507	Botany-V								
FST552	Questioned Document & Fingerprint Examination	PRACTICAL	0	0	4	15	35	50	2
FST553	Chemistry Lab - V	PRACTICAL	0	0	4	15	35	50	2
FST554	Physics Lab- V	PRACTICAL	0	0	4	15	35	50	2
FST555	Zoology Lab- V								
FST556	Computer Lab-V	PRACTICAL	0	0	4	15	35	50	2
FST557	Botany Lab-V								
Total			15	5	16	210	490	700	28

L - Lecture, T - Tutorial, P - Practical, GE- Generic Elective; AECC-Ability Enhancement Compulsory Course; DSE- Discipline Specific Elective; AEEC- Ability Enhancement Elective Course (Skill Based Course)

COURSE CODE	COURSE TITLE	COURSE CATEGORY	HOURS			EVALUATION SCHEME		SUBJECT TOTAL	CREDIT
			L	T	P	CA	EE		
FST601	Forensic Medicine & Toxicology	CORE	3	1	0	30	70	100	4
FST602	Minor Project	CORE	3	1	0	30	70	100	4
FST603	Chemistry-VI	CORE	3	1	0	30	70	100	4
FST604	Physics- VI	GE	3	1	0	30	70	100	4
FST605	Zoology- VI								
FST606	Computer Science-VI	GE	3	1	0	30	70	100	4
FST607	Botany- VI								
FST651	Examination of Human Bones and Toxicological Samples	PRACTICAL	0	0	4	15	35	50	2
FST653	Chemistry Lab- VI	PRACTICAL	0	0	4	15	35	50	2
FST654	Physics Lab- VI	PRACTICAL	0	0	4	15	35	50	2
FST655	Zoology Lab- VI								
FST656	Computer Science-VI	PRACTICAL	0	0	4	15	35	50	2
FST657	Botany-VI								
Total			15	5	16	210	490	700	28

L - Lecture, T - Tutorial, P - Practical, GE- Generic Elective; AECC-Ability Enhancement Compulsory Course; DSE- Discipline Specific Elective; AECC- Ability Enhancement Elective Course (Skill Based Course)

B.Sc. Forensic Science: Semester-V	
FST501: Digital Forensics	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

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

- a. The basics of digital forensics.
- b. The cases which fall under the purview of digital crimes.
- c. The types of digital crimes.
- d. The elements involved in investigation of digital crimes.

Unit 1: Fundamentals and Concepts

Fundamentals of computers Hardware and accessories – development of hard disk, physical construction, CHS and LBA addressing, encoding methods and formats.
Memory and processor. Methods of storing data. Operating system. Software. Introduction to network, LAN, WAN and MAN.

Unit 2: Computer Crimes

Definition and types of computer crimes. Distinction between computer crimes and conventional crimes. Reasons for commission of computer crimes. Breaching security and operation of digital systems.

Unit 3: Malware and Other Crimes

Computer virus, and computer worm – Trojan horse, trap door, super zapping, logic bombs. Types of computer crimes – computer stalking, pornography, hacking, crimes related to intellectual property rights, computer terrorism, hate speech, private and national security in cyber space. An overview of hacking, spamming, phishing and stalking.

Unit 4: Computer Forensics Investigations

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.

Unit 5: 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.

Suggested Readings

1. R.K. Tiwari, P.K. Sastry and K.V. Ravikumar, *Computer Crimes and Computer Forensics*, Select Publishers, New Delhi (2003).
2. C.B. Leshin, *Internet Investigations in Criminal Justice*, Prentice Hall, New Jersey (1997).
3. R. Saferstein, *Criminalistics*, 8th Edition, Prentice Hall, New Jersey (2004).
4. E. Casey, *Digital Evidence and Computer Crime*, Academic Press, London (2000).

B.Sc. Forensic Science: Semester-IV	
FST 502: Questioned Document and Fingerprint	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

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

- a. The importance of examining questioned documents in crime cases.
- b. The tools required for examination of questioned documents.
- c. The significance of comparing hand writing samples.
- d. The importance of detecting frauds and forgeries by analyzing questioned documents.
- e. The fundamental principles on which the science of fingerprinting is based.
- f. Fingerprints are the most infallible means of identification.
- g. The world's first fingerprint bureau was established in India.
- h. The method of classifying criminal record by fingerprints was worked out in India, and by Indians.
- i. The physical and chemical techniques of developing fingerprints on crime scene evidence.
- j. The significance of foot, palm, and lip prints.

Unit 1: Introduction to Questioned Documents

Definition of questioned documents. Types of questioned documents. Preliminary examination of documents. Basic tools needed for forensic document examination.

Instruments used in Document Examination

Ultraviolet, visible, infrared and fluorescence spectrophotometer, photomicrography, microphotography, Video Spectral Comparator, Electrostatic Detection Apparatus.

Unit 2: Comparison of Documents

Determining the relative age of documents. Comparison of handwriting. Development of individuality in handwriting. Natural variations and fundamental divergences in handwritings. Class and individual characteristics. Merits and demerits of exemplar and non-exemplar.

Standards for Comparison of Handwriting

Comparison of paper, ink, printed documents, typed documents, Xeroxed documents.

Unit 3: Forgeries

Alterations in documents, including erasures, additions, over-writings and obliterations. Indented and invisible writings. Charred documents. Examination of counterfeit Indian currency notes, passports, visas and stamp papers. Disguised writing and anonymous letters

Unit 4: Basics of Fingerprinting

Introduction and History. Biological basis of fingerprints. Formation of ridges. Fundamental principles of fingerprinting.

Classification of fingerprints

Fingerprint patterns. Ridge characters/minutiae. Plain and rolled fingerprints. Ridge Tracing and Ridge Counting. Types of Fingerprints found at Crime Scene.

Unit 5: Fingerprint Identification

Classification and cataloguing of fingerprint record. Automated Fingerprint Identification System. Significance of poroscopy and edgeoscopy. Ten Digit Classification. Single Digit Classification

Development of Latent Fingerprints

Constituents of sweat residue. Latent fingerprints' detection by physical and chemical methods. Preservation and lifting of developed fingerprints. Digital imaging for fingerprint enhancement. Fingerprinting the deceased.

Other Impressions

Importance of footprints. Casting of foot prints, Electrostatic lifting of latent foot prints. Podogram. Palm prints and their historical importance. Lip prints - Nature, location, collection and examination of lip prints.

Suggested Readings

1. B R Sharma, *Handwriting Forensics*, Universal Law Publishing - An imprint of LexisNexis
2. Wilson R Harrison, *Suspect Documents: Their Scientific Examination*, Burnham, Incorporated
3. Albert S Osborn, *Questioned Document*, Nelson-Hall, Inc
4. O. Hilton, *Scientific Examination of Questioned Documents*, CRC Press, Boca Raton (1982).
5. R.N. Morris, *Forensic Handwriting Identification: Fundamental Concepts and Principles*, Academic Press, London (2000).
6. E. David, *The Scientific Examination of Documents – Methods and Techniques*, 2nd Edition, Taylor & Francis, Hants (1997).
7. J.E. Cowger, *Friction Ridge Skin*, CRC Press, Boca Raton (1983).
8. D.A. Ashbaugh, *Quantitative-Qualitative Friction Ridge Analysis*, CRC Press, Boca Raton (2000).
9. C. Champod, C. Lennard, P. Margot and M. Stoilovic, *Fingerprints and other Ridge Skin Impressions*, CRC Press, Boca Raton (2004).
10. Lee and Gaenslen's, *Advances in Fingerprint Technology*, 3rd Edition, R.S. Ramotowski (Ed.), CRC Press, Boca Raton (2013).

B.Sc. Forensic Science: Semester-V	
FST503: Chemistry - V	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course Objective: After completion the student will know about-

- The states of matter and their properties
- Thermodynamics and its laws
- Electrochemistry and related theories
- Nuclear chemistry and radioactivity

Unit 1: Gaseous State

Kinetic theory of gases, ideal gas laws based on kinetic theory. Collision in a gas- mean free path, collision diameter, collision number. Behaviour of real gases - the van der Waal's equation. Critical phenomena - critical constants of a gas and their determination, the van der Waals equation and critical state, Principle of corresponding states.

Unit 2: Liquid State

Surface tension of liquids - capillary action, experimental determination of surface tension, temperature effect on surface tension. Viscosity of liquids, experimental determination of viscosity coefficient, its variation with temperature.

Unit 3: Thermodynamics

First Law of thermodynamics and internal energy, state and state functions, sign convention for heat and work, nature of work, path dependence of heat and work. Enthalpy, heat changes at constant volume and constant pressure, heat capacities (CV, CP) and their relationship for ideal gases. Thermodynamic quantities (w, q, ΔU , ΔH) for isothermal and adiabatic reversible expansion of ideal gases and their comparison. Change in internal energy (ΔU) and enthalpy (ΔH) of chemical reactions, relation between ΔU and ΔH , variation of heat of reaction with temperature (Kirchhoff's equation).

Unit 4: Electrochemistry

Arrhenius theory of electrolytic dissociation, Hydrolysis of salts, hydrolysis constant, buffer solutions, indicators and theory of acid-base indicators. Migration of ions: transference number and its determination by Hittorf methods. Conductance of electrolyte solutions, molar conductance of electrolyte and its splitting into ionic molar conductance, Kohlrausch law of independent migration of ions, ionic mobility. Application of conductance measurements: determination of degree of dissociation and dissociation constant of weak electrolytes/acids, solubility of sparingly soluble salts, and Conductometric titrations.

Unit 5: Nuclear Chemistry

Nucleus and its classification, nuclear forces, nuclear binding energy, stability of nucleus. Radioactivity: Radioactive elements, general characteristics of radioactive decay, decay kinetics (decay constant, half-life, mean life period), units of radioactivity.

