

**CURRICULUM**  
**B. Sc. (PCFS)**

**B. Sc. PCFS Semester –I**

S.No	Course Code	Title of the Course	Credit Hrs.		
			L	T	P
1	PHY-331	MECHANICS	3	1	0
2	PHY-333	THERMAL PHYSICS	3	1	0
3	CHEM - 414	INTRODUCTORY ORGANIC CHEMISTRY	2	0	2
4	CHEM - 415	ATOMIC STRUCTURE & PERIODIC CLASSIFICATION	2	0	2
5	CHEM - 416	CHEMICAL KINETICS & ELECTRO CHEM.	2	0	2
6	FS-401	INTRODUCTION OF FORENSIC SCIENCE	2	0	0
7	FS-402	FORENSIC LAW	2	0	0
8	FS-403	PHYSICAL EVIDENCE EVALUATION	3	0	0
9	GPT-301	MORAL & VALUE EDUCATION	3	0	0
10	NSS-318	NATIONAL SERVICE SCHEME	Non Credit Course		

**B.Sc PCFS Sem. –II**

S.No	Course Code	Title of the Course	Credit Hrs.		
			L	T	P
1	CHEM - 423	HYDRO CARBONS	2	0	2
2	CHEM - 424	CHEMICAL BONDING & NUCLEAR CHEM	2	0	2
3	CHEM - 425	GASES, CHEMICAL EQUILIBRIUM & SURFACE CHEM.	2	0	2
4	FS-421	CRIME SCENE INVESTIGATION	2	0	2
5	FS-422	INSTRUMENTATION & ANALYTICAL TECHNIQUES	2	0	2
6	FS-423	ENVIRONMENTAL FORENSIC	2	0	0
7	PHY - 334	WAVES & OSCILLATIONS	3	1	0
8	PHY - 336	ELECTROMAGNETISM	3	1	0
9	PHY-330	PHYSICS LAB – 1	0	0	4
10	LNG-301	STRUCTURAL & SPOKEN ENGLISH	3	0	0
11	NSS-327	NATIONAL SERVICE SCHEME	Non Credit Course		

**B. Sc PCFS Sem. –III**

S.No	Course Code	Title of the Course	Credit Hrs.		
			L	T	P
1	CHEM - 530	ALIPHATIC COMPOUNDS	2	0	2
2	CHEM -531	MAIN GROUP ELEMENTS	2	0	2
3	CHEM - 532	THERMODYNAMICS – I & IONIC EQUILIB	2	0	2
4	PHY-431	ATOMIC & NUCLEAR PHYSICS	3	1	0
5	PHY-433	OPTICS	3	1	0
6	FS-431	FINGERPRINT EXAMINATION	2	0	2
7	FS-432	DOCUMENT EXAMINATION	2	0	2
8	FS-433	WILD LIFE FORENSIC	2	0	0
9	NSS-413	NATIONAL SERVICE SCHEME	Non Credit Course		

**B. Sc PCFS Sem. –IV**

S.No	Course Code	Title of the Course	Credit Hrs.		
			L	T	P
1	CHEM -540	AROMATIC COMPOUNDS	2	0	2
2	CHEM - 541	<i>d &amp; f</i> BLOCK ELEMENTS	2	0	2
3	CHEM - 542	THERMODYNAMIC – II, PHASE EQUILIB &RADIO CHEM.	2	0	2
4	PHY-434	MODERN OPTICS	3	1	0
5	PHY-436	STATISTICAL PHYSICS & ASTROPHYSICS	3	1	0
6	PHY-430	PHYSICS LAB- II	0	0	4
7	FS-441	BALLISTICS & PHOTOGRAPHY	2	0	0
8	FS-442	EXPLOSIVE	2	0	0
9	FS-443	BIOLOGICAL EVIDENCE EVALUATION	2	0	0
10	NSS-414	NATIONAL SERVICE SCHEME	Non Credit Course		

