

CURRICULUM
B. Sc. (Life Science, Chemistry, Forensic Science)

B. Sc. LSCFS Semester –I

S.No	Course Code	Title of the Course	Total Credit	Credit Hrs.		
				L	T	P
1	FS-401	INTRODUCTION OF FORENSIC SCIENCE	2	2	0	0
2	FS-402	FORENSIC LAW	2	2	0	0
3	FS-403	PHYSICAL EVIDENCE EVALUATION	3	3	0	0
4	MCE 301	CELL BIOLOGY	3	2	0	2
5	BIOL 302	INVERTEBRATE-I	3	2	0	2
6	BIOL 310	TECHNIQUES AND INSTRUMENTATION IN BIOLOGY	3	2	0	2
7	BIOL 307	INTRODUCTORY PARASITOLOGY	3	2	0	2
8	CHEM-414	INTRODUCTORY ORGANIC CHEMISTRY	3	2	0	2
9	CHEM-415	ATOMIC STRUCTURE & PERIODIC CLASSIFICATION	3	2	0	2
10	CHEM-416	CHEMICAL KINETICS & ELECTRO CHEMISTRY	3	2	0	2
11	GPT-301	MORAL & VALUE EDUCATION	3	3	0	0
12	PHY-309	BASIC PHYSICS	3	3	0	0
13	NSS-318	NATIONAL SERVICE SCHEME	Non Credit Course			

B.Sc. LSCFS Sem. –II

S.No	Course Code	Title of the Course	Total Credit	Credit Hrs.		
				L	T	P
1	CHEM - 423	HYDRO CARBONS	3	2	0	2
2	CHEM - 424	CHEMICAL BONDING & NUCLEAR CHEM	3	2	0	2
3	CHEM - 425	GASES, CHEMICAL EQUILIBRIUM & SURFACE CHEM.	3	2	0	2
4	IM- 349	INTRODUCTORY MICROBIOLOGY	3	2	0	2
5	BIOL 304	INVERTEBRATE - II	3	2	0	2
6	BIOL 309	GENETICS	3	2	0	2
7	FS-421	CRIME SCENE INVESTIGATION	3	2	0	2
8	FS-422	INSTRUMENTATION & ANALYTICAL TECHNIQUES	3	3	0	0
9	FS-423	ENVIRONMENTAL FORENSIC	2	2	0	0
10	LNG-301	STRUCTURAL & SPOKEN ENGLISH	3	2	0	2
11	NSS-327	NATIONAL SERVICE SCHEME	Non Credit Course			

B.Sc. LSCFS Sem. –III

S.No	Course Code	Title of the Course	Total Credit	Credit Hrs.		
				L	T	P
1	CHEM-530	ALIPHATIC COMPOUNDS	3	2	0	2
2	CHEM-531	MAIN GROUP ELEMENTS	3	2	0	2
3	CHEM-532	THERMODYNAMICS-I & IONIC EQUILIB.	3	2	0	2
4	FS- 431	FINGERPRINT EXAMINATION	3	2	0	2
5	FS- 432	DOCUMENT EXAMINATION	3	2	0	2
6	FS-433	WILD LIFE FORENSIC	2	2	0	0
7	BIOL417	VERTEBRATE I	3	2	0	2
8	BIOL 408	MOLECULAR BIOLOGY	3	2	0	2

9	BIOL 415	ANIMAL TAXONOMY AND DISTRIBUTION	3	2	0	2
10	BCBE-301	ELEMENTARY BIOCHEMISTRY	3	2	0	2
11	NSS-413	NATIONAL SERVICE SCHEME	Non Credit Course			

B.Sc. LSCFS Sem. –IV

S.No	Course Code	Title of the Course	Total Credit	Credit Hrs.		
				L	T	P
1	CHEM -540	AROMATIC COMPOUNDS	3	2	0	2
2	CHEM - 541	<i>d & f</i> BLOCK ELEMENTS	3	2	0	2
3	CHEM - 542	THERMODYNAMIC – II, PHASE EQUILIB &RADIO CHEM.	3	2	0	2
4	BIOL 405	INTRODUCTORY ANIMAL PHYSIOLOGY	3	2	0	2
5	BIOL 418	VERTEBRATE II	3	2	0	2
6	BIOL 422	INTRODUCTORY BIOTECHNOLOGY	3	2	0	2
7	FS-441	BALLISTICS & PHOTOGRAPHY	2	2	0	0
8	FS-442	EXPLOSIVE	2	2	0	0
9	FS-443	BIOLOGICAL EVIDENCE EVALUATION	2	2	0	0
10	CBBI-501	APPLICATION IN BIOINFORMATICS	3	2	0	2
11	NSS-414	NATIONAL SERVICE SCHEME	Non Credit Course			

B.Sc. LSCFS Sem. –V

S.No	Course Code	Title of the Course	Total Credit	Credit Hrs.		
				L	T	P
1	CHEM - 551	COORDINATION CHEMISTRY & ISOMERISM.	3	2	0	2
2	CHEM - 552	SOLUTION CHEMISTRY & ADVANCED ELECTROCHEMISTRY	3	2	0	2
3	CHEM – 550	NATURAL PRODUCTS	3	2	0	2
4	BIOL 520	INTRODUCTORY PLANT PHYSIOLOGY	3	2	0	2
5	BIOL 530	PLANT EVOLUTION AND PALEOBOTANY	3	2	0	2
6	FS-451	FORENSIC CHEMISTRY & TOXICOLOGY	3	2	0	2
7	FS-452	SEROLOGY & DNA FINGERPRINTING	3	2	0	2
8	ENV-415	ENVIRONMENTAL STUDIES- I	2	2	0	0
9	NSS-516	NATIONAL SERVICE SCHEME	Non Credit Course			

B.Sc. LSCFS Sem. –VI

S.No	Course Code	Title of the Course	Total Credit	Credit Hrs.		
				L	T	P
1	CHEM - 560	ADVANCED ORGANIC CHEMISTRY	3	2	0	2
2	CHEM - 561	SPECTROSCOPY	3	2	0	2
3	CHEM-562	PHOTO CHEMISTRY & ADVANCED WAVE MECHANICS	3	2	0	2
4	BIOL 533	PLANT ANATOMY AND EMBRYOLOGY	3	2	0	2
5	BIOL 536	DEVELOPMENTAL BIOLOGY	3	2	0	2
6	BIOL 537	BIODIVERSITY AND CONSERVATION	4	3	1	0
7	FS-561	CYBER FORENSIC	3	2	0	2
8	FS-562	QUALITY & LABORATORY MANAGEMENT	3	3	0	0
9	ENV-416	ENVIRONMENTAL STUDIES -II	2	2	0	0
10	FS-699	PROJECT WORK	5	5	0	0
11	NSS-527	NATIONAL SERVICE SCHEME	Non Credit Course			

B.Sc (PCFS&LSCFS)

Semester-I

Paper I

Code:-FS-401

Credits:-2(2-0-0)

Introduction of Forensic Science

UNIT-I Bridge Course

UNIT-II Forensic Science: - Definition, Introduction , Basic Principles & Significance, History & Development of Forensic Science in India and World, Organizational Structure of Forensic Science laboratory ,Different divisions and units of Forensic Science Laboratory , Organizational Structure of Forensic Science teaching Institution.

UNIT-III Criminalistics- Definition, Introduction, Scope, Significance and use Coordination of Forensic Science activities and its use for court of Law.

UNIT-IV Forensic Statistics-Introduction Definition, Significance Basic concepts of frequency distribution, measure of central values ,Mean, Median Mode Probability Theory, Classical definition of Probability., Basic terms Events, Trials, Mutually exclusives events etc, Application of statistics to particular areas of forensic science.

UNIT-V Forensic Ethics- Introduction, Definition, Scope, Ethics in Forensic Science, Professionalism and ethics: Importance of professional ethics, the importance Of professional ethics to science practitioners, development of code of conduct and code of ethics for Forensic Science; Application of codes and ethics, How ethical requirements impact the daily work of a forensic scientist; Ethical dilemmas and their resolution.