Suggested Readings

1. Physical Chemistry, P. Atkins and J. De Paul, 8th Edition (2006), International Student Edition, Oxford University Press.
2. Physical Chemistry, P. C. Rakshit, 5th Edition (1988), 4th Reprint (1997), Sarat Book House, Calcutta.
3. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma, and M. S. Pathania, 37th Edition (1998), Shoban Lal Nagin Chand & Co., Jalandhar.
4. Physical Chemistry, K. J. Laidler and J. M. Meiser, 3rd Edition, Houghton Mifflin Comp., New York, International Edition (1999)

B.Sc. Forensic Science: Semester-V	
FST504: Physics - V	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

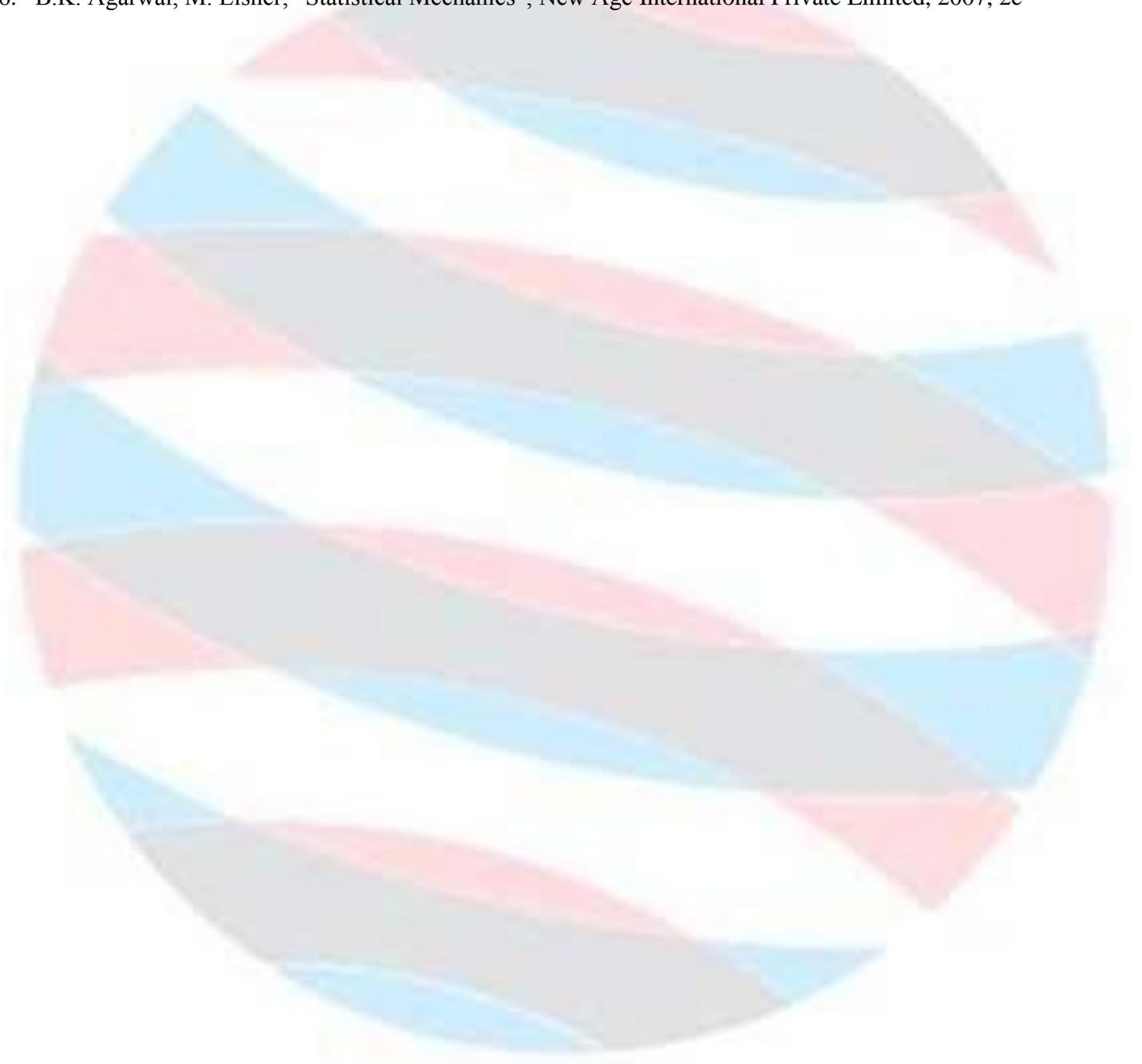
Course outcomes:

- Understand the concepts of generalized coordinates and D’Alembert’s principle.
- Understand the Lagrangian dynamics and the importance of cyclic coordinates.
- Comprehend the difference between Lagrangian and Hamiltonian dynamics.
- Study the important features of central force and its application in Kepler’s problem.
- Recognize the difference between macrostate and microstate.
- Comprehend the concept of ensembles.
- Understand the classical and quantum statistical distribution laws.
- Study the applications of statistical distribution laws.

Unit I – Constrained Motion
<ul style="list-style-type: none"> • Constraints - Definition, Classification and Examples. Degrees of Freedom and Configuration space. Constrained system, Forces of constraint and Constrained motion. Generalised coordinates, Transformation equations and Generalised notations & relations. Principle of Virtual work and D’Alembert’s principle.
Unit II – Lagrangian Formalism
<ul style="list-style-type: none"> • Lagrangian for conservative & non-conservative systems, Lagrange’s equation of motion (no derivation), Comparison of Newtonian & Lagrangian formulations, Cyclic coordinates, and Conservation laws (with proofs and properties of kinetic energy function included). Simple examples based on Lagrangian formulation.
Unit III – Hamiltonian Formalism
<ul style="list-style-type: none"> • Phase space, Hamiltonian for conservative & non-conservative systems, Physical significance of Hamiltonian, Hamilton’s equation of motion (no derivation), Comparison of Lagrangian & Hamiltonian formulations, Cyclic coordinates, and Construction of Hamiltonian from Lagrangian. Simple examples based on Hamiltonian formulation.
Unit IV – Central Force
<ul style="list-style-type: none"> • Macrostate & Microstate: Definition and properties (with prove) of central force. Equation of motion and differential equation of orbit. Bound & unbound orbits, stable & non-stable orbits, closed & open orbits and Bertrand’s theorem. Motion under inverse square law of force and derivation of Kepler’s laws. Laplace-Runge- Lenz vector (Runge-Lenz vector) and its applications.
Unit V – Macrostate & Microstate
<ul style="list-style-type: none"> • Macrostate, Microstate, Number of accessible microstates and Postulate of equal a priori. Phase space, Phase trajectory, Volume element in phase space, Quantisation of phase space and number of accessible microstates for free particle in 1D, free particle in 3D & harmonic oscillator in 1D.

Suggested Readings:

1. Herbert Goldstein, Charles P. Poole, John L. Safko, "Classical Mechanics", Pearson Education, India, 2011, 3e
2. N.C. Rana, P.S. Joag, "Classical Mechanics", McGraw Hill, 2017
3. R.G. Takwale, P.S. Puranik, "Introduction to Classical Mechanics", McGraw Hill, 2017
4. F. Reif, "Statistical Physics (In SI Units): Berkeley Physics Course Vol 5", McGraw Hill, 2017, 1e
5. B.B. Laud, "Fundamentals of Statistical Mechanics", New Age International Private Limited, 2020, 2e
6. B.K. Agarwal, M. Eisner, "Statistical Mechanics", New Age International Private Limited, 2007, 2e



B.Sc. Forensic Science: Semester-V	
FST505: Zoology - V	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

The student at the completion of the course will be able to:

- Demonstrate comprehensive identification abilities of non-chordate diversity
- Explain structural and functional diversity of non-chordate
- Explain evolutionary relationship amongst non-chordate groups
- Get employment in different applied sectors
- Enable students to take up research in Biological Science.

Unit I – Protozoa to Coelenterate
<ul style="list-style-type: none"> • Protozoa – Paramecium (Morphology and Reproduction) • Porifera – Sycon (Canal System) • Coelenterata – Obelia (Morphology and Reproduction)
Unit II – Ctenophora to Nemathelminthes
<ul style="list-style-type: none"> • Ctenophora – Salient features • Platyhelminthes – Taenia (Tape worm) (Morphology and Reproduction) • Nemathelminthes – Ascaris lumbricoides (Morphology and Reproduction)
Unit III – Annelida & Arthropoda
<ul style="list-style-type: none"> • Annelida – Hirudinaria (Leech) (Morphology and Reproduction) • Arthropoda – Palaemon (Prawn) (Morphology, Appendages, Nervous System and Reproduction)
Unit IV – Mollusca to Hemichordata
<ul style="list-style-type: none"> • Mollusca – Pila (Morphology, Shell, Respiration, Nervous System and Reproduction) • Echinodermata – Pentaceros (Morphology and Water Vascular System)
Unit V – Vectors and pests
<ul style="list-style-type: none"> • Life cycle and their control of pests: Gundhi bug, Sugarcane leafhopper, Rodents. Termites and Mosquitoes and their control

Suggested Readings:

1. Barnes et al (2009). The Invertebrates: A synthesis. Wiley Backwell 17
2. Hunter: Life of Invertebrates (1979, Collier Macmillan)
3. Marshall: Parker & Haswell Text Book of Zoology, Vol. I (7th ed 1972, Macmillan)
4. Moore: An Introduction to the Invertebrates (2001, Cambridge University Press)
5. Brusca and Brusca (2016) Invertebrates. Sinauer
6. Jan Pechenik (2014) Biology of the invertebrates. McGraw Hill

7. Neilsen (2012). Animal Evolution: Interrelationships amongst living Phyla. Oxford
8. Parasitology- Chatterjee
9. Parasitology- Chakraborty
10. Thomos C. Chung. General Parasitology. Hardcourt Brace and Co. Ltd. Asia, New Delhi.
11. Gerard D. Schmidt and Larry S Roberts. Foundations of Parasitology. McGraw Hill.
12. Bisht. D.S., Apiculture, ICAR Publication.
13. Singh S., Beekeeping in India, Indian council of Agricultural Research, New Delhi.
14. Jhingran. V.G. Fish and fisheries in India.,
15. Khanna. S.S, An introduction to fishes
16. Boyd. C.E. & Tucker. C.S, Pond aquaculture water quality management,
17. Biswas. K.P, Fish and prawn diseases,
18. Pedigo, L.P. (2002). Entomology and Pest Management, Prentice Hall.
19. Lee, Earthworm Ecology
20. Stevenson, Biology of Earthworms
21. Destructive and Useful Insects by C. L. Metcalf
22. Sericulture for Rural Development : Hanumappa (1978), Himalaya Publication,
23. Sriculture in India Sarkar, D.C. (1988), CSB, Bangalore.