**B. Sc PCFS Sem. –V**

S.No	Course Code	Title of the Course	Credit Hrs.		
			L	T	P
1	CHEM - 551	COORDINATION CHEMISTRY & ISOMERISM.	2	0	2
2	CHEM - 552	SOLUTION CHEMISTRY & ADVANCED ELECTROCHEMISTRY	2	0	2
3	CHEM – 550	NATURAL PRODUCTS	2	0	2
4	PHY-531	QUANTUM MECHANICS	3	1	0
5	PHY-533	ELECTRONICS-I	3	1	0
6	FS-451	FORENSIC CHEMISTRY & TOXICOLOGY	2	0	2
7	FS-452	SEROLOGY & DNA FINGERPRINTING	2	0	2
8	COMP- 302	INTRODUCTION TO COMPUTER APPLICATIONS	1	0	2
9	ENV-415	ENVIRONMENTAL STUDIES- I	2	0	0
10	NSS-516	NATIONAL SERVICE SCHEME	Non Credit Course		

**B. Sc PCFS Sem. –VI**

S.No	Course Code	Title of the Course	Credit Hrs.		
			L	T	P
1	CHEM - 560	ADVANCED ORGANIC CHEMISTRY	2	0	2
2	CHEM - 561	SPECTROSCOPY	2	0	2
3	CHEM-562	PHOTO CHEMISTRY & ADVANCED WAVE MECHANICS	2	0	2
4	PHY-532	SOLID STATE PHYSICS	3	1	0
5	PHY-534	ELECTRONICS-II	3	1	0
6	PHY-530	PHYSICS LAB- III	0	0	4
7	FS-561	CYBER FORENSIC	2	0	2
8	FS-562	QUALITY AND LABORATORY MANAGEMENT	3	0	0
9	ENV-416	ENVIRONMENTAL STUDIES -II	2	0	0
10	CHEM-699	PROJECT WORK	5	0	0
11	NSS-527	NATIONAL SERVICE SCHEME	Non Credit Course		

## **Course Title: MECHANICS**

**B.Sc. PCM/ PMCS/ PCFS**

**Semester-I**

**Course Code: PHY-331**

**Credit Hrs: (3-1-0)**

### ***Unit-1: Vectors Analysis***

Integrals (line, surface and volume), Physical significance of Gradient, Divergence and curl, statement of Gauss's and Stroke's theorems.

### ***Unit-2: Frame of References and Relativity.***

Frame of reference, inertial frames of reference, Galilean transformations, postulates of special theory of relativity, Lorentz transformations, consequences of Lorentz transformations, Relativistic mass, Relativistic energy, Mass energy relation.

### ***Unit-3: Dynamics of Rigid Bodies,***

Angular momentum and moment of inertia, Theorem on moment of inertia, central forces, conservative and non-conservative forces.

### ***Unit-4: Fluid Mechanism,***

Ideal fluids, Equation of Continuity, Viscous fluids, critical velocity, Derivation of Poiseuille's Equation.

### **Reference books:**

1. An introduction to Mechanics  
Kleppner, Tata McGraw Hills
2. Mechanics  
J.C. Upadhyay
3. Mechanics and thermodynamics  
Basavaraju & Ghosh; Tata McGraw Hills
4. Mechanics  
B.S Agarwal
5. Mechanics  
D.S Mathur
6. Mechanics  
J.C Upadhyay

**Course Title: THERMAL PHYSICS**  
**B. Sc. PCM/ PMCS/PCFS**  
**Semester-I**

**Course Code: PHY-333**

**Credit Hrs: (3-1-0)**

***Unit-1: Basic concepts and 1<sup>st</sup> law of Thermodynamics***

Thermodynamic systems, Thermal equilibrium and Zeroth law of thermodynamics, concept of temperature, 1<sup>st</sup> law and its applications, indicator diagram, Reversible and irreversible process.

***Unit-2: 2<sup>nd</sup> law of Thermodynamics and Entropy.***

Carnot's engine and Carnot's Cycle, 2<sup>nd</sup> law of thermodynamics, Carnot's theorem, entropy, change of entropy in a reversible and irreversible processes. Temperature-entropy diagram.

***Unit-3: Thermodynamics Relationships.***

Clausius-Clayperon's equation, second latent heat equation, Triple point, Thermodynamic potentials and their relations with thermo dynamical variables.

***Unit-4: Thermal conduction.***

Fundamental equation of heat conduction, propagation of heat wave in an insulated rod with end heated sinusoidal (periodic flow of heat), propagation of temperature waves in the earth's crust.

