

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; 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		
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

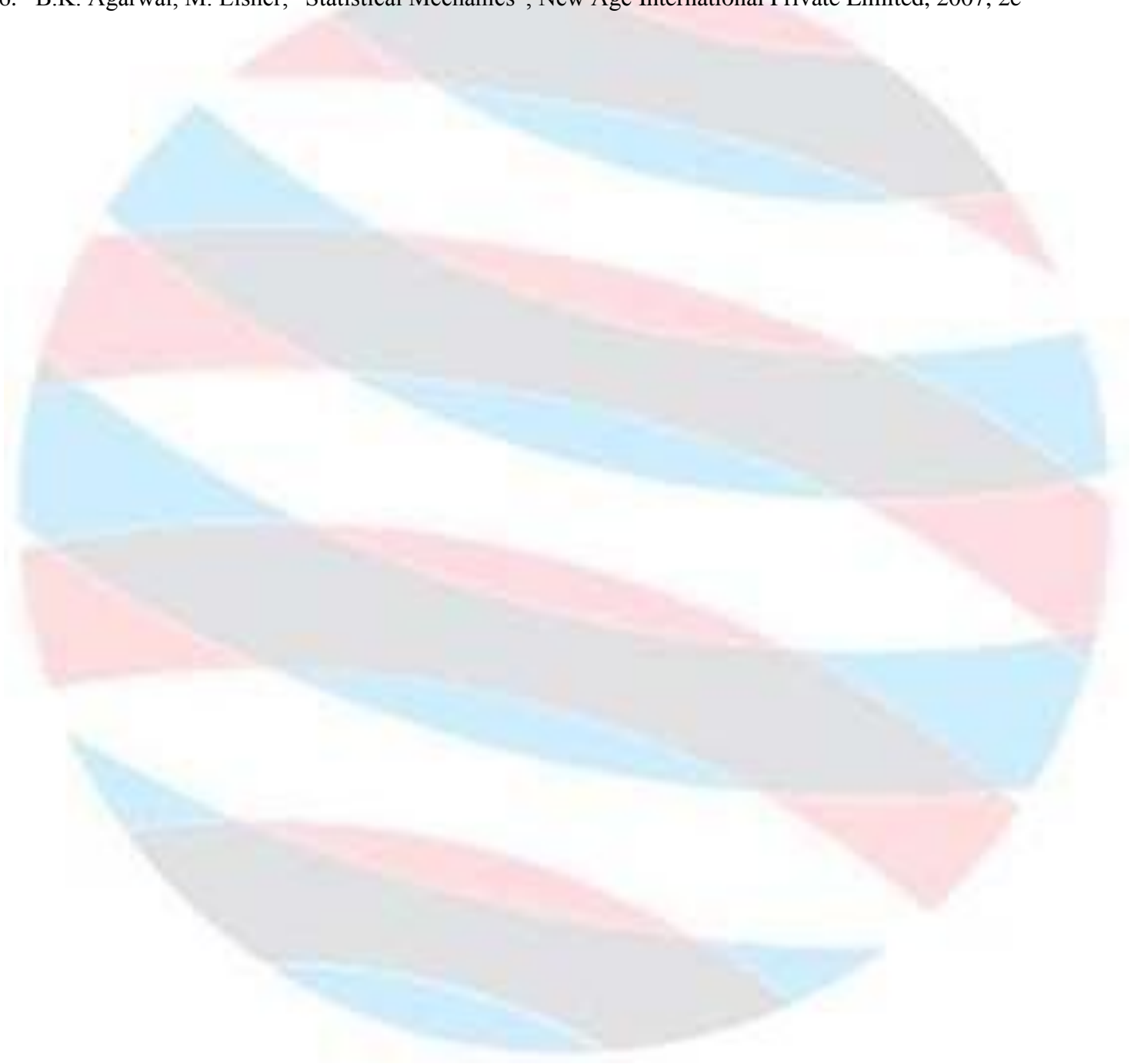
Course outcomes:

- 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

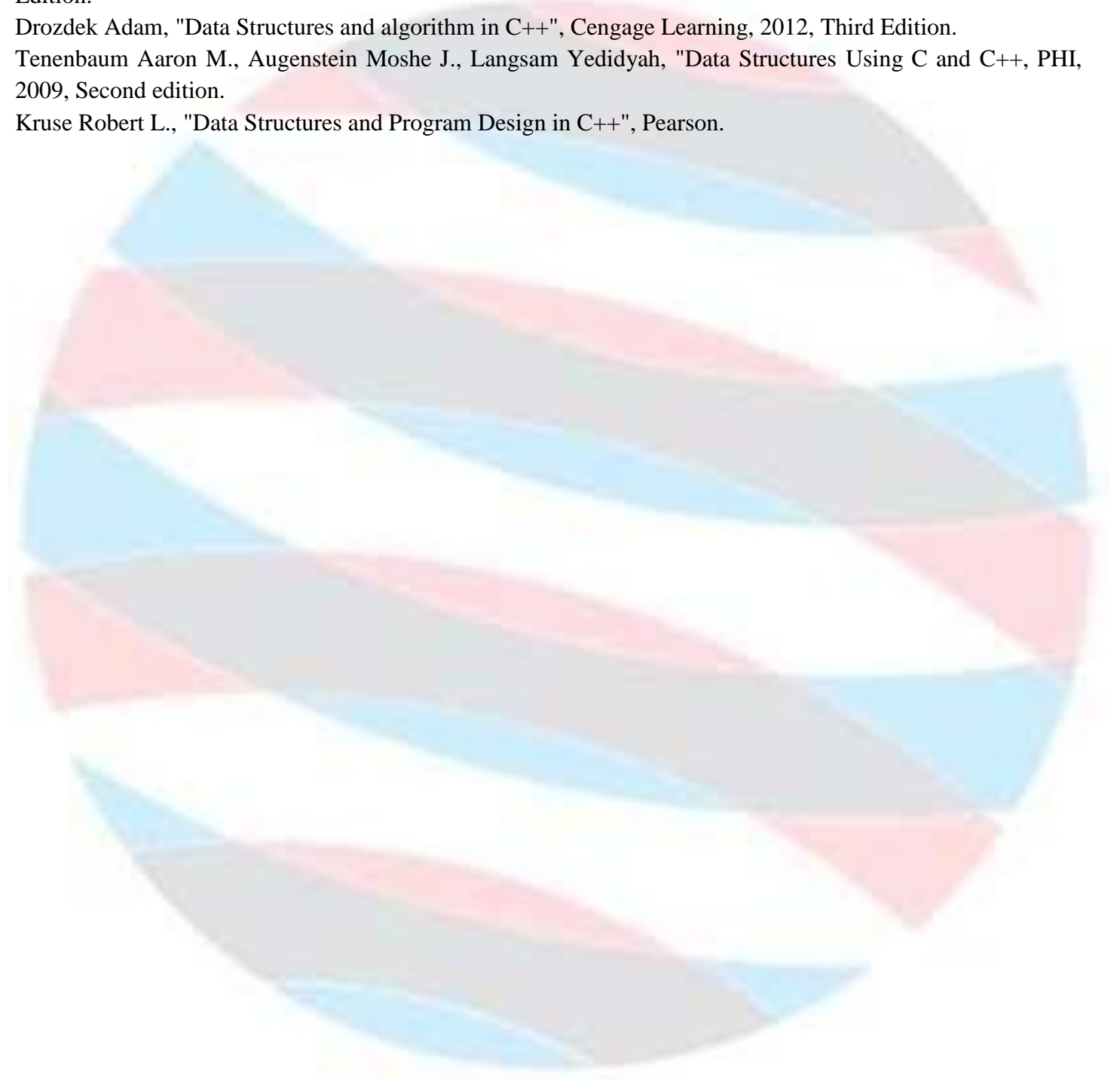
Course outcomes:

- 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

<p>Unit I – Plant water relation, Mineral Nutrition, Transpiration and translocation in phloem</p> <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.
<p>Unit II – Carbon Oxidation</p> <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.
<p>Unit III – Nitrogen Metabolism</p> <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.
<p>Unit IV – Lipid Metabolism & Photosynthesis</p> <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
<p>Unit V – Plant Development, Movements, Dormancy & Responses</p> <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:

- experimental 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 ($K_I + I_2 = K_{I3}$).