B.Sc. Forensic Science: Semester-V	
FST506: Computer Science - V	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

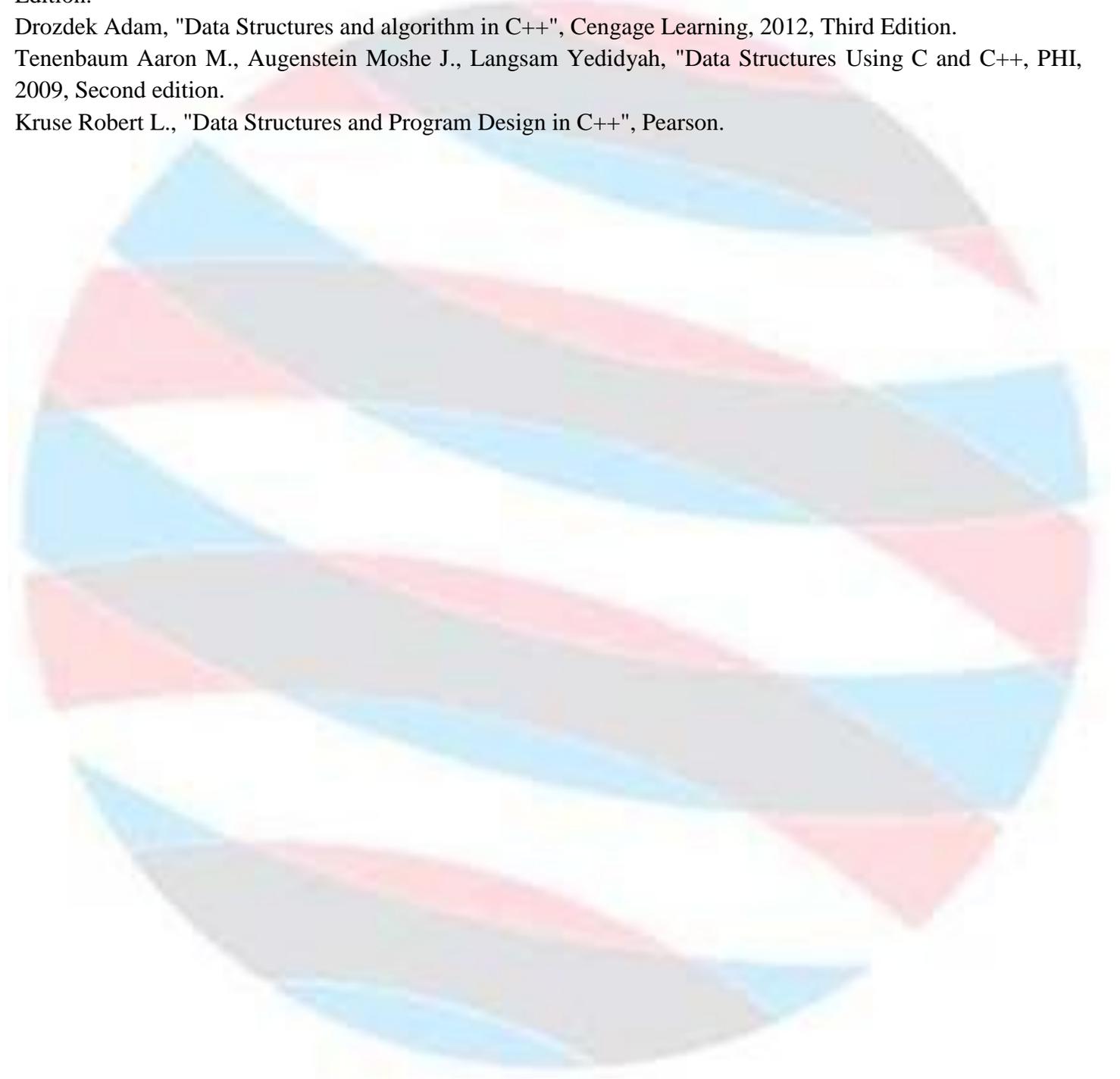
Course outcomes:

- Understand that various problem solving categories exist such as; iterative technique, divide and conquer, dynamic programming, greedy algorithms, and understand various searching and sorting algorithms
- Employ a deep knowledge of various data structures when constructing a program..
- Design and construct simple object-oriented software with an appreciation for data abstraction and information hiding.
- Effectively use software development tools including libraries, compilers, editors, linkers and debuggers to write and troubleshoot programs.

Unit I – Analysis of Algorithm and Data Structures
<ul style="list-style-type: none"> • Introduction: Basic Design and Analysis techniques of Algorithms, time and space complexity, Correctness of Algorithm, Algorithm Design Techniques: Iterative techniques, Divide and Conquer, Dynamic Programming, Greedy Algorithms. • Sorting Techniques: Elementary sorting techniques-Bubble Sort, Insertion Sort, Merge Sort, Advanced Sorting techniques-Heap Sort, Quick Sort, Sorting in Linear Time- Bucket Sort, Radix Sort and Count Sort
Unit II – Searching Techniques and Complexity Analysis
<ul style="list-style-type: none"> • Linear and Binary search, Medians & Order Statistics. • Arrays: Single and Multi-dimensional Arrays, Sparse Matrices;
Unit III – Stacks and Queues
<ul style="list-style-type: none"> • Implementing stack using array and linked list, Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another; Array and Linked representation of Queue, De-queue, Priority Queues
Unit IV – Linked Lists
<ul style="list-style-type: none"> • Singly, Doubly and Circular Lists, representation of Stack and Queue as Linked Lists. • Recursion: Developing Recursive Definition of Simple Problems and their implementation; Advantages and Limitations of Recursion;
Unit V – Trees
<ul style="list-style-type: none"> • Introduction to Tree as a data structure; Binary Trees, Binary Search Tree, (Creation, and Traversals of Binary Search Trees)

Suggested Readings:

1. Cormen T.H., Leiserson Charles E., Rivest Ronald L., Stein Clifford, Introduction to Algorithms, PHI Learning Pvt. Ltd., 2009, 3rd Edition.
2. Basse Sara & A.V. Gelder, Computer Algorithm: Introduction to Design and Analysis, Pearson, 2000, 3rd Edition.
3. Drozdek Adam, "Data Structures and algorithm in C++", Cengage Learning, 2012, Third Edition.
4. Tenenbaum Aaron M., Augenstein Moshe J., Langsam Yedidyah, "Data Structures Using C and C++", PHI, 2009, Second edition.
5. Kruse Robert L., "Data Structures and Program Design in C++", Pearson.



B.Sc. Forensic Science: Semester-V	
FST507: Botany - V	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

After the completion of the course the students will be able to:

- Understand the role of Physiological and metabolic processes for plant growth and development.
- Learn the symptoms of Mineral Deficiency in crops and their management.
- Assimilate Knowledge about Biochemical constitution of plant diversity.
- Know the role of plants in development of natural products, nutraceuticals, dietary supplements, antioxidants

Unit I – Plant water relation, Mineral Nutrition, Transpiration and translocation in phloem
<ul style="list-style-type: none"> • Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation. Criteria of essentiality of elements; Role of essential elements; Symptoms of mineral deficiency in major crops, Transport of ions across cell membrane, active and passive transport, Composition of phloem sap, girdling experiment; Pressure flow model.
Unit II – Carbon Oxidation
<ul style="list-style-type: none"> • Krebs cycle, Glycolysis, fate of pyruvate- aerobic and anaerobic respiration and fermentation, regulation of glycolysis, oxidative pentose phosphate pathway, oxidative decarboxylation of pyruvate, regulation of Kerbs cycle, mitochondrial electron transport, oxidative phosphorylation, ATP-Synthetase, Chemiosmotic mechanism, P/O ratio , cyanide-resistant respiration, factors affecting respiration.
Unit III – Nitrogen Metabolism
<ul style="list-style-type: none"> • Nitrate assimilation, biological nitrogen fixation (examples of legumes and non-legumes), Physiology and biochemistry of nitrogen fixation, Ammonia assimilation (GS-GOGAT), reductive amination and transamination, amino acid synthesis.
Unit IV – Lipid Metabolism & Photosynthesis
<ul style="list-style-type: none"> • Lipid Metabolism: Synthesis and breakdown of triglycerides, -oxidation, glyoxylate cycle, gluconeogenesis and its role in mobilization of lipids during seed germination, -oxidation.; Photosynthesis: Pigments, Action spectra and Enhancement effect, Electron transport system and Photophosphorylation, C3 & C4 photosynthesis, CAM- Reaction and Significance
Unit V – Plant Development, Movements, Dormancy & Responses
<ul style="list-style-type: none"> • Developmental roles of Phytohormones (auxins, gibberellins, cytokinins, ABA, ethylene.) autonomic & paratonic movements, Control and Coordination in plants, Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red-light responses on photomorphogenesis, Seed physiology & Dormancy, Vernalization & Senescence

Suggested Readings:

1. Hopkins, W.G. & Hiiner, N.P. Introduction to Plant Physiology (3rd ed.) 2004, John Wiley & Sons.
2. A Handbook On Mineral Nutrition And Diagnostic Techniques For Nutritional Disorders Of Crops (pb)ISBN : 9788177543377Edition : 01Year : 2011Author : Pathmanabhan G , Vanangamudi M , Chandrasekaran CN , Sathyamoorthi K , Babu CR , Babu RC , Boopathi PNPublisher : Agrobios (India)
3. Jain, V.K. Fundamental of Plant Physiology (7th ed.) 2004. S. Chand and Company.
4. Salisbury, F.B. & Ross, C.W. Plant Physiology (4th ed.), 19992, Wadsoworth Publishing Company.
5. Panday, S.N. & Sinha, B.K. Plant Physiology (4th ed.), 2006, Vikas Publishing House Pvt. Ltd.
6. Mukherjee, S. & Ghosh, A. Plant Physiology (2nd ed.), 2005, New Central Book Agency.
7. Chaudhuri, D., Kar, D.K., and Halder, S.A. Handbook of Plant Biosynthetic Pthways 2008, New Central Book. Agencies.
8. Voet, D. and Voet, J.G., Bio-Chemistry (3rd ed.), 2005, John Wiley & Sons.
9. Mathews, C.K., Van Holder, K.E. & Ahren, K.G. Bio-Chemistry (3rd ed.), 2000, Pearson Education.
10. Lehninger Principles of Biochemistry. Sixth Edition. 2013. David L. Nelson, Michael M. Cox. Freeman, Macmillan.
11. Srivastava, HN. 2006. Pradeep's Botany Vol. V. Pradeep Publications, Jalandhar.
12. Verma, SK. Plant Physiology and Biochemistry. S. Chand & Sons, New Delhi.
13. Buchanon, Gruissen and Jones. Plant Physiology & Biochemistry: Biochemistry and Molecular Biology of plants, 2000, I.K. International.