**References books:**

1. Thermal Physics,  
B.K. Agarwal; Lokbaharti Publications.
2. Heat thermodynamics  
D.S. Mathur and M.N. Bapat; Sultan Chand book window.
3. Heat and thermodynamics  
Mark W Zemansky; Tata McGraw Hills.
4. Mechanics and thermodynamics  
Basavaraju and Ghosh; Tata McGraw Hills.
5. Heat, Thermodynamics & Statistical Physics,  
Satya Prakash
6. Heat & Thermodynamics  
Brij Lal & Subrahmanyam
7. Heat Thermodynamics & Statistical Physics  
Singhal, Agarwal, S.P
8. Heat & Thermodynamics  
Zemansky/Dittmann

**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) Mendeleef, 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.

## 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

Course Code:-FS-402

Credits:-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.

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

**Course Code: GPT-301**

**Credit: 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**

**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 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

Code:-FS-422

Credits: 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.

**Course Title: WAVES AND OSCILLATIONS**  
**B.Sc. PCM/ PMCS/PCFS**  
**Semester-II**

**Course Code: PHY-334**

**Credit Hrs: (3-1-0)**

***Unit-1: Simple Harmonic Motion.***

Simple harmonic motion and harmonic oscillator, Maclaurine series and expansion for harmonic oscillator. Education of motion of harmonic Oscillator and its solution, Energy of harmonic oscillator, Examples of harmonic oscillator- Simple pendulum, extended spring, U-tube, torsion pendulum, Helmholtz resonator and LCR circuit.

***Unit-2 Anharmonic Oscillator and composition of SHMs.***

Anharmonic oscillator, equation of motion and its solution, compound pendulum (detail study), Determination of 'g', composition of two SHMs of equal periods (Lissajous figures) and with periods in ratio 1:2.

***Unit-3: Damped oscillations, forced oscillation and Resonance.***

Damping force, damped oscillator, Equation of motion and its solution, power dissipation, Q factor. Examples of Damped harmonic oscillators, forced oscillations, Equation of motion and its solution. Resonance, LCR circuit, power in AC circuit and RMS value.

***Unit-4: Wave motion.***

General wave equation, De-Broglie hypothesis and uncertainty principle, particle, wave and group velocity, progressive plane wave solution, Longitudinal wave motion in strings, waves in liner bounded medium, flow of energy in stationary states.

**Reference books:**

1. The Physics of waves and Oscillations  
Bajaj, Tata McGraw Hills.
2. Waves and Oscillations  
Brijlal and Subrahmanyam.
3. Waves  
Frank S Crawford
4. Physics of Vibration & Waves  
H. J. Pain
5. Oscillation & Waves  
Satya Prakash
6. Physics of Vibration & Waves  
H.J. Pain
7. Waves & Oscillation  
Subrahmanyam / Brij Lal

**Course Title: ELECTROMAGNETISM**  
**B.Sc. PCM/ PMCS/PCFS**  
**Semester-II**

**Course Code: PHY-336**

**Credit Hrs: (3-1-0)**

***Unit-1: Electric field and potential.***

Vector form of Coulomb's law, Electric field and potential, Poisson's and Laplace equation .Gauss's law and its application for calculation of electric field due to spherical, cylindrical, linear and flat sheet charge distributions, charged soap bubble, Energy of ionic crystal, Method of electrical images for conducting plane only.

***Unit-2: Magnetostatics.***

Definition of magnetic field by Biot-Savart's law, Field due to circular Coil, Helmholtz coil and solenoid. Energy stored in magnetic field, line integral of magnetic field, Curl and Divergence of magnetic field, Ampere's theorem, Earth's magnetism, Tangent galvanometer, Magnetic materials and their classification, Langevin's theory of para and diamagnetic materials, field due to magnetised matter, Hysteresis loss and cycle.

***Unit-3: Electromagnetic Induction.***

Faraday's experiment, Lenz's law conducting rod moving through uniform Magnetic field, law's of electromagnetic induction, Eddy currents, Mutual inductance, Mutual inductance of solenoid, Maxwell's Equation, Basic concept of electromagnetic waves and its solution in free space. EM propagation through free space, Poynting theorem

***Unit-4: Varying currents.***

Currents through CR and LR circuits, High resistance by leakage, Alternating and Direct current, Analysis of LC and LCR circuits using complex number representation, Resonance, Q factor, Kirchoff's law and its application to AC circuits, Anderson's, Owen's and De-Dauty's bridges, Transformer and choke coil.