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

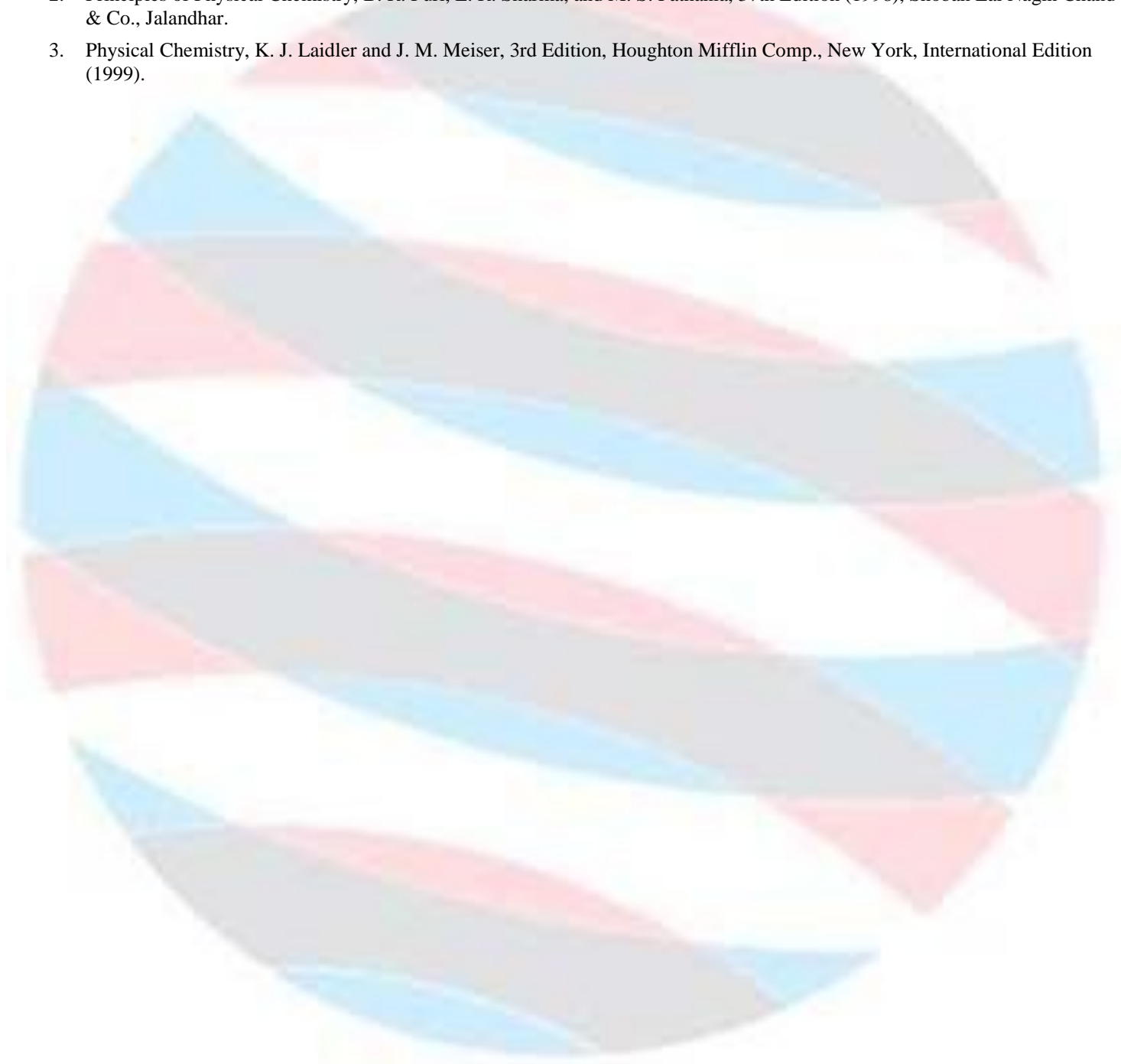
Order and molecularity of chemical reactions, pseudo order. Kinetic law for second order reactions, determination of the rate constant and order of reaction from kinetic data. Effect of temperature on rate of reaction: collision theory of rates of bimolecular reactions and its comparison with Arrhenius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