Semester-I

Code:-FS-402

Credit:-2(2-0-0)

Course Title: Forensic Law

- UNIT-I** Definition of Law, Court, Judge, Crime and Criminal, Basic Terminology in Law, Introduction to Indian Penal Code, History and Background of Indian Penal Code,
- UNIT-II** Common Object, Common Intention, General Exception (Section 76-95), Right of Private Defense, (Section 96 to Section 106) brief introduction to offences affecting Human life and Property.
- UNIT III** Introduction to Criminal Procedure Code, FIR, Introduction to Indian Evidence Act, Expert Opinion. Case Studies regarding various crimes.

SEMESTER -I

Physical Evidence evaluation

FS- 403

Credit:-3(3-0-0)

Unit-1 Physical Evidences

Introduction to physical evidences- evidences nature and type of physical evidences (NDPS explosives, murder, poisoning, sexual offences, burglary, dacoit, counterfeit etc.)

Unit-2 Source and Significance

Sources (victim, suspect, crime scene) Significance, Corpus Delicti, Modus Operandi, Suspect link with victim, Suspects link with Crime Scenes.

Unit-3 Search, Collection

1. Searching- Strip method, Spiral method, Zonal method, Wheel or radial method ,Grid or cross- hatch method
2. Collection- Evidence collection ,Techniques of collection, General precautions

Unit- 4 Preservation, Packaging& Transportation

Preservation – from loss, damage or deterioration, contamination, tempering

General precautions, packaging, sealing, marking and labelling, chain and custody, dispatch to the laboratory

Unit-5 Examination & Evaluation

Ballistics, physics, chemistry, narcotics and excise section, toxicology section, biology, serology, DNA section etc.

Course Title: Cell biology
Semester-I

Course Code: BIOL 306

Credit: 3 (2-0-2)

UNIT I Plant and animal cells, Eukaryotic and prokaryotic cell. Plasma membrane, structure & function of plasma membrane.

UNIT II Nucleus, Nuclear membrane & nucleolus. Chromosomes polytene & lampbrush chromosomes.

UNIT III Golgi apparatus, mitochondria, lysosomes, Endoplasmic reticulum & Ribosomes, cytoskeleton Cilia, Flagella, Microtubules & Microfilaments.

Practical:

- Study of plant cell.
- Study of animal cell.
- Study of blood cell.
- Study of mitosis and meiosis with the help of permanent slides.
- Study of polytene and lampbrush chromosomes with the help of permanent slides.

UNIT I

Principles and handling of Microscope, Spectrophotometer, Colorimeter, Flame photometer, Autoclave, Laminar air flow, Fermenter (Bioreactor), Electronic and Electrical balance, Refrigerator, minor Instrument and Glass wares.

UNIT II

Principles, types working and maintenance of: Microscopes, centrifuge, incubator, colorimeter, Spectrophotometer, Electrophoresis and Chromatography

UNIT III

Sterilization techniques. Preparation of different types of solutions. culture techniques & cryopreservation

UNIT IV

Herbaria Techniques, Microtomy staining techniques, Preparation of permanent mount, specimen preservation techniques

UNIT V

Seed viability testing, testing of pollen viability, Tissue culture of crop plants; description of flowering plants in botanical terms in relation to taxonomy.

UNIT VI

Preparation of different agrochemical doses in field and pot application;

PRACTICALS

- Study of different parts of simple and compound microscopes
- Preparation of Solutions and buffers
- Study of different parts of centrifuge and types of rotors
- Study of electrophoretic apparatus

Semester – I
Course Title: INTRODUCTORY ORGANIC CHEMISTRY

Course Code-CHEM-414

Credit: 3(2-0-2)

Unit 1: IUPAC classification and Nomenclature.

Unit 2: Structure of Organic Molecules: Electronic theory of bonding. Wave mechanical model of Atom and Chemical bonding. Atomic Orbital theory, Nature and types of Covalent bond. Hybridization. Electro negativity Polarity Resonance. Hydrogen bonding.

Unit 3: Organic Reactions and their Mechanisms: Electron displacement effects. Bond fission, Carbonium ions Carbanions. Attacking reagent and their role. Types of reaction mechanisms and Organic reactions.

Unit 4: Isomerism: Introduction, Types of Isomerism, Asymmetric Carbon Atom, Chirality Absolute & Relative Configuration. R & S System. Optical isomerism, Racemic Mixtures.

Semester – I
Course Code: ATOMIC STRUCTURE & PERIODIC CLASSIFICATION

Course Code: CHEM-415

3(2-0-2)

Unit I: Structure of atom: Quantum and wave mechanical approaches to the structure of atom.

Unit II: Periodic classification and Properties: (a) Mendleef, Modern, Extended and long form.
(b) Periodic properties: Atomic and ionic radii, crystal co-ordination no., Radius ratio, factors influencing magnitude of ionic radii. Periodic variations of atomic and ionic radii.
Ionization energy, electron affinity and electronegativity.

Semester – I
Course Title: CHEMICAL KINETICS & ELECTROCHEMISTRY

Course Code: CHEM-416

3(2-0-2)

1. Chemical Kinetics:- Reaction rate, order and molecularity of reaction, zero, first, second and third order reaction (derivation included), methods for determining the order of reaction, complex reactions, opposing reactions, consecutive reactions and side reactions with reference to first order reactions. Effect of temperature on reaction on reaction velocity, Energy of activation and collision theory.

2. Electrochemistry:- Reversible and irreversible cells, EMF of a cell and free energy change, Nernst's equation, Equilibrium constant, standard electrode potential, types of reversible electrode, Application of EMF measurements (determination of solubility product, pH, dissociation constant of acids, hydrolysis constant, solubility of sparingly soluble salts.)

3. Colloidal State:- Lyophilic and Lyophobic solution, origin of charge, zeta potential, electrophoresis, electro-osmosis, Tyndall effect, coagulation, Hardy Schulze rule, Donnan membrane equilibrium.

BASIC PHYSICS

B.Sc. LSCFS

Semester-I

Course Code: PHY-309

Credit Hrs: (3-0-0)

Unit-I: Optics

Interference: Coherent sources, conditions of interference, Fresnel's bi-prism experiment, interference in thin films, wedge shaped film, Newton's ring.

Diffraction: Single slit and double slit diffraction, diffraction grating, Raleigh's criterion of limit resolution, resolving power of telescope and microscope.

Polarization: Polarization of light, Brewster's law, Malus law, phenomenon of double refraction, geometry of calcite crystal, optic axis, principal section, ordinary and extraordinary rays, construction and working of Nicol prism. Plane, circularly and elliptically polarized light. Their production and analysis. Retardation Plates, optical activity, specific rotation, polarimeters.

Unit-II: X-rays

Origin of X-rays, continuous and characteristic X-ray spectra, Mosley's law, absorption of X-rays, Diffraction of X-rays, Bragg's law, Bragg's spectrometer, practical applications of X-ray, X-ray Machine.

Unit-III: Laser

Spontaneous and stimulated emission of radiation, Einstein's Coefficients. Components of laser. Type of laser and their working and application. Classes of laser equipments.

Unit-IV: Electromagnetic Theory.

Gauss's law, Poisson and Laplace equation, Maxwell's equations, Basic concepts of Electromagnetic waves and its solution in free space. Para, dia, ferro, antiferro and ferri magnetic materials. Hysteresis and magnetic circuits.

Reference books:

1. Fundamentals of Optics
Jetkins & White.
2. Perspectives of Modern Physics
Beiser
3. Electrodynamics
David Griffith.
4. Laser – Theory & Applications
Thyagranjan / Ghatak
5. Fundamentals Of Physics
Resnick & Halliday.
6. Engineering Physics
Uma Mukherjee.
7. Text book of Engineering Physics
Navneet Gupta & Kumar.

Semester-I
Course Title: MORAL & VALUE EDUCATION
B. Sc. (PCM/ PCFS/ PMCS/ LSCFS/ ZBC)

Course Code: GPT-301

Credit Hrs.3-0-0

OBJECTIVES

- To explicitly discuss that is implicitly communicated through Academic disciplines.
- To inculcate Life affirming values based on 'Fear of God as the beginning of wisdom'.
- To focus on specific values in decision making process.

Section I – BASICS

- Integrating 'Heart-Head-Hand' – Story of Sam Higginbottom.
- 'Contextual – Dialogical – Praxiological' character of value education.
- Different Values: Academic – Economic – Social – Material – Moral – Spiritual.