**References:**

1. Electricity Principles and Application  
Fowler; Tata McGraw Hills.
2. Electricity and Magnetism  
Mahajan; Tata McGraw Hill.
3. Electromagnetic Waves and Radiating systems  
Jordan Balman
4. Electricity and Magnetism  
K.K. Tewari

**B.Sc. (PCM/ PMCS/ PCFS) Semester–II**

**Course Title: PHYSICS LAB. – I**

**Course Code: PHY-330**

**Credit Hrs: 0-0-4**

**List of Experiments**

1. To determine the Moment of Inertia of a Flywheel about its axis of rotation.
2. To determine the value of (g) with the help of a compound pendulum.
3. To determine Young's Modulus of the given material in the form of a beam.
4. To determine the Modulus of Rigidity of the material of a given wire and Moment of Inertia of an irregular body with the help of Torsion Table.
5. To determine the Poisson's ratio for rubber.
6. To determine the force constant of the given spring and to verify that the force constant of a parallel combination of spring is equal to the algebraic sum of the force constants of the individual springs.
7. To determine the surface tension of the given liquid by capillary rise method.
8. To determine the surface tension of a liquid by Jaeger's method.
9. To determine the viscosity of a liquid by poiseuille's method.
10. To determine the Modulus of Rigidity of a given material in the form of a wire by Statistical Method (Horizontal Pattern).
11. To determine the Modulus of Rigidity of a given material in the form of a wire by Statistical Method (Vertical Pattern).
12. To determine the thermal conductivity of a non-metallic solid (Bad conductor) by Lee's disc method.
13. To determine the coefficient of thermal conductivity of a metal using Searle's apparatus.
14. To determine the value of Stefan constant.
15. To determine mechanical equivalent of heat  $J$  by mechanical method.
16. To determine the value of  $J$  with the help of Joule's calorimeter.
17. To determine the value of  $\gamma$  for air by Clement and Desorme's.
18. To determine the frequency of tuning fork by sonometer.

**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.



**Course Title: ATOMIC AND NUCLEAR PHYSICS**  
**B.Sc. PCM/ PMCS/ PCFS**  
**Semester-III**

**Course Code: PHY-431**

**Credit Hrs: (3-1-0)**

***Unit-1: Atomic Physics.***

Origin of atomic spectra (historical background), Bohr's theory and explanation of different series in hydrogen spectra. Experimental verification of discrete energy levels, Correspondence principle, Bohr & Sommerfield model, Shortcomings of old quantum theory, De-Broglie hypothesis, Planck's quantum hypothesis and explanation of photoelectric effect, Qualitative treatment of hydrogen atom, Quantum numbers, spin quantum number, Pauli's exclusion principle, Stern-Gerlach experiment, elementary idea of X-rays.

***Unit-2: Basic Nuclear Physics.***

Basic constituents of nuclei, nuclear radii, Magnetic moment and quadrupole moments, Nuclear binding energy curve, stability of nuclei, Mass defect and

packing fraction, semi empirical mass formula, Nuclear forces.

***Unit-3: Nuclear models and Radioactivity decay.***

Feature of shell model, magic numbers and liquid drop model, Fusion and Fission, Idea of  $\alpha$ -decay, Geiger-Nuttall rule,  $\beta$ -decay,  $\beta$ -spectrum and neutrino,  $\gamma$ -decay.

***Unit-4: Elementary Particles.***

Classification: Bosons and Fermions, photons, leptons mesons, Baryons and Hyperons-life times and their decay modes, Ideas of symmetries and conservation laws for various interactions, Quantum numbers, Iso-spin, Lepton number; Baryon number; Strangeness, hypercharge, Quarks.

**Reference books:**

1. Introduction to Atomic Spectra  
White; Tata McGraw Hill.
2. Nuclear Physics  
Kaplan; Narosa Pub.
3. Concepts of Nuclear Physics,  
Cohen; Tata McGraw-Hill.
4. Nuclear Physics  
D.C.Tayal
5. Nuclear Physics  
Roy & Nigam
6. Nuclear Physics  
S. N. Ghoshal

**Course Title: OPTICS**  
**B. Sc. PCM/ PMCS/ PCFS**  
**Semester-III**

**Course Code: PHY-433**

**Credit Hrs: (3-1-0)**

***Unit-1: Interference.***

Interference due to division of wave front, Bi-prism, Thickness of a transparent thin sheet, Interference due to division of amplitude, Interference due to thin films and wedge shaped films. Newton's Ring. Interferometers: Michelson's and Multiple beam. Intensity distribution and sharpness of fringes.