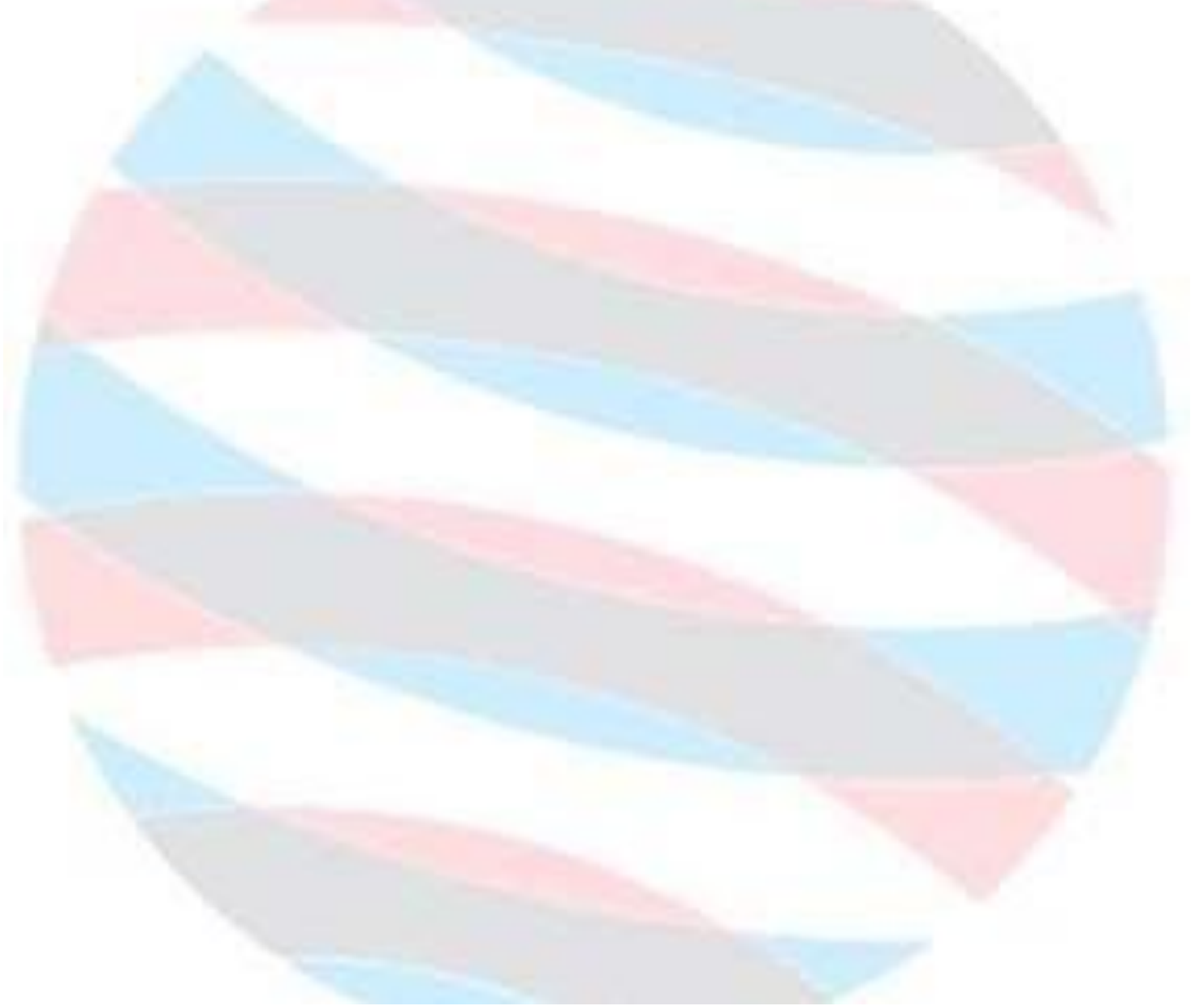
- Demonstrate comprehensive identification abilities of chordate diversity
- Explain structural and functional diversity of chordates
- Explain evolutionary relationship amongst chordates
- Take up research in biological sciences.