Section II – Biblical Foundation

- Proverbs Chapter 2 – 4
- Ten Commandments Exodus 20: 1 – 17
- Two Commandments of Jesus Mark 12: 29 – 31
- Sermon on Mount Matthew chapter 5 – 7
- Lord's Prayer Matthew 6: 9 – 13, Luke 11: 1 – 4
- Parable of Good Samaritan Luke 10: 29 – 37
- Parable of Two Brothers Luke 15: 11 – 32

Section III – Formation of Character

- Voice of Conscience
- Virtues Prudence – Justice – Courage – Discipline – Success – Faith – Hope – Love
- Values of Life Marriage – No same-sex marriage – Divorce – Abortion
- Values of Belonging Family - Friends – Faith Community – Nation – World

Section IV – God – Human – Plants – Animals

- Stewardship of Creation
- Biotechnological Advancement
- Exploitation of Animals & Plants & Micro-Organisms
- Environmental Hazards

Section V – Our Constitution

- Fundamental Rights
- Directive Principles of State Policy
- Fundamental Duties
- Enlightened Citizenship: Ten points of Dr. A. P. J. Kalam

Section VI – Interactive Sessions

- Sexual Harassment
- Corruption
- Substance Abuse
- Violence
- Communalism
- Cyber crime

Course Title: HYDROCARBONS
Semester-II

Course Code-CHEM-423

Credit: 3(2-0-2)

Unit-1: Alkanes: Structure, Nomenclature, Isomerism, Preparation, Properties.

Unit 2: Cycloalkanes: Nomenclature Preparation Properties stability of cyclohexanes-Baeyer strain theory. Sachse-Mohr Concept of Strain less Rings. Conformations of Cyclohexane and its derivatives.

Unit 3: Alkenes: Structure, Nomenclature, Isomerism, Preparation, Properties.

Unit4: Petroleum and Petrochemicals: Composition of Petroleum, Cracking, Octane Number. Synthesis of Pure Chemicals

Unit 5: Alkyl Halids: Structure, Nomenclature, Isomerism, Preparation, Properties.

Unit 6: Organo metallic compounds: Grignard Reagent Structure, Preparation, Properties.

Unit 7: Alcohols: Introduction, Classification. Structure, Nomenclature, Isomerism Preparation, Properties

Course Title: CHEMICAL BONDING & NUCLEAR CHEMISTRY
Semester-II

Course Code: CHEM-424

Credit: 3(2-0-2)

Unit I: Chemical Bonding: Co-valent, Ionic, Metallic, Hydrogen, Vander Waals, Lattice energy, Hydration energy, Fajan's rule, Co-ordinate bond.

Unit II: Nuclear and Radiochemistry.

Course Title: GASES, CHEMICAL EQUILIBRIUM & SURFACE CHEMISTRY
Semester-II

Course Code: CHEM-425

Credit: 3(2-0-2)

1. **Gases:-** Gas laws and kinetic theory of gases, Critical constants and their determination, specific heat ratio, Vander waals equation of state, other equations of state e.g. Berthelot and Dieterici principles of corresponding states. Qualitative treatment of Maxwell law Distribution of velocities.

2. **Chemical Equilibrium:-** Law of mass action, Significance of equilibrium constant, Relation between K_p and K_c , application in homogeneous and heterogeneous equilibria, Le-chatier's principle and its application to chemical equilibrium.

3. **Surface Phenomenon:-** Physical and chemical adsorption, Freundlich, Langmuir and Gibbs Adsorption isotherm, B.E.T. Theory.

Semester-II
Course Title: History of Botany, Algae and Bryophyte

Course Code: BIOL 303

Credit: 3 (2-0-2)

- Unit I Scope of Botany, Phylogenetic trends in botany, contribution of some India Scientist like B. Sahni, M.O.P. Iyengar, P. Maheswari, S. R. Kashyap
- Unit II General Description, classification & economic importance of Algae. Important feature of at least two members of each: Cyanophyceae, Chlorophyceae, Xanthrophyceae, Bacillariophyceae, Phaeophyceae & Rodophyceae.
- Unit III General description, classification & economic importance of Bryophytes. External morphology, Anatomy & reproduction & life cycle of thalloid & leafy bryophytes with special reference to alternation of generation.

Course Title: Invertebrate – II
Semester-II

Course Code: BIOL 304

Credit: 3 (2-0-2)

- Unit I Phylum Annelida: General characters, classification, structure, habit & habitat, metamerism in Annelida, Economic importance of Earthworm.
- Unit II Phylum: Arthropoda: General characters, classification, Insects metamorphosis, Palaemon, Economic importance of Arthropods.
- Unit III Phylum Mollusca: General characters, classification, Torsion & Desertion in Gastropoda, Economic importance of mollusca.
- Unit IV Phylum Echinodermata: General characters, classification, water vascular system in star fish, Regeneration & Autonomy.

PRACTICAL

- Study of morphology of the preserved invertebrate animals in the laboratory.
- Dissection-Cockroach, Grasshopper, Prawn.

Course Title: Molecular biology

Semester-II

Course Code: BIOL 408

Credit: 3 (2-0-2)

UNIT I Basic introduction to molecular biology, Structural aspects of nucleic acids and proteins

UNIT II Replication and transcription in eukaryotes and prokaryotes; regulation and post transcriptional modification; concept of *lac & trp operon*

UNIT III Concept of genetic codon and modern concept of gene

UNIT IV Translation and post translational modification

UNIT V Transposons and extra nuclear inheritance

Practical:

- Basic methodology to molecular biology
- Preparation of reagent
- Protein isolation and quantization
- DNA isolation and agarose gel electrophoresis
- DNA purification

Course Title: Biological Techniques and Instrumentation

Semester-II

Course Code: BIOL 409

Credit: 3(2-0-2)

UNIT I Herbaria Techniques, Microtomy staining techniques, Preparation of permanent mount, specimen preservation techniques

UNIT II Sterilization techniques, culture techniques & cryopreservation

UNIT III Principles, types working and maintenance of: Microscopes, centrifuge, incubator, colorimeter, Spectrophotometer, Electrophoresis and Chromatography

PRACTICAL

- Study of different parts of simple and compound microscopes
- Preparation of Solutions and buffers
- Study of different parts of centrifuge and types of rotors
- Study of electrophoretic apparatus

Semester-II

Course Code:-FS-421

Credit:-3(2-0-2)

Course Title: Crime Scene Investigation

- UNIT-I** **Crime:** - Definition & causation, crime scene, types of crime, processing of crime scene, protection and recording of crime scene, search of physical clues, collection and preservation, packing and forwarding of physical clues to Forensic Science Laboratory.
- UNIT-II** **Protection, Sketching and Photography:** Collecting and Packing of physical clues from the scene of crime in case of Hit and Run, Burglary, House breaking, Road accident, Theft and Dacoity, arson and shooting. Reconstruction and evaluation of scene of crime.
- UNIT-III** **Investigative Techniques:** - Criminals, Criminal behavior, modus operandi, criminal profiling, Portrait parley, Polygraph analysis, Narco analysis, Brain Fingerprinting, Voice stress analysis & Speaker profiling.
- UNIT-IV** **Blood spattering / Pattern analysis** - Introduction, Scope , Significance, Use, its analysis and interpretation in respect of crime scene investigation.

Semester-II

Course Code:-FS-422

Credit:-3(3-0-0)

Course Title: Instrumental and Analytical Technique

UNIT- I Introduction to Instrumental methods of Chemical analysis

General introduction, classification of instrumental method, spectroscopy, properties, of electromagnetic radiation, introduction of electromagnetic radiation with matter origin of spectrum.

UNIT-II Visible spectrophotometry & Colorimetry

Introduction, theory of spectrophotometry & colorimetry, deviation from Beer's law, instrumentation, application of Colorimetry & spectrophotometry.

UNIT-III Emission Spectroscopy

Introductory, theory, instrumentation, spectrograph, application, of emission spectroscopy, advantages and disadvantages of emission spectroscopy.

UNIT – I V Microscopy

Basic principles of simple microscope, phase contrast microscope, stereoscopic microscopic and compound microscope, comparison microscope, polarizing microscope, fluorescent microscope.