***Unit-2: Diffraction.***

Fresnel's Class: half period zone, construction of plane wave front, half period strips for cylindrical wave front, Rectilinear propagation of light, zone plate, diffraction at a single edge, Fresnel's integrals and Cornu's spiral.

Fraunhofer class: Diffraction at a single and double slit, Plane diffraction grating (Multiple), overlap and absent spectra, Dispersive power.

***Unit-3: Polarization.***

Polarization of light, pictorial representation, 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, circularly and elliptically polarized light, Dichroism, Polaroid, production and analysis of plane, circularly and elliptically polarized light, retardation plate. Optical activity, rotatory dispersion, Fresnel's explanation of plane of polarization, Half shade and Bi-quartz polarimeter. Elementary idea of Kerr and Faraday effects.

***Unit-4: Resolving power and Geometrical optics.***

Resolving power, Rayleigh criteria, Resolving power of prism, grating and telescope. Geometrical optics: Focal length of a system of two lenses separated by

a small distance, Cardinal points of coaxial system of lenses. Eye piece (Ramsden's and Hugen's), Aberration in lenses and their removal.

**Reference books:**

1. Optics  
Ghatak
2. Principle of Optics  
Mathur.
3. Geometrical and Physical Optics  
Longhurst
4. A Text Book of Optics,  
Subramanyam and Brijlal

## Semester-III

Code:-FS-431

Credits:-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

Code:-FS-432

Credits:-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.

**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)**

**1<sup>st</sup> 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 biomolecular 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 Title: MODERN OPTICS

#### B. Sc. PCM/ PMCS/ PCFS

Course Code: PHY-434

Credit Hrs: (3-1-0)

#### *Unit-1: X-Rays*

Origin, production and properties, Laue spots and Bragg's law for X-ray diffraction, Bragg's X-ray spectrometer. Debye and Scherrer method. Continuous X-ray and Bremsstrahlung process. Characteristic X-ray spectra, Mosley's law.

#### *Unit-2: Lasers*

Concept of spontaneous and induced emission, Einstein coefficients. Basic principles of laser action; Population inversion and different pumping methods. Rate equation for a three level laser. Simple idea of laser cavities and their characterization . Characteristic of laser radiation. Ruby and He-Ne laser.

#### *Unit-3: Holography*

Basic principle of holography, Recording and reconstruction of hologram. Property of a hologram, Holographic process viewed as Bragg diffraction. Holographic storage.

#### *Unit-4: Non-linear Optics*

Physical origin of non-linear polarization of the medium. Non-linear interaction of light with materials. Wave propagation in non-linear medium. Second harmonic generation. Phase matching ,frequency mixing, Self focusing phenomena.

#### **Reference books:**

1. Introduction to Atomic spectra  
White
2. Elementary Modern Physics  
Arya
3. Modern Physics  
Murugesan
4. Optical Electronics  
Ghatak & Tlyagarjan.
5. Laser – Theory & Applications  
Thyagranjan / Ghatak
6. Laser & Non-Linear Optics  
B. B. Laud

**Semester-IV**  
**Course Title: Statistical Physics and Astrophysics**  
**B. Sc. PCM/ PMCS/ PCFS**

**Course Code: PHY-436**

**Credit Hrs: (3-1-0)**

**Unit-1:**

Probability and distribution functions, Binomial and Gaussian distributions. Macroscopic and microscopic states. Phase space, Contact between static and thermodynamics. Calculation of thermodynamic quantities. Ensemble average. Liouville's Theorem in classical mechanics.

**Unit-2:**

Microcanonical ensemble, classical ideal gas. Entropy of mixing and Gibb's paradox. Harmonic oscillator, partition function physical significance of various statistical quantities. Canonical ensembles. Description of classical Ideal gas and harmonic oscillator. Grand-canonical ensembles. Calculation of statistical quantities and their physical significance. Maxwell Boltman, Fermi-Dirac and Bose-Einstein statistics. Photon statistics and plank radiation formula. Bose condensation.