B.Sc. Forensic Science: Semester-V	
FST552: Questioned Document and Fingerprint Examination	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

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

- a. The importance of examining questioned documents in crime cases.
- b. The tools required for examination of questioned documents.
- c. The significance of comparing hand writing samples.
- d. The importance of detecting frauds and forgeries by analyzing questioned documents.
- e. The fundamental principles on which the science of fingerprinting is based.
- f. Fingerprints are the most infallible means of identification.
- g. The physical and chemical techniques of developing fingerprints on crime scene evidence.
- h. The significance of foot, palm, etc

Experiment Details

1. To identify handwriting characters.
2. To study natural variations in handwriting.
3. To compare handwriting samples.
4. To detect simulated forgery.
5. To detect traced forgery.
6. To study the line quality defects in handwriting samples.
7. To examine the security features of currency notes, passports and plastic money.
8. To study alterations, obliterations and erasures in handwriting samples.
9. To cite a case wherein Section 45 of Indian Evidence Act was invoked, seeking expert opinion for authentication of handwriting and/or signatures.
10. To cite a case wherein Section 489A of the Indian Penal Code was invoked in context of fake currency.
11. To record plain and rolled fingerprints.
12. To carry out ten digit classification of fingerprints.
13. To identify different fingerprint patterns.
14. To identify core and delta.
15. To carry out ridge tracing and ridge counting.
16. To investigate physical methods of fingerprint detection.
17. To investigate chemical methods of fingerprint detection.
18. To use different light sources for enhancing developed fingerprints.
19. To prepare cast of foot prints.

Suggested Readings

1. B R Sharma, Handwriting Forensics, Universal Law Publishing - An imprint of LexisNexis
2. Wilson R Harrison, Suspect Documents: Their Scientific Examination, Burnham, Incorporated
3. Albert S Osborn, Questioned Document, Nelson-Hall, Inc
4. O. Hilton, Scientific Examination of Questioned Documents, CRC Press, Boca Raton (1982).
5. R.N. Morris, Forensic Handwriting Identification: Fundamental Concepts and Principles, Academic Press, London (2000).
6. E. David, The Scientific Examination of Documents – Methods and Techniques, 2nd Edition, Taylor & Francis, Hants (1997).
7. J.E. Cowger, Friction Ridge Skin, CRC Press, Boca Raton (1983).
8. D.A. Ashbaugh, Quantitative-Qualitative Friction Ridge Analysis, CRC Press, Boca Raton (2000).
9. C. Champod, C. Lennard, P. Margot an M. Stoilovic, Fingerprints and other Ridge Skin Impressions, CRC Press, Boca Raton (2004).
10. Lee and Gaensleen's, Advances in Fingerprint Technology, 3rd Edition, R.S. Ramotowski (Ed.), CRC Press, Boca Raton (2013).

B.Sc. Forensic Science: Semester-V FST553: Chemistry Lab - V	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course Objective: To give the students a hands on approach toward the physical chemistry

Experiment Details

1. Determination of water equivalent of a calorimeter (cooling curve).
2. Heat of neutralization (strong acid-strong base). 2. Heat of dissociation of weak acid.
3. Heat of solution (NH₄NO₃, CaCl₂).
4. Basicity of an acid by thermochemical method.

Suggested Readings

1. Physical Chemistry, P. Atkins and J. De Paul, 8th Edition (2006), International Student Edition, Oxford University Press.
2. Physical Chemistry, P. C. Rakshit, 5th Edition (1988), 4th Reprint (1997), Sarat Book House, Calcutta.
3. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma, and M. S. Pathania, 37th Edition (1998), Shoban Lal Nagin Chand & Co., Jalandhar.
4. Physical Chemistry, K. J. Laidler and J. M. Meiser, 3rd Edition, Houghton Mifflin Comp., New York, International Edition (1999)

B.Sc. Forensic Science: Semester-V FST554: Physics Lab - V	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

- perimental physics has the most striking impact on the industry wherever the instruments are used to study and
- determine the optical Exproperties. Measurement precision and perfection is achieved through Lab Experiments.
- Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.

Lab Experiment List

- Fresnel Biprism: Wavelength of sodium light
- Fresnel Biprism: Thickness of mica sheet)
- Newton’s Rings: Wavelength of sodium light
- Newton’s Rings: Refractive index of liquid
- Plane Diffraction Grating: Resolving power
- Plane Diffraction Grating: Spectrum of mercury light
- Spectrometer: Refractive index of the material of a prism using sodium light
- 8. Spectrometer: Dispersive power of the material of a prism using mercury light
- 9. Polarimeter: Specific rotation of sugar solution
- 10. Wavelength of Laser light using diffraction by single slit

Suggested Readings:

1. B.L. Worsnop, H.T. Flint, “Advanced Practical Physics for Students”, Methuen & Co., Ltd., London, 1962, 9e
2. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd., 2015, 1e
3. R.K. Agrawal, G. Jain, R. Sharma, “Practical Physics”, Krishna Prakashan Media (Pvt.) Ltd., Meerut, 2019
4. S.L. Gupta, V. Kumar, “Practical Physics”, Pragati Prakashan, Meerut, 2014, 2e

B.Sc. Forensic Science: Semester-V	
FST555: Zoology Lab - V	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

The student at the completion of the course will be able to:

- identify the abilities of non- chordates diversity
- explain structural and functional diversity of non- chordates
- explain evolutionary relationship amongst non- chordates
- Enable students to take up research in biological sciences.

Unit I
<ul style="list-style-type: none"> • Study of animal specimens of various animal phyla. • To prepare permanent stained slide of septal nephridia of earthworm. • To take out the nerve ring of earthworm. • To take out hastate plate from Palaemon.
Unit II
<ul style="list-style-type: none"> • Permanent Preparation of: Euglena, Paramecium • Study of prepared slides/specimens of Entamoeba, Giardia, Leishmania, Trypanosoma, Plasmodium, Fasciola, Cotugnia, Taenia, Rallietina, Polystoma Schistosoma, Echinococcus, Enterobius, Ascaris and Ancylostoma • Permanent Preparation of Cimex (bed bug)/ Pediculus (Louse), Haematopinus (cattle louse), fresh water annelids, arthropods; and soil arthropods. •
Unit III
<ul style="list-style-type: none"> • Larval stages of helminths and arthropods. • Permanent mount of wings, mouth parts and developmental stages of mosquito and house fly. • Permanent preparation of ticks/ mites, abdominal gills of aquatic insects viz. Chironomus larva, dragonfly and mayfly nymphs, preparation of antenna of housefly. • Cockroach : Central nervous system

Suggested Readings:

1. Barnes et al (2009). The Invertebrates: A synthesis. Wiley Backwell 17
2. Marshall: Parker & Haswell Text Book of Zoology, Vol. I (7th ed 1972, Macmillan)
3. Moore: An Introduction to the Invertebrates (2001, Cambridge University Press)
4. Brusca and Brusca (2016) Invertebrates. Sinauer
5. Jan Pechenik (2014) Biology of the invertebrates. McGraw Hill
6. Boradale, L.A. and Potts, E.A. (1961). Invertebrates: A Manual for the use of Students. Asia Publishing Home
7. Robert Leo Smith Ecology and field biology Harper and Row publisher

B.Sc. Forensic Science: Semester-V FST556: Computer Lab - V	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

- Optimize the solution with respect to time complexity & memory usage
- Assess how the choice of data structures and algorithm design methods impacts the performance of programs.
- Choose the appropriate data structure and algorithm design method for a specified application.
- Solve problems using data structures such as linear lists, stacks, queues, binary trees, binary search trees and writing programs for these solutions

Lab Experiment List

- Write a program that uses functions to perform the following:
 - a) Create a singly linked list of integers.
 - b) Delete a given integer from the above linked list.
 - c) Display the contents of the above list after deletion.
- Write a program that uses functions to perform the following:
 - a) Create a doubly linked list of integers.
 - b) Delete a given integer from the above doubly linked list.
 - c) Display the contents of the above list after deletion.
- Write a program that uses stack operations to convert a given infix expression into its postfix Equivalent, implement the stack using an array.
- Write program to implement a double ended queue using
 - i) array and
 - ii) doubly linked list respectively.
- Write a program that uses functions to perform the following:
 - a) Create a binary search tree of characters.
 - b) Traverse the above Binary search tree recursively in Postorder.

B.Sc. Forensic Science: Semester-V FST557: Botany Lab - V	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

After the completion of the course the students will be able to:

- Know and authentic the physiological processes undergoing in plants along with their metabolism
- Identify Mineral deficiencies based on visual symptoms

List of Experiments

- Determination of osmotic potential of plant cell sap by plasmolytic method using leaves of Rhoeo / Tradescantia.
- Osmosis – by potato osmoscope experiment
- Experiment to demonstrate the transpiration phenomenon with the bell jar method
- Experiment for demonstration of Transpiration by Four-Leaf Experiment:
- Structure of stomata (dicot & monocot)
- Determination of rate of transpiration using cobalt chloride method.
- To study the phenomenon of seed germination (effect of light).
- To study the induction of amylase activity in germinating grains.