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:

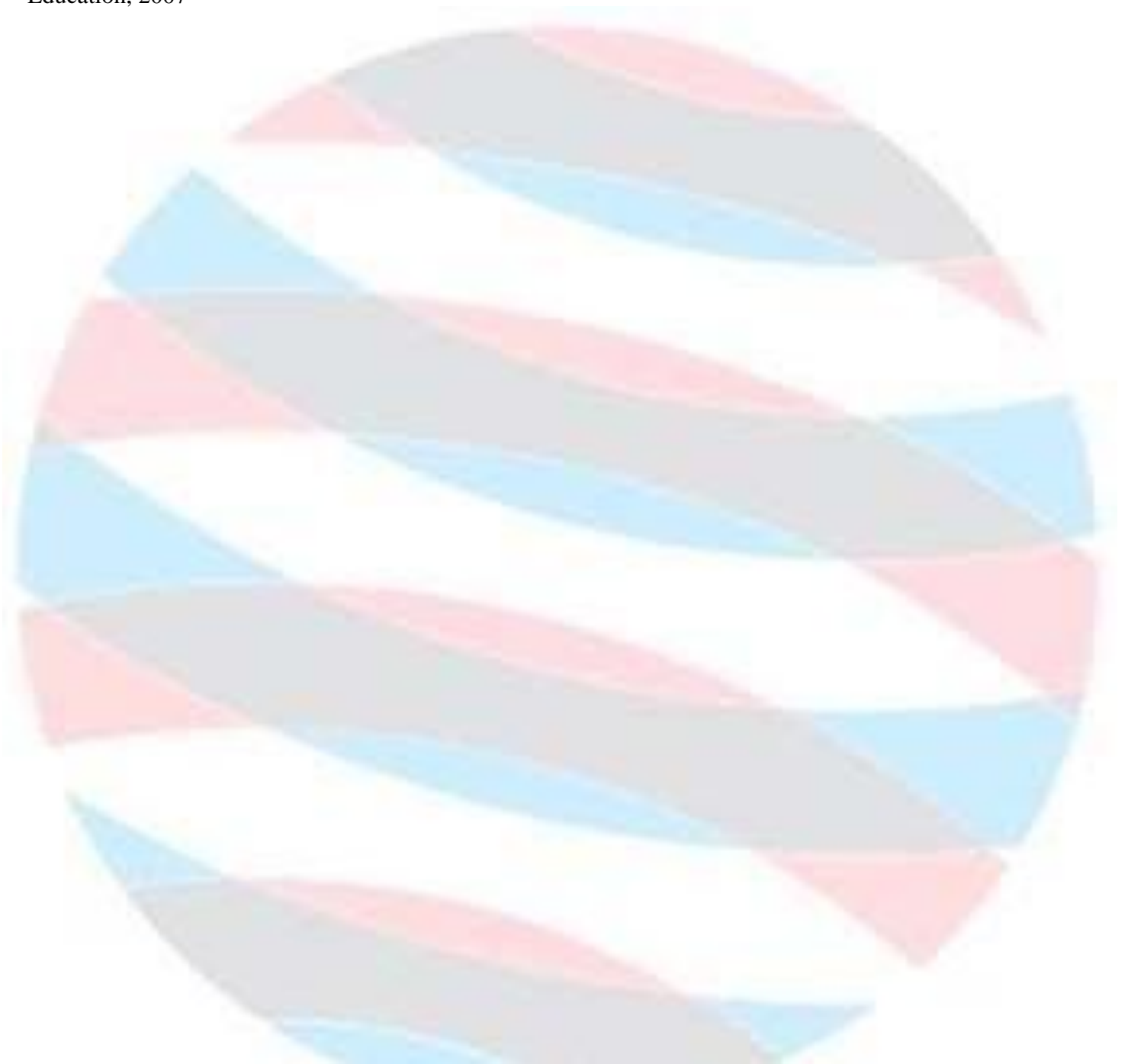
After the completion of the course the students will be able:

- 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)