**Unit 3:**

Section of a sphere, concepts of small and great circles, spherical triangles and their properties. Celestial Sphere: Systems of Co-ordinates. Annual motion of the sun, and ecliptic, Rising and setting of stars, Latitudes and Longitudes.

**Unit 4:**

Kepler's Laws, Newton's Laws of gravitation, Ecliptic motion, Anomaly, Kepler's equation, Euler's theorem. Planets, Stars and Galaxy; Origin of the Solar System- Hypotheses, the planet Earth, atmosphere and its usefulness., Solar phenomenon and solar Energy.

**References:**

1. Spherical Astronomy: Gorakh Prasad and N. Saran (Pothisala Pvt. Ltd; India)
2. Spherical Astronomy: Lodhunter, S.C., Gorakh Prasad and N. Saran (Revised) ( Pothisala Pvt. Ltd., India).
3. General Science: Introduction to Astronomy, Astrophysics, Physics, Climatology Etc.: J.P. Sharma (Gita) Press Road, Gorakhpur, India)
4. Spherical Trigonometry and Spherical Astronomy: Pragati Prakashan, Meerut, India): Malik and Pandey.

**B.Sc. (PCM/ PMCS/ PCFS) Semester-IV**

**PHYSICS LAB. – II**

**Course Code: PHY-430**

**Credit Hrs: 0-0-4**

List of Experiments

1. To determine the wavelength of Sodium light with help of Michelson Interferometer.
2. To determine the wavelength of Sodium light by Newton ring method.
3. To determine the wavelength of Sodium light using Fesnel's Bi-prism.
4. To determine the refractive index of the prism and its dispersive power with the help of spectrometer.
5. To determine the wavelength of different spectral light emitted by light sources with the Plane Transmission Gratings.
6. To verify Newton's formula for combination of two lenses.
7. To find the focal length of concave and convex lenses.
8. To calibrate a given Voltmeter of  $L$ -ampere range with the help of potentiometer.
9. To calibrate a given Voltmeter of  $L$ -volts range with the help of potentiometer.
10. To convert a Weston galvanometer with an Ammeter and voltmeter.
11. To find out internal resistance of Lechlanche cell by means of Potentiometer.
12. To compare two resistances by means of Potentiometer.
13. To find out and unknown resistances with help of Meter Bridge.
14. To determine the ballistic constant  $K$  of a moving coil Ballistic Galvanometer and to calibrate Ballistic Galvanometer.
15. To plot a graph showing variation of magnetic field with distance along the axis of circular coil carrying current and to estimate from it the radius of the coil with the help of Helmholtz Galvanometer.
16. To determine the magnetic movement ( $M$ ) of a magnet and horizontal component of Earth's Magnetic field ( $H$ ) using deflection magnetometer.
17. To determine the magnetic movement ( $M$ ) of a magnet and horizontal component of Earth's Magnetic field ( $H$ ) using vibration magnetometer.
18. To determine the electro chemical equivalent of Copper using copper voltmeter.



## Semester-IV

Course Code:-FS-441

Credits:-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

Credits:-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

**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.**  
**Semester-IV**

**CHEM-542**

**Credit 3(2-0-2)**

**Thermodynamics II:** Spontaneous processes, carnot cycle, statement 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 temperature & volume, variation of entropy with temperature and pressure, Entropy change in chemical reaction. Helmholtz and Gibbs free energies. Properties of Gibbs-Helmholtz 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 + H<sub>2</sub>O).

**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 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: QUANTUM MECHANICS**

**B.Sc. PCM/ PMCS/ PCFS**

**Semester-V**

**Course Code: PHY-531**

**Credit Hrs: (3-1-0)**

***Unit I : Inadequacy of Classical Mechanics***

Black Body Radiation, Rayleigh-Jean's Law, Wien's law, Planck's Radiation Law, Photoelectric Effect and its experimental results, Einstein's Theory of Photoelectric Effect, Compton Effect and experiment.

***Unit II : Difficulties with classical Theory of specific Heats of Solids-***

Einstein's Theory of Specific Heats, Debye's modification. Bohr's Theory of Hydrogen Atom, Experimental verification, Bohr's correspondence principle, Franck & Hertz Experiment, J.P. Thomson's Experiment, Wilson- Sommerfeld Quantization Rule & Applications.