Suggested Readings:

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. A Laboratory Manual Of Plant, Physiology, Biochemistry And Ecology ISBN : 9788177544589 Edition: 01 Year : 2012 Author : Akhtar Inam Publisher : Agrobios (India)
3. Advanced Methods In Physiology And Biochemistry (pb) ISBN : 9789381191132 Edition : 01 Year : 2016 Author : Padmanaban G, Chandrasekaran CN, Thangavelu AU, Dr. Sivakumar R, Kalimuthu N, Dr. Boominathan P, Dr. Anbarasan P, Agrobios.
4. Methods in Plant Biochemistry and Molecular Biology. 1997. Dashek, WV (ed.). CRC Press.
5. Wilson and Walker .Practical Biochemistry: Principles and Techniques. Cambridge University Press.U.K.
6. Thimmaiah, SR. 2004. Standard Methods of Biochemical Analysis. Kalyani Publishers.
7. Henry, RJ. 1997. Practical Application of Plant Molecular Biology. Chapman & Hall, London

B.Sc. Forensic Science: Semester-VI FST 601: Forensic Medicine & Toxicology	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

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

- a. What is death called in context of Medicine.
- b. The Signs of death
- c. The importance of ascertaining whether the crime was staged to appear as suicide or accident.
- d. Types of injuries
- e. The importance of forensic odontology
- f. The significance of toxicological studies in forensic science.
- g. The classification of poisons and their modes of actions.
- h. The absorption of poisons in body fluids.
- i. The forensic identification of illicit liquors.
- j. The classification and characteristics of the narcotics, drugs and psychotropic substances.
- k. The menace of designer drugs.
- l. The methods of identifying narcotic, drugs and psychotropic substances.

Unit 1: Thanatology

Definition. Brain/Brainstem Death, Cause, Mechanism and Manner of Death, Modes of Death, Anoxia, Sudden Death

Signs of Death

Definition. Immediate Changes, Early Changes, Cooling of the Dead Body, Postmortem Staining, Rigor Mortis, Cadaveric Spasm, Decomposition/Putrefaction, Estimation of Time Since Death

Asphyxia

Introduction. Hanging, Strangulation, Throttling, Drowning, Sexual Asphyxia, Drowning

Unit 2: Injuries

Definition, Classification of Wounds/Injuries, Firearm injury, Regional injury, Thermal injury, Transportation injury

Forensic Anthropology and Odontology

Study of human bones and estimation of age and sex. Development, scope and role of forensic odontology in mass disaster and anthropology. Types of teeth and their comparative anatomy.

Bite marks. Forensic significance of bite marks. Collection, preservation and photography of bite marks evidence. Legal aspects of bite marks. Estimation of age from teeth.

Unit 3: Basics of Toxicology

Introduction and Brief History. Significance of toxicological findings. Techniques used in toxicology. Dose-response relationship. Lethal dose 50 and effective dose 50.

Poison

Definition. Classification of poisons. Physico-chemical characteristics and mode of action of poisons. Accidental, suicidal and homicidal poisoning in India. Signs and symptoms of common poisoning.

Unit 4: Collection, Preservation and Examination of Evidence

Collection and Preservation of viscera, blood and urine in various cases of poisoning. Identification of biocides and metal salts in body fluids. Metabolism and excretion of poisons. Analysis and identification of ethyl alcohol. Estimation of ethyl alcohol in blood and urine.

Unit 5: Narcotic Drugs and Psychotropic Substances

Definition as per NDPS Act. Broad classification – Narcotics, stimulants, depressants and hallucinogens. General characteristics and common example of each class. Natural, synthetic and semi-synthetic narcotic drugs and psychotropic substances. Designer drugs.

Isolation and Detection – Presumptive and screening tests for narcotic drugs and psychotropic substances. Microcrystalline testing of drugs of abuse. Dope tests.

Postmortem changes affecting the analysis of narcotic drugs and psychotropic substances.

Suggested Readings

1. Gautam Biswas, *Review of Forensic Medicine and Toxicology*, 4th Edition, Jaypee Brothers Medical Publishers
2. K S Narayan Reddy, *The Essentials of Forensic Medicine and Toxicology*, 34th Edition, Jaypee Brothers Medical Publishers
3. J P Modi, *A Textbook of Medical Jurisprudence and Toxicology*, Lexis Nexis
4. K. Smyth, *The Cause of Death*, Van Nostrand and Company, New York (1982).
5. M. Bernstein, Forensic odontology in, *Introduction to Forensic Sciences*, 2nd Ed., W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).

B.Sc.: Semester-VI	
FST 602: Minor Project	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Internal Assessment- 30marks
Tutorials: 1 hr/Week	External Assessment- 70marks
Credits: 4	

The minor project will be based on a research topic in Forensic Science. The topic will be assigned in consultation with police and forensic science establishments, giving due consideration to the problem areas faced by these institutions. The students will be expected to undertake extensive field work, in collaboration with mobile police laboratories. Students are required to submit a project report to the department in partial fulfillment of their degree. Students shall also present his/her topic to the examiners through power point presentation.

B.Sc. Forensic Science: Semester-VI	
FST603: Chemistry - VI	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course Objective: After completion the student will know about-

- Thermodynamics and its laws
- Electrochemical cell and its application
- Chemical kinetics and complex reactions

Unit 1: Thermodynamics

Second Law of Thermodynamics, Carnot cycle, entropy, entropy changes in reversible and irreversible processes and of universe, physical concept of entropy, entropy changes of an ideal gas in different processes, entropy of an ideal gas, entropy changes in mixture of gases. Joule-Thomson effect, Joule-Thomson coefficient of real (van der Waal) gases, inversion temperature. Free energy and its concept, Gibbs and Helmholtz free energies and their relationship, variation of free energy with temperature and pressure. Free energy and equilibrium constant. Maxwell's relations, Gibbs-Helmholtz equations, its application for the determination of ΔG , ΔH , ΔS of a reversible cell reaction. Criteria for reversible and irreversible processes based on entropy and free energy. Partial molal quantities, chemical potential, the Gibbs-Duhem equation, determination of partial molal quantities, variation of chemical potential with temperature and pressure, chemical potential in case of a system of ideal gases.

Unit 2: Phase Equilibria

Thermodynamics of phase transition-Clapeyron-Clausius equation and its applications. Phase rule, phase, component, degree of freedom, thermodynamic derivation of phase rule, phase diagrams of one-component system (water), two component systems (phenolwater, lead-silver). The distribution law, applications to cases of dissociation and association of solutes in one of the phases, solvent extraction, equilibrium constant from distribution coefficient ($K_1 + I_2 = K_3$).

Unit 3: Electrochemical Cells

Reactions in reversible cells, free energy and emf of reversible cell. Single electrode potential (Nernst equation), its measurement and sign convention. Standard electrode potential. Emf of reversible cell from electrode potentials. Types of reversible electrode, reference electrodes. Applications of emf measurements: determination of ionic activities, pH, and equilibrium constant. Potentiometric titration. Concentration cells with and without transference. Liquid junction potential and its elimination.

Unit 4: Chemical Kinetics

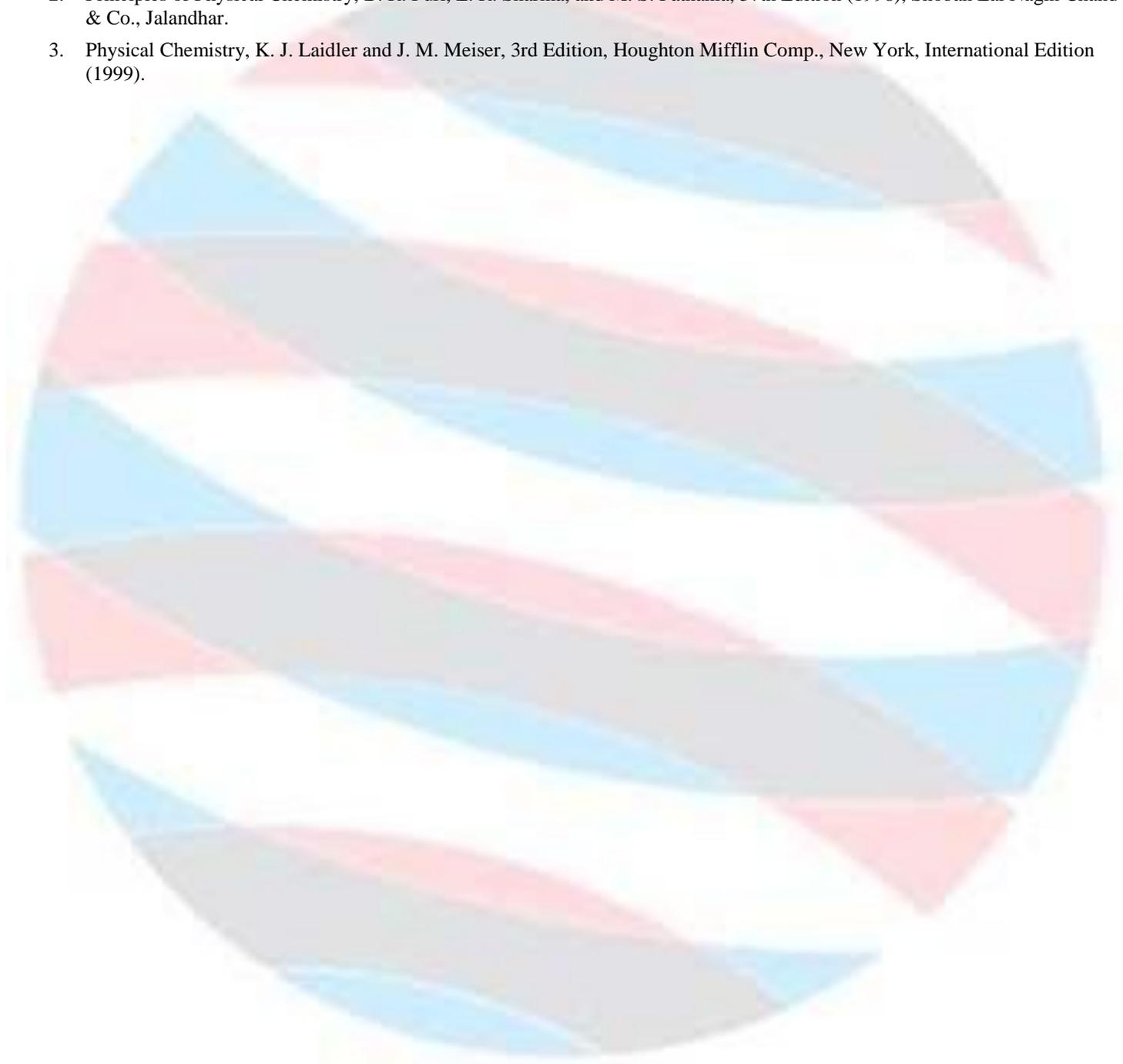
Order and molecularity of chemical reactions, pseudo order. Kinetic law for second order reactions, determination of the rate constant and order of reaction from kinetic data. Effect of temperature on rate of reaction: collision theory of rates of bimolecular reactions and its comparison with Arrhenius equation.