UNIT-V Centrifugation Techniques:

Basic principles of sedimentation, various types of centrifuges, Density gradient centrifugation, Preparative centrifugation, Analysis of sub- cellular fractions, Ultra- centrifuge- Refrigerated Centrifuges.

Electrophoretic Technique: - General principles, Factors affecting electrophoresis, Low voltage thin sheet electrophoresis, High voltage electrophoresis, Sodium dodecylsulphate (SDS) polyacrylamide gel electrophoresis, Isoelectric focusing (IEF), Isoelectrophoresis, Preparative electrophoresis, Horizontal and Vertical electrophoresis.

B.Sc. LSCFS/PCFS
II Semester

Course code FS 423

Credits: 2(2-0-0)

Course Title: Environmental Forensics

Unit I: Environmental Forensics Introduction to Environmental Forensics. Mercury- Natural and anthropogenic sources, detecting mercury in indoor environment and forensic aspects. Asbestos-sources and detection in air, water, fibers etc. Sewage, Lead- sources, compounds, analytical methods and lead forensics. Arsenic- sources, compounds, analytical methods and forensic aspects. Pesticides- Types, analytical testing and forensic techniques. Polycyclic aromatic hydrocarbons (PAHS) - sources, types and analytical techniques.

Unit II: Environment and Ecosystems. Ecosystem characteristics structure and function; environmental pollution , xenobiotic and recalcitrance, Introduction to BOD and COD, use of biosensors to determine the quality of environment, Introduction and scope of environmental management, basic concepts of sustainable development, Environmental Impact Assessment (EIA), general guidelines for the preparation of environmental impact statement (EIS), international organization for standardization (ISO), ISO 14000 standards and certification, environmental safety, risk management and emergency preparedness, international summit and treaties, important dates dedicated to environmental management.

Unit III Environmental Legislation: Central and State Boards for the prevention and control of environmental pollution, powers and functions of pollution control boards, penalties and procedure, duties and responsibilities of citizens for environmental protection. The Water (Prevention and Control of Pollution) Act 1974. Prevention and Control of Air Pollution Act 1981, Forest Conservation Act 1981, Environment (protection) Act 1986, Hazardous waste (Management and Handling) Rules, 1989, Bio-Medical Waste (Management and Handling) Rules, 1998. Issues involved in enforcement of environmental legislation, public awareness, and public interest litigations (PILs) and its role in control of environmental pollution in India.

Semester-II
Course Title: STRUCTURAL & SPOKEN ENGLISH
B. Sc. (PCM/ PCFS/ PMCS/ LSCFS/ ZBC)

Course Code: LNG-301

Credit Hours: (2-0-2)

Structure:

- a. Word enrichment (Antonyms, Synonyms, Homophones, Homonyms, Acronyms)
- b. Inflections – Noun
- c. Tenses
- d. Syntax- (SVO Pattern)
- e. Modifiers (Adjective, Adverb, Participle)
- f. Preposition (Usage)
- g. Concord
- h. Determiners (Central Specific)

Spoken English:

- a. Accent and Stress
- b. Rhythm
- c. Self Introduction
- d. Conversation in different Situations
- e. Group Discussions

Speech Techniques:

- a. Organizing
- b. Delivering

Written Communication:

- a. Organizing
- b. Writing (Process)
- c. Resume
- d. Curriculum Vitae
- e. Letter (Components, Request and orders)
- f. Other Communications (Advertisements, Circulars, Invitation, Reports, Proposals)
- g. Usage of Visual Aids in Technical writing.

Books Prescribed:

- Gerson, Sharon J. and Gerson, Steven M. Technical Writing-Process and product, I ed.2000, Pearson Education INC, New Delhi.
- Dickson, Grisalda J.S. Higgin's Technical writing 2004, Godwin Publication, Allahabad.
- Martinet A.V. and Thomason A.J.A Practical English Grammar, IV ed. 1986, Oxford University Press, Delhi
- Agarwal, Malti: Krishnan's Professional Communication, KRISHNA Prakashan Media (P) Ltd. Meerut.

Semester-III

Course Code:-FS-431

Credit-3(2-0-2)

Course Title: Fingerprints Examination

- UNIT-I** Introduction definition ,scope, History and development of Fingerprint Science, formation of ridges, different type of ridge characteristics, classification of fingerprints – Henry system of classification, Single digital classification.
- UNIT-II** Search and collection of Fingerprint, development of latent fingerprints, conventional methods of development of fingerprints – fluorescent method, magnetic power method, fuming method, chemical method etc.
- UNIT-III** Taking of finger prints preserving and lifting of fingerprints, photography of fingerprints, comparison of fingerprints, and basis of comparison, class characteristics, and individual characteristics.
- UNIT-IV** Introduction of Foot prints: Tyre mark, Lip prints, Bite marks and Ear prints.

Semester-III

Course Code:-FS-432

Credit:-3(2-0-2)

Course Title: Document Examination

- UNIT-I Introduction & Definition:** Introduction to Document, Classification and types of Document, Nature and problems of document. Procurement of standard admitted / specimen writings, handling and marking of documents, preliminary examination of documents,
- UNIT-II Handwriting** Principles and basics of handwriting identification individuality of handwriting, natural variations, process of comparison, various types of documents genuine and forged documents, various writing features and their estimation, general characteristics of handwriting, individual characteristics of handwriting, basic tools needed for forensic documents examination and their use.
- UNIT-III Disguised writing and anonymous letters:-** Identification of written, examination of signatures characteristics of genuine and forged signatures, examination of alterations, erasers overwriting, additions and obliterations decipherment of secret, indented and charred documents,

SEMESTER –III Wild Life Forensic

FS- 433

Credit:-2(2-0-0)

Unit -1 Wild Life Forensic

Introduction to wild life forensic, Types of Wild Life evidences – blood, hair, teeth, foot print etc., Problems of wild life Forensics

Unit- 2 Wild Life Crime

Wild life, Offences related to wild life, Commodities in the trade, Trade level, Value of trade, Prevention of wild life crime.

Unit-3 Laws regulating wild life crimes and examination

Wildlife Act, Foreign Trade Act 1992, Customs Act 1962, CITES, Collection of evidences, Identification of evidences.

Course Title: Introductory Biochemistry

Semester-III

Course Code: BCBT- 401

Credit: 3(2-0-1)

Unit I: Chemical structure of proteins and their properties, cellular membrane and transport phenomenon.

Unit II: Intermediary metabolism- concept of anabolism and catabolism, metabolism of carbohydrates, lipids and amino acids and their interrelationship.

Unit III: Biological oxidation, electron transport system, oxidative phosphorylation, free energy changes in biochemical reactions, energy changes in biochemical reactions, energy rich compounds.

Unit IV: Metabolism of nucleic acids and proteins.

Unit V: Hormones: regulation of metabolism by various hormones.

Practicals:

1. Specific group tests for carbohydrates
2. Specific group tests for amino acids.
3. Specific tests for lipids.
4. Determination of mil protein, fat and lactose.
5. Determination of acidity in sample.

Course Title: Introductory Microbiology

Semester-III

Course Code: MBFT-349

Credit: 3(2-0-2)

Theory

- Definition, Scope and History of Microbiology
- Cellular organization of prokaryotic and eukaryotic cells
- Difference between prokaryotic and eukaryotic cells
- General characteristics and nature of Bacteria, Mycoplasma, Rickettsiae, Chlamydiae, Actinomycetes, Protozoa, Algae & Viruses

Practical

- Familiarity with equipment to be used in Microbiology Laboratory.
- Cleaning, washing and sterilization of glass wares
- Observation of permanent slides to study the structural characteristics of common bacteria, Fungi, Algae & Protooa.

UNIT I

Introduction: History, Stages in Taxonomy; Problems of Taxonomists, Aims and tasks of a taxonomist, Taxonomy as a profession.

UNIT II

Newer trends in Taxonomy: Morphological approach, immature stages, Embryological approach, Behavioral approach, Cytological approach, Biochemical approach. Molecular taxonomy.