***Unit III : Foundations of Wave Mechanics***

Dual Nature of Light, Experimental evidence for Matter Waves, de-Broglie concepts of Stationary orbits & de-Broglie wavelength. Phase velocity, group velocity & relationship in case of a free particle, Equation of motion for a material particle, physical Interpretation of  $\psi$ . Uncertainty principle, Examples and application.

***Unit IV : Application of Schrodinger Equation -D***

Free Particle, Particle in a Box, Potential Step, Rectangular Potential Barrier, Application to  $\alpha$ -decay, 1-D infinitely Deep Well, 3-D Square Well potential, 1-D Linear Simple Harmonic Oscillator.

**Reference books:**

1. Basic Quantum Mechanics  
Ajoy Ghatak
2. Quantum Mechanics  
Peebles
3. Quantum Mechanics  
Agarwal / Hari Prakash
4. Introduction to Quantum Mechanics  
Pauling / Wilson
5. Quantum Mechanics,  
Schiff
6. Quantum Mechanics  
Powell and Crasemann
7. Quantum Mechanics  
Eisberg / Resnick
8. Advanced Quantum Mechanics  
J. J. Sakurai

**Semester-V**  
**Course Title: ELECTRONICS – I**  
**B. Sc. PCM/ PMCS/ PCFS**

**Course Code: PHY-533**

**Credit Hrs: (3-0-0)**

***Unit-I: Introduction to Semiconductors***

Bohr's Theory, Atomic Structure, Energy bands, Valence band, Conduction Band & forbidden energy gap. Insulators, semi-conductors and conductors. Types of Semiconductors, P-type, N-type semiconductor, Mechanism of conduction in electrons and holes.

***Unit-II: Power Supplies***

PN diode, its principle & working. PN diode as rectifier; half wave and full wave. DC and RMS current, power efficiency. Ripple factor, peak inverse voltage, Regulation bridge rectifier. Capacitor and inductor as filters. L &  $\pi$  section filters, Zener diode and voltage regulation.

***Unit-III: Basic Logic Concepts***

Digital and analog methods; Number systems: Decimal, Binary, Hexadecimal and Octal, Conversion between number systems. One's, Two's complement and Nine's complement, Binary Arithmetic. Binary codes: BCD, Gray. Excess-3.

**Reference books:**

1. Electronic Devices & Circuit Theory  
Bodystead / Nashelsky
2. Electronic Principles  
Malvino
3. Electronic Devices & Circuits  
Sanjeev Gupta
4. Principles of Electronics  
V.K.Mehta
5. Electronic Devices & Circuits  
David A. Bell
6. Electronic Fundamental & Applications  
John K. Ryder

## 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

Credits:-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, Haptenes 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 from 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.



**Course Title: Computer Applications**  
**Semester-V**

**Course Code: COMP-302**

**Credit: 2 (1-0-2)**

1. Introduction to computers
2. H/W and S/W concepts & Terminology
3. Operating System
  - a. Dos
  - b. Windows
4. Introduction to Commonly used Applications Softwares
  - a. MS-Word
  - b. MS-Excel
5. Computer Languages & Introduction to 'C' Programming Language
  - a. Input & output Statements
  - b. Declaration of Variables
  - c. Operators
  - d. Control statements (Branching and Looping)
6. Introduction to Computer Networks
7. Introduction to Internet
8. Application of I.T.

**Reference Books:**

- Raja Raman V. (2004), "Introduction to Information Tehnology", PHI.
- J.B. Dixit, "Fundamentals of Computers & Programming in 'C'", Laxmi Publication (P) Ltd.
- Yashavant Kanetkar, "Let us C", BPH Publications
- E. Balaguruswamy, "ANSI C", TMH

**Practical List:**

1. Working with operation systems like MS-DOS, Windows
2. Study of Software packages like MS-Word, MS-Excel and MS-Power point
3. Packages related to Medical Applications
4. How to search data, workable knowledge of Internet
5. Simple programs in C language
  - i. To find the largest among three numbers
  - ii. To check whether the given number is palindrome or not
  - iii. To find whether the given number is the prime
  - iv. To find sum and average of n integer using linear array
  - v. To generate the Fibonacci series
  - vi. To find factorial of a given number using function

**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.

**Course Title: SOLID STATE PHYSICS**

**B. Sc. PCM/ PMCS/ PCFS**

**Semester-VI**

**Course Code: PHY-532**

**Credit Hrs: (3-1-0)**

**Unit 1:** Crystalline solids, crystal structure, Elements of external Symmetry of crystals, symmetries of a cube, primitive lattice, cell and unit cell, symmetry operations, No. of atoms per unit cell and coordination no. for cubic lattice cells, Packing factor, Miller indices.