Unit 5: Complex reactions

Reversible (first order in both directions), concurrent, consecutive reactions. Unimolecular gas reactions (Lindmann theory), steady-state approximations, theory of absolute reaction rate and its thermodynamic formulation.

Suggested Readings

1. Physical Chemistry, P. C. Rakshit, 5th Edition (1985), 4th Reprint (1997), Sarat Book House, Calcutta.
2. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma, and M. S. Pathania, 37th Edition (1998), Shoban Lal Nagin Chand & Co., Jalandhar.
3. Physical Chemistry, K. J. Laidler and J. M. Meiser, 3rd Edition, Houghton Mifflin Comp., New York, International Edition (1999).



B.Sc. Forensic Science: Semester-VI	
FST604: Physics - VI	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

The student at the completion of the course will be able to:

- Study the drift and diffusion of charge carriers in a semiconductor.
- Understand the Two-Port model of a transistor.
- Study the working, properties and uses of FETs.
- Comprehend the design and operations of SCRs and UJTs.
- Understand various number systems and binary codes.
- Familiarize with binary arithmetic.
- Study the working and properties of various logic gates.
- Comprehend the design of combinational and sequential circuits.

Unit I – Semiconductor Junction
<ul style="list-style-type: none"> • Expressions for Fermi energy, Electron density in conduction band, Hole density in valence band, Drift of charge carriers (mobility & conductivity), Diffusion of charge carries and Life time of charge carries in a semiconductor. Work function in metals and semiconductors. Expressions for Barrier potential, Barrier width and Junction capacitance (diffusion & transition) for depletion layer in a PN junction. Expressions for Current (diode equation) and Dynamic resistance for PN junction.
Unit II – Transistor Modeling
<ul style="list-style-type: none"> • Transistor as Two-Port Network. Notation for dc & ac components of voltage & current. Quantitative discussion of Z, Y & h parameters and their equivalent two-generator model circuits. h-parameters for CB, CE & CC configurations. Analysis of transistor amplifier using the hybrid equivalent model and estimation of Input Impedance, Output Impedance and Gain (current, voltage & power).
Unit III – Number System
<ul style="list-style-type: none"> • Number Systems: Binary, Octal, Decimal & Hexadecimal number systems and their inter conversion. • Binary Codes: BCD, Excess-3 (XS3), Parity, Gray, ASCII & EBCDIC Codes and their advantages & disadvantages. Data representation.
Unit IV – Logic Gates
<ul style="list-style-type: none"> • Truth Table, Symbolic Representation and Properties of OR, AND, NOT, NOR, NAND, EX-OR & EX-NOR Gates. Implementation of OR, AND & NOT gates (realization using diodes & transistor) De Morgan's theorems. NOR & NAND gates as Universal Gates. Application of EX-OR & EXNOR gates as parity checker. Boolean Algebra. Karnaugh Map.
Unit V – Combinational & Sequential Circuits
<ul style="list-style-type: none"> • Combinational Circuits: Half Adder, Full Adder, Parallel Adder, Half Subtractor, Full Subtractor. Data Processing Circuits: Multiplexer, Demultiplexer, Decoders & Encoders. Sequential Circuits: SR, JK & D Flip-Flops, Shift Register (transfer operation of Flip-Flops), and Asynchronous & Synchronous counters.

Suggested Readings:

1. R.L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall of India Pvt. Ltd., 2015, 11e
2. Millman, C.C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits", McGraw Hill, 2015, 4e
3. B.G. Streetman, S.K. Banerjee, "Solid State Electronic Devices", Pearson Education India, 2015, 7e
4. J.D. Ryder, "Electronic Fundamentals and Applications", Prentice-Hall of India Private Limited, 1975, 5e
5. S.L. Gupta, V. Kumar, "Hand Book of Electronics", Pragati Prakashan, Meerut, 2016, 43e
6. D. Leach, A. Malvino, Goutam Saha, "Digital Principles and Applications", McGraw Hill, 2010, 7e
7. William H. Gothmann, "Digital Electronics: An Introduction to Theory and Practice", Prentice-Hall of India Private Limited, 1982, 2e
8. R.P. Jain, "Modern Digital Electronics", McGraw Hill, 2009, 4e

B.Sc. Forensic Science: Semester-VI	
FST605: Zoology - VI	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

The student at the completion of the course will be able to:

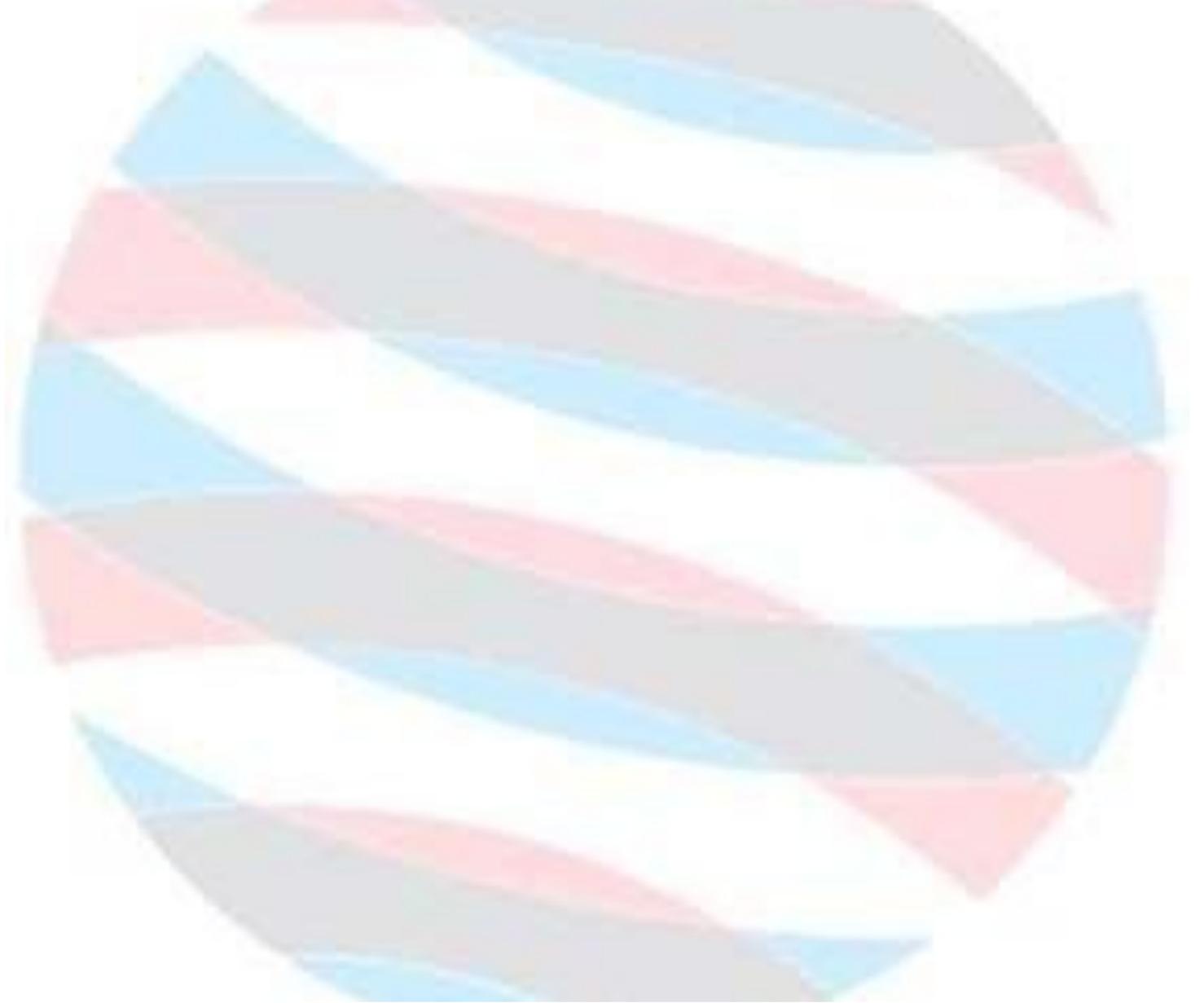
- Demonstrate comprehensive identification abilities of chordate diversity
- Explain structural and functional diversity of chordates
- Explain evolutionary relationship amongst chordates
- Take up research in biological sciences.

Unit I – Chordates
<ul style="list-style-type: none"> • Origin of Chordates. • Classification of Phylum Chordata up to the class.
Unit II – Hemichordata
<ul style="list-style-type: none"> • Hemichordata: General characteristics, classification and detailed study of Balanoglossus (Habit and Habitat, Morphology, Anatomy, Physiology and Development).
Unit III – Cephalochordata
<ul style="list-style-type: none"> • Cephalochordata: General characteristics, classification and detailed study of Branchiostoma (Amphioxus) (Habit and Habitat, Morphology, Anatomy, Physiology).
Unit IV – Urochordata
<ul style="list-style-type: none"> • Urochordata: General characteristics, classification and detailed study of Herdmania (Habit and Habitat, Morphology, Anatomy, Physiology and Post Embryonic Development).
Unit V – Classification and General Characteristics of Vertebrates
<ul style="list-style-type: none"> • General characters and Classification of different classes of vertebrates (Pisces, Amphibia, Reptilia, Aves, Mammalia) up to the order with examples. • Poisonous and Non Poisonous Snakes and biting mechanism. • Neoteny and Paedogenesis • Migration in birds • Dentition in Mammals

Suggested Readings:

1. Harvey et al: The Vertebrate Life (2006)
2. Colbert et al: Colbert's Evolution of the Vertebrates: A history of the backboned animals through time (5th ed 2002, Wiley - Liss)
3. Hildebrand: Analysis of Vertebrate Structure (4th ed 1995, John Wiley)
4. Kenneth V. Kardong (2015) Vertebrates: Comparative Anatomy, Function, Evolution McGraw Hill

5. McFarland et al: Vertebrate Life(1979, Macmillan Publishing)
6. Parker and Haswell: TextBook of Zoology, Vol. II (1978, ELBS)
7. Romer and Parsons: The Vertebrate Body (6th ed 1986, CBS Publishing Japan)
8. Young: The Life of vertebrates (3rd ed 2006, ELBS/Oxford)
9. Weichert C.K and William Presch (1970). Elements of Chordate Anatomy, Tata McGraw Hills