UNIT III

Taxonomic procedure: Collection, Preservation of collected material, Methods of identification and problems encountered in Identification

UNIT VI

Comparative Biogeography, Endemic Areas, Zoogeographic regions of the World, Zoogeographic regions of India, Major habitat types of the subcontinent

UNIT V

Natural history of Indian subcontinent: Role of physical and biotic environments in determining taxonomic distributions. Migrations of species in the subcontinent; common Indian mammals, birds

Practical:

- Collection and Taxonomy of Mosquitoes
- Collection of immature stages of insects
- Preservatives and methods of preservation
- Identifying local habitats and distribution of different animal groups
- Study of the role of pH in determining animal distribution

Recommended Books

- Kapoor. 2013. Theory and practice of animal Taxonomy. Oxford & IBH Publishing.
- Rastogi. 2006. Palaeontology&Zoogeography. KedarNath Ram Nath
- Beddard. 2010. A Text- Book of Zoogeography. Nabu Press.

Semester-III
Course Title: ALIPHATIC COMPOUNDS

Course Code: CHEM-530

Credit: 3(2-0-2)

Unit 1: Ethers: Structure, Preparation, Properties and uses.

Unit 2: Carbonyl Compounds: Structure, Preparation and properties of Aldehydes and Ketones.

Unit 3: Carboxylic Acid: Classification, Structure, Preparation, Properties.

Unit 4: Di- Carboxylic Acid: Classification, Structure, Preparation, and Properties.

Unit 5: Esters: Structure, Preparation, Properties.

Unit 6: Urea: Structure, Preparation, Properties.

Unit 7: Fats and Oils: Structure and Composition, Properties and Analysis of fats & oils.

Unit 8: Aliphatic Amines: Structure, Preparation, and Properties.

Course Title: MAIN GROUP ELEMENTS
Semester – III

Code-CHEM-531

Credit: 3(2-0-2)

Unit I: Main group elements: Alkali and Alkaline earth metals and p- block elements.

Unit II: Inter halogen compound and pseudo halogens.

Course Title: THERMODYNAMICS –I & IONIC EQUILIBRIUM
Semester – III

CHEM-532

Credit: 3(2-0-2)

1st Law of Thermodynamics- Thermodynamics terms, statement of law, thermodynamics reversibility and maximum work, enthalpy of the system, heat capacity at constant volume and as constant pressure, Extensive and intensive properties, state functions cyclic rule, temperature and volume, enthalpy as a function of temperature and pressure, Joule-Thomson effect.

Thermchemistry- Heat of reaction, formation, combustion and neutralization, Hess's law and its application, Kirchoffs's equation, bond energy and resonance energy.

Kinetics of Catalysed Reaction- Kinetics of homogenous acid-base catalysis, enzyme catalysis, negative catalysis and inhibition, Kinetics of gaseous reaction on solid surface, Uni and bimolecular surface reaction, Effect of temperature on surface reaction. Primary salt effect.

Ionic Equilibrium- Concept of acids and bases and their relative strength. Bronsted and Lewis acids and bases, pH and pKa, acid-base concept in non aqueous media, buffer solutions, Theory of acid-base indicators, Salt hydrolysis, Solubility product.

Semester-IV

Course Code:-FS-441

Credit:-2(2-0-0)

Course Title: Ballistics and Photography

- UNIT – I** **History and background of firearms:-** Their classification and characteristics, various component of small arms, smooth bore and class characteristics, purpose of rifling, types of rifling trigger and firing mechanism, improvised / country-made / imitative firearm and their constructional features.
- UNIT-II** **Ammunition:** Definition, History and Classification, constructional features of different types of cartridges, types of primers and priming composition, propellants and their compositions, various types of bullet and compositional aspects.
- UNIT-II** **Introduction to Ballistics:-** Definition, and types, Internal Ballistics, External Ballistics, Terminal Ballistics, Hydro Ballistics & Forensic Ballistics. Various components of Internal, External and Terminal Ballistics, and factors affecting them.
- UNIT- III** **Photography:** History and Development of Photography, Basic principles and techniques of Black & White and colour photography, cameras and lenses, exposing, development and printing, different kinds of developers and fixtures, modern developments in photography, linkage of cameras and film negatives, digital photography. Types of Lighting Used in Photography, Introduction to Crime Scene Photography.

Semester-IV

Course Code:-FS-442

Credit:-2(2-0-0)

Course Title: Explosive

- UNIT-I** Introduction, Definition, Scope, Classification, composition and characteristics of explosives,
- UNIT-II** Explosion, type of explosion, process and effects, types of hazard, effect of blast wave on structures, human etc. specific approach to scene of explosion, post-blast residue collection, preservation and packing
- UNIT-III** Reconstruction of sequence of events, evaluation and assessment of scene of explosion,
- UNIT-IV** Systematic examination of explosives and explosion residues in the laboratory using chemical and instrumental techniques and interpretation of results,
- UNIT-V** Explosives Act. Pyrotechnics, IEDs,

SEMESTER- IV

Biological Evidence evaluation

FS-443

Credit:-2(2-0-0)

Unit-1 Introduction to biological evidences

Type of evidences, Collection, Preservation, Handling and sampling.

Unit-2 Analysis of Biological evidences

Physical (microscopical), Chemical and Instrumentation Examination of Evidences, Case study relating to different biological evidences, Biological evidence deposition and Testimony.

UNIT-I

Reptilia: General characters and classification, General anatomy of *Uromastix*, Snakes, *Sphenodon*: The Living fossil.

UNIT-II

Aves: General characters and classification, General anatomy of *Columba livia*, Aerial adaptations in birds, Types of feathers and Migration in birds.

UNIT-III

Mammals: General characters and classification, General anatomy of *Oryctolagus*, Oviparous mammals, Aquatic mammals, aerial mammals.

UNIT-IV

Comparative Anatomy: Comparative account of digestive system, respiratory system, circulatory system, nervous system, exoskeletal system, endoskeletal system, excretory system of reptiles, aves and mammals.

UNIT-V

Connecting links: Definition, General characters of *Peripatus*, *Neopilina*, *Balanoglossus*, *Chimaera*, *Protopterus*, *Archaeopteryx* and egg laying mammals.

PRACTICALS

- To study the museum specimen of vertebrate (Aves and mammals).
- Study of Morphology and anatomy of Bird and Rat through the method Chart preparation.

Suggested Reading:

1. Vertebrates: R.L. Kotpal
2. Vertebrates: Jordan & Verma
3. A textbook of Zoology: Parker & Haswell

UNIT I

Broad outline of morphology of vegetative & reproductive organ of Angiosperms.

UNIT II

Principles of Systematic, classical & modern taxonomy,

UNIT III

Rules of nomenclature. Comparative study of different classification systems proposed. UNIT IV
General morphology of flower & its parts.

UNIT V

Taxonomic studies of some important families. Brassicaceae, Poaceae, SolanaceaeLeguminoseae

PRACTICAL

- Study of floral parts and role of different flower parts
- Study of inflorescence
- Study of different plant families eg. Brassicaceae, Poaceae, SolanaceaeLeguminoseae.

UNIT I

Introduction to Biomolecules: Definition, general classification and important functions of carbohydrates, lipids, proteins, Nucleic Acids: Structure of DNA and RNA, DNA replication, translation and transcription

UNIT II

Enzymes as biocatalysts: General characteristics, nomenclature and classification of Enzymes, Effect of temperature, pH, enzyme and substrate concentrations on the activity of enzymes, Elementary concept of cofactors and coenzymes

UNIT III

Microbial System and Biotechnology: Types of microbes and their properties; Basic concepts, scope and achievements in biotechnology, Significance of genetic engineering, Tools used in biotechnology, Elementary knowledge of Recombinant DNA Technology, Bio-informatics and Genomics

UNIT IV

Gene libraries: Construction and screening of genomic DNA library and cDNA library, Construction and use of cloning vectors, Modes of gene transfer, Molecular markers: RAPD, RFLP, SSLP, AFLP, VNTR, SSR, SNP STR, SFP, DArT and RAD

UNIT V

Applications of Biotechnology in Agriculture, Medicine and Environment: an elementary knowledge, Biotechnology in paper industry, biofertilizers, bioinsecticides, sewage treatment using microbial system, Application of genetically engineered microbes, Prospects and public perception of Biotechnology

PRACTICALS:

- **Introduction to lab equipment: Autoclave, Laminar Air Flow, Microscope,**
- **Sterilization techniques: Dry and Hot,**
- **Electrophoresis: Types and instrumentation,**
- **Preparation of plant tissue culture media, Isolation and staining of bacteria, DNA detection by gel electrophoresis**

BOOKS RECOMMENDED:

1. Cell Biology and Genetics, 9th edition. Starr, C. and Taggard; R. (2001) Thomson Learning USA.
2. Life Science of Biology, 6th edition, Purves W.K.; Sadava, D.; Orians, G.H. and Heller, H.C. (2001). W.H. Freeman & company, USA.
3. Basic Biotechnology, Ignacimuthu, S.J. (2002) Tata McGraw-Hill Pub., New Delhi
4. Genes VII, Lewis Benjamin (2002). Oxford Univ. Press Oxford.
5. Biotechnology, 3rd Edition. Smith, J.E. (2003) Cambridge University Press.