**Unit 2:** Separation between lattice planes for cubic lattice, Reciprocal Lattice, Diffraction of X-rays, Bragg's law, comparison of X-ray, electron and neutron diffraction by crystals, Ionic bonding, potential energy diagram of ion molecules, covalent bonding, Vanderwall's bonding, Metallic bonding & hydrogen bonding.

**Unit 3:** Lattice vibrations, phase velocity, Group velocity, Lattice defects, classification of defects. (pt. defeat, line defeat, plane defeat) Lattice vacancies, Specific heat of gases, specific heat of Solids, Einstein's model of the lattice specific heat of Solids.

**Unit 4:** Properties of metals, Lorentz- Drude theory, Electrical conductivity & Ohm's law. Thermal conductivity, Kroning - Penney model, Bloch theories. Relaxation time, Mean free path, Mobility and Drift velocity, Superconductivity.

**Reference books:**

1. Introduction to Solid State Physics  
Kittle
2. Solid State Physics  
Dekker
3. Introduction to Solids  
Azaroff
4. Solid State Physics  
R.L. Singhal
5. Solid State Physics  
Ashcoft & Mumin
6. Crystallography for Solid State Physics  
Verma & Srivastava

**Course Title: ELECTRONICS – II**

**B. Sc. PCM/ PMCS/ PCFS**

**Semester-VI**

**Course Code: PHY-534**

**Credit Hrs: (3-0-0)**

***Unit-I: Bipolar junction transistor***

Junction transistors and their working, Basic transistor equation. Transistor configurations,  $\alpha$  and  $\beta$  of transistors. Biasing techniques and stabilization. JFET & MOSFET.  $Z$ ,  $y$  and  $h$  parameters and their interrelations. Single stage CB, CE & CC amplifiers and their comparison.

***Unit-II: Oscillators***

Feedback in amplifiers: principle and effect on amplifier characteristics. Classification of Oscillators, Principle of feedback oscillators, Barkhausen criterion. Analysis of tuned collector, tuned base, Hartley, Colpitt, R.C. phase shift and Wein's Bridge Oscillators.

***Unit-III: Digital Electronics***

Logic gate: AND, OR, NAND, NOT and NOR gates. Their electrical and electronics circuits, Truth tables, EXOR gate, Half adder full adder and subtractor. Series and Parallel Adders.

**Reference books:**

1. Electronic Devices & Circuit Theory  
Bodystead / Nashelsky
2. Electronic Principles  
Malvino
3. Electronic Devices & Circuits  
Sanjeev Gupta
4. Principles of Electronics  
V.K.Mehta
5. Electronic Devices & Circuits  
David A. Bell
6. Electronic Fundamental & Applications  
John K. Ryder

**Semester-VI**  
**Physics Lab-III**  
**B. Sc. (PCM/ PMCS/ PCFS)**  
**(ELECTRONICS)**

**Course Code PHY-530**

**Credit Hrs: (0-0-4)**

1. To draw the characteristic of Si semiconductor diode and calculate its forward resistance.
2. To draw the characteristic of Ge semiconductor diode and calculate its forward resistance.
3. To draw the characteristic of Zener diode in reverse and forward bias voltage.
4. To draw the input and output characteristic for a PNP transistor in the Common emitter configuration and evaluate the hybrid parameters.
5. To draw the input and output, characteristic for a PNP transistor in the Common base configuration and evaluate the hybrid parameters.
6. To draw the input and output characteristic for a PNP transistor in the Common collector configuration and evaluate the hybrid parameters.
7. To study Lissajous figures by C.R.O to determine the wave form and frequency of an electrically maintained tuning fork using C.R.O.
8. Using A.C. supply find gain for common emitter configuration.
9. Verify open characteristic and find slow rate value for it.
10. To verify Truth table of OR and AND gate.
11. To verify Truth table of NOR and NAND gate.
12. To verify Truth table of XOR gate.

## Semester-VI

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.



**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.