B.Sc. Forensic Science: Semester-VI	
FST606: Computer Science - VI	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

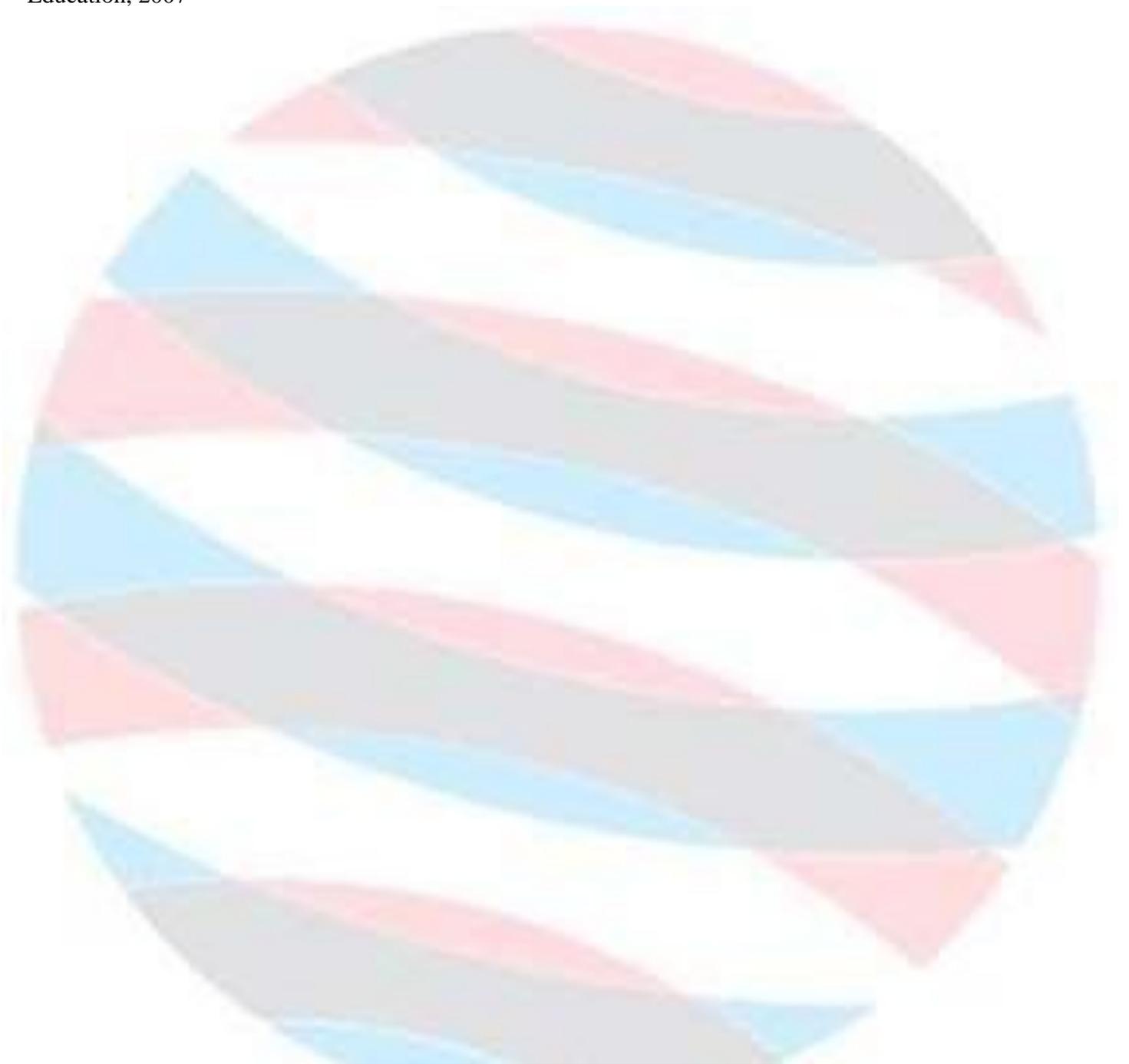
After the completion of the course the students will be able:

- To develop understanding of computer networks and communication basics.
- To understand design issues and services at different layers of reference models.
- To learn various error detection/correction techniques, routing protocols, congestion control algorithms, and connection establishment/release.
- To describe and analyze related technical, administrative, and social aspects of networking.

Unit I – Data Communication and Computer Network
<ul style="list-style-type: none"> • Introduction to Signals, Data and Information, Data communication, Characteristics of data communication, Components of data communication, Data Representation, Data Flow, Simplex, Half Duplex, Full Duplex, Analog and Digital Signals, Periodic and Aperiodic signals, Time and Frequency Domain, Composite Signals
Unit II – Basic concepts of Networks
<ul style="list-style-type: none"> • Components of data communication, standards and organizations, Network Classification, Network Topologies ; network protocol; layered network architecture; overview of OSI reference model; overview of TCP/IP protocol suite. • Physical Layer: Cabling, Network Interface Card, Transmission Media Devices- Repeater, Hub, Bridge, Switch, Router, Gateway.
Unit III – Data Link Layer
<ul style="list-style-type: none"> • Designing issues, Framing and Data Link Control, Error detection schemes (parity, checksums, CRCs), Error correction schemes (Hamming codes, binary convolution codes), Data link layer protocols (Simplex, Stop & Wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ, Sliding Window), MAC sub layer (Ethernet, ALOHA, CSMA family, Contention-free access/Token Ring).
Unit IV – Network Layer
<ul style="list-style-type: none"> • Design issues, Switching, Routing algorithms (Shortest path, Link state, Flooding, Broadcast, Multicast), Packet Scheduling, Internetworking, Internet Protocol (IPv4, IPv6), IP addressing, Internet Control Protocols (ICMP, ARP, DHCP), Mobile IP.
Unit V
<ul style="list-style-type: none"> • Transport Layer: Transport layer services, Connection establishment and teardown, TCP, UDP, Congestion Control, Quality of Service, Domain Name System, World Wide Web. • Application Layer : Application layer protocols and services – Domain name system, HTTP, WWW, telnet, FTP, SMTP • Network Security : Common Terms, Firewalls, Virtual Private Networks

Suggested Readings:

1. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks," Fifth Edition, Pearson, 2014.
2. William Stallings, "Data and Computer Communications", Tenth Edition, Pearson, 2013.
3. Behrouz A. Forouzan, "Data Communications and Networking," Fourth Edition, McGraw-Hill Higher Education, 2007



B.Sc. Forensic Science: Semester-VI	
FST607: Botany - VI	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

Course outcomes:

After the completion of the course the students will be able:

- Acquire knowledge on ultrastructure of cell.
- Understand the structure and chemical composition of chromatin and concept of cell division.
- Interpret the Mendel's principles, acquire knowledge on cytoplasmic inheritance and sex linked inheritance.
- Understand the concept of 'one gene one enzyme hypothesis' along with molecular mechanism of mutation.
- Interpret the concept of Lemarkism, Neo Lamarkism, Darwinism and also understand the concept of natural selection.

Unit I – Cell biology

- Structure and function of cell wall, plasma membrane, ribosomes, Endoplasmic reticulum, golgi apparatus, mitochondria, chloroplast, lysosomes, peroxisomes and cell inclusions - Organization of nucleus: nuclear envelope, nucleoplasm and nucleolus. Chromosomal nomenclature- chromatids, centromere, telomere, satellite, secondary constriction. Organization of chromosomes- Nucleic acid and histones- types and classification. Lampbrush chromosomes and polytene chromosomes- Karyotype and idiogram. Cell cycle: G₀, G₁, S and G₂ phases – mitosis: open and closed mitosis – amitosis - meiosis. Variation in Chromosome number (Numerical aberrations)- aneuploidy and Euploidy-haploidy , polyploidy- significance (Structural aberrations) - deletion, duplication, inversion and translocation.

Unit II – Genetics

- Chromosome theory of inheritance, crossing over and linkage; Incomplete dominance and codominance; Interaction of Genes; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Polygenic inheritance; Extra-nuclear Inheritance, Linkage, crossing over , Concept of sex determination and Sex chromosomes; Patterns of Sex determination in plants

Unit III – Plant breeding

- Plant introduction. Agencies of plant introduction in India, Procedure of introduction -Acclimatization – Achievements, Selection - mass selection, pure line selection and clonal selection. Genetic basis of selection methods , Hybridization: Procedure of hybridization, inter generic, inter specific, inter varietal hybridization with examples. Composite and synthetic varieties, Male sterility , Heterosis and its exploitation in plant breeding, Mutation, Molecular Breeding (use of DNA markers in plant breeding) , achievements in India, Breeding for pest, pathogenic diseases and stress resistance.

Unit IV – Plant tissue culture

- Principles, components and techniques of in vitro plant cultures, Callus cultures, Cell culture, cell suspension cultures, Embryogenesis and organogenesis , Protoplast- isolation and culturing of

protoplast- principle and application, regeneration of protoplasts, protoplast fusion and somatic hybridization- selection of hybrid cells, Somaclonal variation, , Plant secondary metabolites production.

Unit V – Biostatistics

- Definition, statistical methods, basic principles, variables- measurements, functions, limitations and uses of statistics. Biometry: Data, Sample, Population, random sampling, Frequency distribution- definition only, Central tendency– Arithmetic Mean, Mode and Median; Measurement of dispersion– Coefficient of variation, Standard Deviation, Standard error of Mean; Test of significance: chi- square test for goodness of fit. Computer application in biostatistics - MS Excel and SPSS

Suggested Readings:

1. G.M. Cooper. (2015). The cell: A Molecular Approach. 7th Edition. Sinauer Associates.
2. Alberts, B., Johnson, A.D., Lewis, J., Morgan, D., Raff, M., Roberts, K., Walter, P. (2014). Molecular Biology of Cell. 6th Edition. WW. Norton & Co.
3. Campbell, M.K. (2012) Biochemistry, 7th ed., Published by Cengage Learning.
4. Campbell, P.N. and Smith, A.D. (2011). Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone
5. Tymoczko, J.L., Berg, J.M. and Stryer, L. (2012). Biochemistry: A short course, 2nd ed., W.H.Freeman.
6. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2011) Biochemistry, W.H.Freeman and Company
7. Nelson, D.L. and Cox, M.M. (2008). Lehninger Principles of Biochemistry, 5th Ed., W.H. Freeman and Company.
8. Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition.
9. Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell. 8th edition. Pearson Education Inc. U.S.A.)
10. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, John Wiley & sons, India. 8th e
11. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India.5th edition.