Semester-IV
Course Title: AROMATIC COMPOUNDS

Code-CHEM-540

Credit: 3 (2-0-2)

Unit 1: Chlorobenzene: Structure, Preparation, Properties and uses.

Unit 2: Nitrobenzene: Structure, Preparation, Properties and uses.

Unit 3: Aniline: Structure, Preparation, Properties and uses.

Unit 4: Phenols: Structure, Preparation, Properties and uses.

Unit 5: Benzaldehyde: Structure, Preparation, Properties and uses.

Unit 6: Benzophenone: Structure, Preparation, Properties and uses.

Unit 7: Benzoic Acid: Structure, Preparation, Properties and uses.

Course Title: *d* & *f* BLOCK ELEMENTS
Semester-IV

Code-CHEM-541

Credit: 3(2-0-2)

Unit I: *d*-block elements.

Unit II: Platinum metals.

Unit III: *f*- block elements.

Course Title: THERMODYNAMICS-II, PHASE EQUILIBRIUM & RADIO CHEM.
Semesater-IV

CHEM-542

Credit 3(2-0-2)

Thermodynamics II: Spontaneous processes, carnot cycle, staement of second law, concept of entropy, combined form of the first and second law of Thermodynamics, enthalpy and entropy. Thermodynamics equation of state (energy as a function of V, & T, enthalpy as a function of T & P), entropy in isolated system, variation of entropy with temperatutere & volume, variation of entropy with temperature and pressure, Entropy change in chemical reaction. Helmholtz and Gibbs free energies. Properties of Gibbs-Helmoltz equation.

Phase Rule: Phase, component and degree of freedom. Phase rule and its application to one component (water and Sulpher), biocomponent system (Ag + Pb), KI + H₂O).

Radiochemistry: Definition and measurement of radioactivity, rate of atomic disintegration radioactive equilibrium, theory of radioactivity artificial transmutation of elements, induced radioactivity and nuclear energy, nuclear fission and fission, radioactive isotopes.

Semester-V

Course Code:-FS-451

Credit:-3(3-0-0)

Course Title: Forensic Chemistry & Toxicology

- UNIT-I** Forensic Chemistry Introduction, types of cases / exhibits, preliminary screening, presumptive test, inorganic analysis, micro-chemical methods of analysis, examination procedures involving standard methods and instrumental techniques.
- UNIT-II** Analysis of beverages: alcoholic and non-alcoholic, country made liquor, illicit liquor and medicinal preparations containing alcohol and drugs as constituents.
- UNIT-III** Drugs of abuse: introduction, classification of drugs of abuse, drug of abuse in sports, narcotics drugs and psychotropic substances, designer drug and their forensic examination, Drugs and Cosmetic Act, Excise Act, NDPS Act.
- UNIT-IV** Quantitative and qualitative forensic analysis of organic and inorganic industrial products, chemical fertilizers, insecticides, metallic and non metallic products, consumer items such as gold, silver, tobacco, tea, sugar, salts, acids, and alkalis etc.
- UNIT-V** Poison-Administration, action of poison, classification, collection, evaluation, isolation, classical identification techniques, modern technique Chromatography, mass spectroscopy, spectrophotometry, x-ray diffraction.)
- UNIT -VI** Individual Poison- Barbiturate, Arsenic, Organophosphorus Compound, classification, nature, administration, symptoms, detection, Post mortem finding, estimation, toxicological material.
- UNIT-VII** Vegetable poison- Dhatura, oleander, madar (Aak, Akdo) Nature, use, system, fatal dose, fatal period, Post mortem finding, isolation, detection, estimation.

Semester-V

Course Code:-FS-452

Credit:-3(3-0-0)

Course Title: Forensic Serology and DNA Profiling

- UNIT-I Introduction to Serology:** Definition, Types of Body Fluids,(Blood, Semen, Saliva, Sweat, Urine) their properties, Significance, collection, preservation, preliminary and confirmatory tests.
- UNIT- II Introduction to Immunology:-** Definition of Immunology, Immune system, Immune response, Innate & Acquired Immune System, Antigens, Haptens and Adjuvant, Immunoglobulin – Structure, types, physiochemical properties and functions.
- UNIT-III Determination of Origin of Species:-** Determination of human and animal origin from body fluids / stains viz. blood, semen, saliva, sweat, through immuno- diffusion and immuno – electrophoresis techniques.
- UNIT IV Serogenetic markers:-** Blood groups – biochemistry and genetics of ABO, Rh, Mn systems, methods of ABO blood grouping form blood stains and other fluids / stains semen, saliva, sweat, their forensic significance.
- UNIT-V DNA Profiling Structure & Analysis:-** Introduction to Genetics, Genotypes, Phenotypes, Structure and History of DNA, Molecular Biology of DNA, Variations, Polymorphism DNA system. Introduction to DNA Fingerprinting RELP analysis, and PCR amplifications. Application and Forensic Significance of DNA Profiling.

SEMESTER-V

Reasoning and Data interpretation

FS- 453

Credit:-2(2-0-0)

Unit-I logical reasoning – understanding the structure of arguments; evaluating and discussing deductive and inductive reasoning, verbal analogies, verbal classification, reasoning logical diagrams, venn diagrams

Unit –II Data interpretation- sources, acquisition and interpretation of data, quantitative and qualitative data, graphical representation and mapping of data.

UNIT – I

Introduction, Origin of Plants, Geological time scale

UNIT – II:

Evolutionary pattern and diversification in plants, rise and dominance of seed plants

UNIT – III

Fossils; Introduction, Types of fossils, Formation of fossils, evidences from fossils

UNIT – IV:

Subdiscipline of paleobotany; Biostratigraphy, Biomechanics and allometry, Paleoecology, Dendrochronology

UNIT –V:

Fossil records of different era, Paleobotanical methods, Time line of plant evolution, Plant adaptations

Reference Book:

- ✓ Principles of Paleobotany by Lily Bora
- ✓ Text Book of Paleobotany by S.R.Mishra
- ✓ Paleobotany and Evolution of Plant by Wilson Nichols Stewarts
- ✓ Plant diversity and Evolution by Robert J. Henry
- ✓ Palaeobotany and Plant evolution by Iqbal Hussain

Semester-V
Course Title: CO-ORDINATION CHEMISTRY & ISOMERISM

Course Code-CHEM-551

Credit: 3(2-0-2)

Unit I: Co-ordination Chemistry: Introduction, Nomenclature, Crystal field theory, Valence-shell electron pair theory.

Unit II: Isomerism

Unit III: Non aqueous solvent

Course Title: SOLUTION CHEM. & ADVANCED ELECTROCHEMISTRY
Semester-V

Course Code: CHEM-552

Credit: 3(2-0-2)

Conductance and Transference: Electrolytic conductance and measurement of specific/equivalent. Molecular conductance. Effect of dilution on specific and equivalent conductance. Kohlrausch's law and its applications. Transport number and its determination.

Physical Properties and Chemical Constitution: Molar volume, Parachor, Molecular refraction and polarization, Dipole moment, Delye and Clausius-Mossottic equation (Derivation not required).

Electrochemical Cell: E.M.F. determination, concentration cells with and without transference, liquid junction potential, Chemical cells without transference, fuel cells and their applications.

Course Title: NATURAL PRODUCTS
Semester-V

Course Code-CHEM-550

Credit: 3(2-0-2)

Unit 1: Heterocyclic Compounds: Five membered rings Pyrrole: Structure, Preparation, Properties Furan structure, preparation, properties. Thiophene: structure, preparation, properties. Six membered rings: structure, preparation, properties. Pyridine: structure preparation, properties.