B.Sc. Forensic Science: Semester-VI	
FST651: Examination of Human Bones and Toxicological Samples	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

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

- a. Significance of somatoscopy and somatometry.
- b. Anthropometry and its application in forensic science
- c. The importance of forensic odontology
- d. The significance of toxicological studies in forensic science.
- e. The classification of poisons and their modes of actions.
- f. The absorption of poisons in body fluids.
- g. The forensic identification of illicit liquors.
- h. The classification and characteristics of the narcotics, drugs and psychotropic substances.
- i. The menace of designer drugs.
- j. The methods of identifying narcotic, drugs and psychotropic substances.

Experiment Details

1. To analyze and preserve bite marks.
2. To determine of age from skull and teeth.
3. To determine of sex from skull.
4. To determine sex from pelvis.
5. To study identification and description of bones and their measurements.
6. To investigate the differences between animal and human bones.
7. To identify biocides.
8. To identify metallic poisons.
9. To identify organic poisons.
10. To identify ethyl alcohol.
11. To identify methyl alcohol.
12. To carry out quantitative estimation of ethyl alcohol.
13. To prepare iodoform.
14. To identify drugs of abuse by spot tests.
15. To perform color tests for barbiturates.
16. To separate drugs of abuse by thin layer chromatography.

Suggested Reading

1. Gautam Biswas, *Review of Forensic Medicine and Toxicology*, 4th Edition, Jaypee Brothers Medical Publishers
2. K S Narayan Reddy, *The Essentials of Forensic Medicine and Toxicology*, 34th Edition, Jaypee Brothers Medical Publishers
3. J P Modi, *A Textbook of Medical Jurisprudence and Toxicology*, Lexis Nexis
4. K. Smyth, *The Cause of Death*, Van Nostrand and Company, New York (1982).
5. M. Bernstein, Forensic odontology in, *Introduction to Forensic Sciences*, 2nd Ed., W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).

B.Sc. Forensic Science: Semester-VI FST653: Chemistry Lab - VI	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course Objective: To give the students a hands on approach toward the physical chemistry

Experiment Details

1. Critical Solution Temperature.
2. Effect of impurity on Critical Solution Temperature.
3. Distribution of solute in two immiscible solvents (without association).
4. Distribution of solute in two immiscible solvents (with association in one solvent).
5. Determination of pH of a given buffer.

Suggested Readings

1. Physical Chemistry, P. C. Rakshit, 5th Edition (1985), 4th Reprint (1997), Sarat Book House, Calcutta.
2. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma, and M. S. Pathania, 37th Edition (1998), Shoban Lal Nagin Chand & Co., Jalandhar.
3. Physical Chemistry, K. J. Laidler and J. M. Meiser, 3rd Edition, Houghton Mifflin Comp., New York, International Edition (1999).

B.Sc. Forensic Science: Semester-VI FST654: Physics Lab - VI	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

- Analog & digital circuits have the most striking impact on the industry wherever the electronics instruments are used to study and determine the electronic properties. Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.

Lab Experiment List

- Energy band gap of semiconductor by reverse saturation current method
- Energy band gap of semiconductor by four probe method
- Hybrid parameters of transistor
- Characteristics of FET, MOSFET, SCR, UJT
- FET Conventional Amplifier
- FET as VVR and VCA
- Study and Verification of AND gate using TTL IC 7408
- Study and Verification of OR gate using TTL IC 7432
- Study and Verification of NAND gate and use as Universal gate using TTL IC 7400
- Study and Verification of NOR gate and use as Universal gate using TTL IC 7402
- Study and Verification of NOT gate using TTL IC 7404
- Study and Verification of Ex-OR gate using TTL IC 7486

Suggested Readings:

1. R.L. Boylestad, L. Nashelsky, “Electronic Devices and Circuit Theory”, Prentice-Hall of India Pvt. Ltd., 2015, 11e
2. J. Millman, C.C. Halkias, Satyabrata Jit, “Electronic Devices and Circuits”, McGraw Hill, 2015, 4e
3. B.G. Streetman, S.K. Banerjee, “Solid State Electronic Devices”, Pearson Education India, 2015, 7e
4. J.D. Ryder, “Electronic Fundamentals and Applications”, Prentice-Hall of India Private Limited, 1975, 5e
5. S.L. Gupta, V. Kumar, “Hand Book of Electronics”, Pragati Prakashan, Meerut, 2016, 43e
6. D. Leach, A. Malvino, Goutam Saha, “Digital Principles and Applications”, McGraw Hill, 2010, 7e
7. William H. Gothmann, “Digital Electronics: An Introduction to Theory and Practice”, Prentice-Hall of India Private Limited, 1982, 2e
8. R.P. Jain, “Modern Digital Electronics”, McGraw Hill, 2009, 4e

B.Sc. Forensic Science: Semester-VI FST655: Zoology Lab - VI	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

The student at the completion of the course will be able to:

- identify the abilities of chordates diversity
- explain structural and functional diversity of chordates
- explain evolutionary relationship amongst chordates
- Enable students to take up research in biological sciences.

Unit I
<ul style="list-style-type: none"> • Study of animal specimens of various animal phyla. • Study on use and ethical handling of model organisms (Mice, rats, rabbit and pig). • To prepare stained/unstained slide of placoid scales. • Comparative study of bones of different vertebrates. • Comparative study of histological slides of different tissues of vertebrates.
Unit II
<ul style="list-style-type: none"> • Identification of pests. • Different types of important edible fishes of India.

Suggested Readings:

1. Harvey et al: The Vertebrate Life (2006)
2. Colbert et al: Colbert's Evolution of the Vertebrates: A history of the backboned animals through time (5th ed 2002, Wiley - Liss)
3. Hildebrand: Analysis of Vertebrate Structure (4th ed 1995, John Wiley)
4. Kenneth V. Kardong (2015) Vertebrates: Comparative Anatomy, Function, Evolution McGraw Hill
5. McFarland et al: Vertebrate Life (1979, Macmillan Publishing)
6. Parker and Haswell: TextBook of Zoology, Vol. II (1978, ELBS)
7. Romer and Parsons: The Vertebrate Body (6th ed 1986, CBS Publishing Japan)
8. Young: The Life of vertebrates (3rd ed 2006, ELBS/Oxford)
9. Santanam, B. et al, A manual of freshwater aquaculture
10. Boyd. C.E. & Tucker. C.S, Pond aquaculture water quality management

B.Sc. Forensic Science: Semester-VI FST656: Computer Lab - VI	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

- Understand and explain the concept of Data Communication and networks, layered architecture and their applications.
- Analyze and Set up protocol designing issues for Communication networks.
- Evaluate data communication link considering elementary concepts of data link layer protocols for error detection and correction.
- Apply various network layer techniques for designing subnets and supernets and analyze packet flow on basis of routing protocols.
- Estimate the congestion control mechanism to improve quality of service of networking application

Software Lab based on Computer Networks

- Implement the concepts of Computer Networks such as:
 1. Simulate Checksum Algorithm.
 2. Simulate CRC Algorithm
 3. Simulate Stop & Wait Protocol.
 4. Simulate Go-Back-N Protocol.
 5. Simulate Selective Repeat Protocol.

Suggested Readings:

1. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks," Fifth Edition, Pearson, 2014.
2. William Stallings, "Data and Computer Communications", Tenth Edition, Pearson, 2013.
3. Behrouz A. Forouzan, "Data Communications and Networking," Fourth Edition, McGraw-Hill Higher Education, 2007

B.Sc. Forensic Science: Semester-VI FST657: Botany Lab - VI	
Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week Credits: 2	Internal Assessment – 15 Marks
	External Assessment – 35 Marks
	End Semester Exam – 50 marks

Course outcomes:

After the completion of the course the students will be able:

- To perform all experiments related to the semester-i.e. Plant tissue cultured plants, conducting breeding on field, conserving and depolluting the environment.
- Can be employed in environment impact assessment companies & start his own venture.

Unit I – Cell biology

- Study of plant cell structure with the help of epidermal peel mount of Onion/Rhoeo/Crinum
- Measurement of cell size by the technique of micrometry.
- Counting cells per unit volume with the help of haemocytometer (Yeast/pollen grains)
- Determination of mitotic index and frequency of different mitotic stages in pre-fixed root tips of Allium cepa.

Unit II – Genetics

- Monohybrid cross (Dominance and incomplete dominance)
- Dihybrid cross (Dominance and incomplete dominance)
- Gene interactions (All types of gene interactions mentioned in the syllabus)
 - a. Recessive epistasis 9: 3: 1.
 - b. Dominant epistasis 12: 3: 1
 - c. Complementary genes 9: 7
 - d. Duplicate genes with cumulative effect 9: 6: 1
 - e. Inhibitory genes 13: 3
- Observe the genetic variations among inter and intra specific plants.
- Demonstration of Breeding techniques-Hybridization, case studies of mutation, polyploidy, emasculation experiment

Suggested Readings:

1. Practical Botany (Part III) Author: Sunil D Purohit, Anamika Singhvi & Kiran Tak 2013 Apex Publishing House,Raj.
2. Practical Botany (Part II) Author: N. C. Aery, Sunil D Purohit & Gotam K Kukda 2013 Apex Publishing House,Raj.
3. A Handbook Of Soil, Fertilizer And Manure (2nd Ed.) (pb) ISBN : 9788177544152Edition : 02Year : 2017Author : Gupta PKPublisher : Agrobios (India)
4. Green Technology: An Approach For Sustainable Environment ISBN : 9788177543438Edition : 01Year : 2021Author : Dr. Purohit SSPublisher : Agrobios (India)

5. Laboratory Manual Of Chemical And Bacterial Analysis Of Water And Sewage ISBN: 9788177540802 Edition : 01 Year : 2011 Author : Theroux FR , Eldridge EF , Mallmann WLPublisher : Agrobios (India)
6. Methods In Environmental Analysis: Water Soil And Air (2nd Ed.) ISBN : 9788177543087 Edition : 02 Year : 2021 Author : Gupta PK Publisher : Agrobios (India)