Unit 2: Alkaloids: Classification, Determination of Structure Coniine, Nicotine, Atropine Structure and Properties.

Unit 3: Terpenoids: Isoprene rule, Classification, Structure and Properties of Myrcene, Citral, Camphor.

Unit 4: Polymers: Addition Polymers, Copolymers, condensation Polymers, Thermoplastic and Thermo setting Polymers, Natural and Synthetic Rubber.

Unit 5: Introduction to Spectroscopy: Ultraviolet and Visible Spectroscopy (UV), Infrared Spectroscopy (IS), Nuclear Magnetic Resonance Spectroscopy (NMR), Mass Spectroscopy (MS).

Books Recommended:

1. Reaction Mechanism: S.M.Mukherjee & S.P.Singh.
2. Advanced Organic Chemistry: B.S.Bahl & Arun Bahl.
3. Advanced Organic Chemistry: P.L.Soni & H.M.Chawla
4. Advanced Organic Chemistry: M.K.Jain.
5. Chemistry of Natural Products: O.P.Agarwal.
6. Chemistry of Natural Products: I.L.Finar.

Course Title: Genetics
Semester-V

Course Code: BIOL 523

Credit: 3(2-0-2)

UNIT I Mitosis and Meiosis, Elements of Heredity and Variations. Mendel's experiments and Laws, Principles of segregation and independent assortment, test and back cross.

UNIT II Linkage and crossing over, mutation and mutagens. Human Chromosomes and Human chromosomal abnormalities.

Practical:

- Different types fossils.
- Study of plant specimens used by ethnic groups.

Course Title: Evolutionary Biology
Semester-V

Course Code: BIOL 524

Credit: 3 (2-0-2)

UNIT I Introduction and importance of evolutionary biology. A short history of evolutionary biology.

UNIT II Evolutionary Genetics and diversity.

UNIT III Species Concepts and Intraspecific Geographic variation, genetic drift.

UNIT IV Macroevolution the History of Life Fossils as evidence of evolution, The origin of life, The origin of cells, The origin of multicellular life Evolutionary Genomics and horizontal gene transfer. Evolutionary Developmental Biology. Rates of Evolution Coevolution and coadaptation. Extinction and Radiation

Practical:

- Study of adaptive modification of feet/claws in birds
- Study of adaptive modification in mouth parts in insects
- Study of connecting links during the period of evolution

Semester-V
Course Title: ENVIRONMENTAL STUDIES – I
B. Sc. (PCM/ PCFS/ PMCS/ LSCFS/ ZBC)

Course Code: ENV-415

Credit: (2-0-0)

1: The Multidisciplinary Nature of Environmental Studies
Definition, Scope and Importance

(i) Ecosystems

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposes
- Energy flow in the ecosystem
- Ecological succession
- Food chains, types, Characteristics features, structures and function of the following ecosystem:
 - (a) Forest Ecosystem
 - (b) Grassland Ecosystem
 - (c) Desert Ecosystem
 - (d) Aquatic ecosystem (Ponds, streams, lakes, river, oceans, estuaries.)

(ii) Social Issues and the Environment

- From Unsustainable of sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, water shed management
- Rescurement and rehabilitation of people; Its problems and concerns Case studies
- Environmental ethics, Issues and possible solutions
- Climate change, global warming, and rain ozone layer depletion, nuclear accidents and holocaust, Case studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of pollution) Act.
- Visit to local polluted site-Urban/ Rural/ Industrial/ Agricultural
- Study of Common plants, insects, birds
- Study of simple ecosystems-Ponds, river, Hills/ Pocs etc (Field work equal to 5 lecture hours).
- Issues involved in enforcement of environmental legislation, Public awareness.

Semester-VI

Course Title: ADVANCED ORGANIC CHEMISTRY

Course Code: CHEM-560

Credit: 3(2-0-2)

Unit-1 Organic Photochemistry:- Heterocyclic, Nomenclature, synthesis & reaction of following compounds containing one heteroatom – Structure, preparation & properties.

- (i) Five membered ring system:- Furan, pyrrole, thiophene.
- (ii) Six membered ring:- Pyridine

Unit 2:Polymers: Addition Polymers, Copolymers, condensation Polymers, Thermoplastic and Thermo setting Polymers, Natural and Synthetic Rubber, polyethene & PVC.

Unit-3 Introduction to Spectroscopy:- UV & Visible, IR, NMR, Mass Spectroscopy.

Unit-4 Some reactions of Industrial Importance:- Hoffman, Diel's Alder, Skraup, Bechmann, Cannizaro and Riemann Teimann.

Course Title: SPECTROSCOPY

Semester-VI

Course Code-CHEM-561

Credit: 3(3-0-0)

Unit I: Spectroscopy

- (a) UV
- (b) IR
- (c) NMR
- (d) Raman
- (e) Mass

Books Recommended:

1. Advanced Inorganic Chemistry: Gurdeep Raj, Goel publications Meerut.
2. Text-Book of Inorganic Chemistry: PL.Soni, S.Chand & Sons.
3. Inorganic Chemistry: Satya Prakash Tuli, Basu & Sons, S.Chand & Co.
4. Advanced Inorganic Chemistry: S.K.Agarwala & Keeti Lal, Pragati Prakasan.
5. Inorganic Chemistry: Cotton & Wilkinson.

Course Title: PHOTOCHEMISTRY & ADVANCED WAVE MECHANICS

Semester-VI

Course Code: CHEM-562

Credit: 3(2-0-2)

Photochemistry: Photochemistry and thermal reactions, Chain reaction, free radical chains, thermal decomposition of acetaldehyde and ethane, Lambert and Beer's law, Grothus Draper's law, Elinstin law of decomposition of hydrogen-iodide, hydrogen-bromine etc, Fluoescence, Photosensitization, Phosphorescence Chemiluminescence.

Thermodynamics: Law of mass action (thermodynamic derivation, reaction isotherm and Vant Hoff equation (influence of temperature on equilibrium constant), Partial molar quantities, Chemical potential, Gibbs Duhem equation, Effect of temperature and pressure on chemical potential, Chemical potential of real gases and fugacity, Thermodynamic treatment of colligative properties (lowering vapour pressure, elevation of boiling point, depression of freezing point, osmotic pressure).

Atomic Structure & Wave Mechanic: Bohr's theory, Sommerfeld's model, dual nature of electron, De Broglies concept of the dual nature of the electron, de-Broglies equation, experimental verification (Davisson and Germer's experiment), Heisenbergs uncertainty principle and its derivation-Schrodinger wave equation (derivation), Schrodinger equation with respect to time, Eigen values and functions, Operators (Addition and Substraction of operators, Multiplication, Linear, Hamiltonian, Hermitian), Postuates of Quantum mechanism, free particle, particles in potential barrier, Particle in one dimensional box, Particle in 3 dimentional box, Simple Harmonic Oscillator, Hydrogen Atom.

Semester-VI

BIOL 533

PLANT ANATOMY AND EMBRYOLOGY

3 (2-0-2)

UNIT I

Broad outline of anatomy of vegetative & reproductive organs of angiosperms. An account of normal primary & woody plants.

UNIT II

Primary anomaly. Anomalous secondary growth in Boerhaavia, Bignonia, Dracaena and Chenopodium

UNIT III

Nodal Anatomy and Anatomy of leaf

UNIT IV

A brief history of Embryology, development of anther & pollen, Microsporogenesis, anther dehiscence & viability curvature of ovule leading to different types,

UNIT V

meiosporogenesis & mono, bi & tetra sporic type of embryo-sacs. Types of embryogeny.

UNIT VI

General account of apomixes & polyembryony. Development of seed.

PRACTICALS:

- Slide study of parenchyma, collenchyma, sclerenchymatous tissues.
- Study of L.S. of Dicot and Monocot shoot
- Study of L.S. of Dicot and Monocot roots
- Study of Trichomes
- Section cutting for anatomical studies of root
- Section cutting for anatomical studies of shoot

BOOKS:

- A text book of Botany Angiosperms – Singh, Pande and Jain
- College Botany – Gangulee, Das and Dutta
- Anatomy – A. Fahn

UNIT I:

Basic concepts of development: Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development.

UNIT II:

Gametogenesis: Spermatogenesis, Oogenesis, Oogenesis in insects and mammals

UNIT III:

Fertilization and early development cell surface molecules in sperm-egg recognition in animals; embryo sac development zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals.

UNIT IV:

Morphogenesis and organogenesis in animals: Cell aggregation and differentiation, Axes and pattern formation, amphibia and chick; organogenesis –eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons,

UNIT V:

Post embryonic development: larval formation, metamorphosis; environmental regulation of normal development; sex determination.

PRACTICALS

- Study of different types of placenta in mammals by charts,
- identification of cross sections of chick embryo through eye and ear part, vital staining of chick embryo (in vitro), induced ovulation and fertilization in fishes, Study of fish embryo

Recommended Books:

1. Gilbert. 2013. *Developmental Biology*. SinauerAssociates.
2. Sastry and Shukal. 2007. *Developmental Biology*. Rastogi publications.
3. Verma and Agarwal. 2012. *Chordate Embryology: Developmental Biology*.

UNIT I

Introduction, Distribution, types of biodiversity, Hot spots of biodiversity

UNIT II

Ecosystem: Definition and concept, Component and structure, Ecosystem energetic, Types of ecosystem, Ecological succession

UNIT III

Biodiversity conservation: In-situ and Ex-situ, advantages and disadvantages, Importance of biodiversity, Cultural and aesthetical values

UNIT IV

Threats to biodiversity, classification of species based on threats, National parks, Biosphere reserves, Botanical garden,

UNIT V

National and international Laws on biodiversity, Project Tiger, Project Elephant, Project Crocodile, Project Rhino

Reference Book:

- ✓ Biodiversity and its conservation by S.S. Negi
- ✓ Biodiversity conservation and Environmental Management by D.R. Khanna
- ✓ Environmental studies by Deswal and Deswal
- ✓ Biodiversity and Conservation by Mike J. Jeffries
- ✓ Biodiversity: Monitoring and Utilization by B.B. Hosetti and K.L. Naik

Semester-VI

Course Code:-FS-561

Credit:-3(3-0-0)

Course Title: Cyber Forensic

- UNIT-I** **Introduction & Fundamental Concepts:** Fundamentals of computers, History of and generation of computers, hardware and accessories, operating system, software. Introduction to networking, LAN, MAN and WAN, types of topology, introduction to internet and its application.
- UNIT II** **Introduction to Computer & Cyber Crimes-** Definition, Motives, Mode and manner and types of Computer and cyber crime. Difference between computer crime and cyber crimes
- UNIT-III** **Introduction to Cyber Forensic** Search and Seizures of Evidence, Investigation of cyber crimes and tools for analysis. Introduction to Cyber laws and IT security.

**Course Title: Quality & Laboratory Management
Semester-VI**

Course Code: FS-462

Credit: 3(3-0-0)

UNIT-II Quality Management (ISO/IEC 17025) General requirements for the competence of testing and calibration laboratories, Introduction, Scope, Management requirements: organization, Quality System, Document Control, Test and calibration methods and methods validation, Equipment, measurement traceability, Sampling, Handling of test and calibration items, assuring the quality of test calibration results and reporting the results.

UNIT-II Laboratory Management, Laboratory information management system, validation and safety equipments.

UNIT-III Report Writing and Evidence Evaluation, Components of reports and Report formats in respect of Crime Scene and Laboratory findings. Court Testimony- admissibility of expert testimony, per Court preparations & Court appearance, Examination in chief, cross examination and re-examination, Ethics in Forensic Science.

UNIT-IV Cases of Special Importance, Pertaining to forensic examination (Biology, serology, chemistry, toxicology) documents, fingerprints, ballistics, photography and physics, Voice identifications, Tape authentication & Computer frauds pertaining to forensic examination of cases

SEMESTER-VI

General English Precise writing and Comprehension

FS – 563

Credit:-3(3-0-0)

Unit I

Comprehension passage, paragraph writing, letter writing, change the number, change the gender, opposites, identifying nouns, pronouns, use of is/am/are, re-arranging letters to make words, make sentences etc.

Unit II

Comprehension test through objective-type questions on grammar, vocabulary, sentence correction, synonyms, antonyms, idioms and phrases and comprehension passages basic knowledge of word usages, matching of subject and verbs, correct usage of tenses and grammatically correct sentences acceptable in standard written communication, test of English language, verbal ability test, test of comprehension ability and reading comprehension.

Unit III

General English, understanding of the English language and its correct usage, writing ability and writing skills, comprehension and writing ability, vocabulary and correct usage of words and sentences, comprehension of passage and answering questions based on the passage, word analogies, spellings and word meanings, error detection and word usages.

Unit IV

English grammar, sentence completion, synonyms, antonyms, comprehension of a passage, one-word substitutes, idioms/phrases & error detection, sentence completion, sentence structure, phrases and idiomatic use of words, questions on paragraph writing, Spotting the Errors; Filling in the blanks, use of prepositions, test of spellings, re-arranging jumbled up sentences.

Course Title: Biodiversity and Taxonomy
Semester-VI

Course Code: BIOL 528

Credit: 3 (2-0-2)

UNIT I Definition and explanation of biodiversity, alpha and beta biodiversity and methods of their study present level of biodiversity and the rate of loss of biodiversity Extent of biodiversity in different groups of animal, plants and microbes Red data books and endangered plant and species *In situ* and *ex situ* conservation, Biodiversity prospecting for pharmaceuticals and agriculture

UNIT-II Animal Taxonomy: Binomial classification Meaning, various systems of classification of animals, its scope and usefulness in zoology.

UNIT III Plant Taxonomy: Types of taxonomy Meaning, various systems of classification of plants, its scope and usefulness in Botany.

Practical:

- Study of floral parts and role of different flower parts
- Study of inflorescence
- Study of different plant families eg. Brassicaceae, Poaceae, Solanaceae Leguminosae.
- Field visit for the concept of Biodiversity

Course Title: Biotechnology
Semester-VI

Course Code: BIOL 529

Credit: 3 (2-0-2)

UNIT I Basic concepts & scope of genetic engineering: significance of genetic engineering in different life forms, Mile stones in genetic engineering. Tools of Genetic Engineering: Cloning vehicles, Restriction enzymes, and other Modifying enzymes, DNA and RNA markers etc.

UNIT II Construction and use of cloning vectors: transposons as vectors. Modes of gene transfer: gene transfer methods in human

UNIT III Molecular markers: Molecular markers in genome analysis with special reference to RAPD, RFLP, AFLP, VNTR, SSR, SNP and their roles in forensic science, genetic counseling and diversity analysis. Gene libraries - Construction and screening of Genomic DNA library and cDNA library,

UNIT IV Modifying Genes: Basic concept of genomics, proteomics, transcriptomics and metabolomics

UNIT V Application of Biotechnology, Biosafety, bioethics and IPR issues

Practical:

- Basic methodology to molecular biology
- Preparation of reagent
- Protein isolation and quantization

Semester-VI
Course Title: ENVIRONMENTAL STUDIES-II
B. Sc. (PCM/ PCFS/ PMCS/ LSCFS/ ZBC)

Course Code: ENV-416

Credit: (2-0-0)

1) Natural Resources

- (a) Forest resources
- (b) Water resources
- (c) Mineral resources
- (d) Food resources
- (e) Energy resources
- (f) Land resources

Role of an individual in conservation of natural resources.

Equitable use of resources for sustainable life style.

2) Biodiversity and its conservation

- (a) introduction- Definition genetic, species and ecosystem diversity
- (b) Bio geographical classification of India.
- (c) Value of diversity consumptive use, productive use, social, ethical aesthet and option values.
- (d) Biodiversity at global, National and local levels.
- (e) India as mega-diversity nation
- (f) Hot – Spots of biodiversity
- (g) Threats to biodiversity habitat loss, poaching of wild life, man-wild life conflicts.
- (h) Endangered and endemic species of India
- (i) Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

3) Environment Pollution

Definition

Causes effect and control measures of

- (a) Air Pollution
- (b) Water Pollution
- (c) Soil Pollution
- (d) Marine Pollution
- (e) Noise Pollution
- (f) Thermal Pollution
- (g) Nuclear hazards

Solid waste Management; Causes, effect and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution

Pollution case studies

Disaster Management: floods, earthquake, cyclone and landslides.