

# CURRICULUM

## B. Sc. (PCM)

### B. Sc. PCM - 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	MAS - 321	DIFFERENTIAL EQUATIONS & VECTOR CALCULAS	3	0	0
4	MAS - 322	DIFFERENTIAL & INTEGRAL CALCULUS	3	0	0
5	MAS - 323	REAL ANALYSIS - I	3	0	0
6	CHEM - 414	INTRODUCTORY ORGANIC CHEMISTRY	2	0	2
7	CHEM - 415	ATOMIC STRUCTURE & PERIODIC CLASSIFICATION	2	0	2
8	CHEM - 416	CHEMICAL KINETICS & ELECTRO CHEM.	2	0	2
9	MVE-301	MORAL & VALUE EDUCATION	2	0	0

### B. Sc. PCM - Semester – II

S. No.	Course Code	Title of the Course	Credit Hrs.		
			L	T	P
1	PHY - 334	WAVES & OSCILLATIONS	3	1	0
2	PHY - 336	ELECTROMAGNETISM	3	1	0
3	MAS - 351	REAL ANALYSIS – II	3	0	0
4	MAS - 352	ALGEBRA – I	3	0	0
5	MAS - 353	3D COORDINATE GEOMETRY	3	0	0
6	CHEM - 423	HYDRO CARBONS	2	0	2
7	CHEM - 424	CHEMICAL BONDING & NUCLEAR CHEM	2	0	2
8	CHEM - 425	GASES, CHEMICAL EQUILIBRIUM & SURFACE CHEM.	2	0	2
9	PHY - 330	PHYSICS LAB. – I	0	0	4
10	LNG- 301	STRUCTURAL & SPOKEN ENGLISH	2	0	2

### B. Sc. PCM - Semester – III

S. No.	Course Code	Title of the Course	Credit Hrs.		
			L	T	P
1	PHY - 431	ATOMIC & NUCLEAR PHYSICS	3	1	0
2	PHY - 433	OPTICS	3	1	0
3	MAS - 421	LINEAR ALGEBRA -I	3	0	0
4	MAS - 422	REAL ANALYSIS – III	3	0	0
5	MAS - 423	STATICS	3	0	0
6	CHEM - 530	ALIPHATIC COMPOUNDS	2	0	2
7	CHEM -531	MAIN GROUP ELEMENTS	2	0	2
8	CHEM - 532	THERMODYNAMICS – I & IONIC EQUILIB.	2	0	2

### B. Sc. PCM - Semester – IV

S. No.	Course Code	Title of the Course	Credit Hrs.		
			L	T	P
1	PHY - 434	MODERN OPTICS	3	1	0
2	PHY - 436	STATISTICAL PHYSICS & ASTROPHYSICS	3	1	0
3	MAS - 451	LINEAR ALGEBRA-II	3	0	0
4	MAS - 452	NUMERICAL- ANALYSIS	3	0	0
5	MAS - 453	DYNAMICS	3	0	0
6	CHEM -540	AROMATIC COMPOUNDS	2	0	2
7	CHEM - 541	<i>d &amp; f</i> BLOCK ELEMENTS	2	0	2
8	CHEM - 542	THERMODYNAMIC – II, PHASE EQUILIB &RADIO CHEM.	2	0	2
9	PHY - 430	PHYSICS LAB. – II	0	0	4

**B. Sc. PCM - Semester – V**

S. No.	Course Code	Title of the Course	Credit Hrs.		
			L	T	P
1	PHY - 531	QUANTUM MECHANICS	3	1	0
2	PHY- 533	ELECTRONICS – I	3	0	0
3	MAS - 521	ALGEBRA- II	3	0	0
4	MAS - 522	ADVANCED ANALYSIS	3	0	0
5	MAS - 523	HYDRODYNAMICS	3	0	0
6	CHEM - 551	COORDINATION CHEMISTRY & ISOMERISM.	2	0	2
7	CHEM - 552	SOLUTION CHEMISTRY & ADVANCED ELECTROCHEMISTRY	2	0	2
8	CHEM – 550	NATURAL PRODUCTS	2	0	2
9	COMP- 302	COMPUTER APPLICATIONS	1	0	2
10	ENV – 415	ENVIRONMENTAL STUDIES – I	2	0	0

**B. Sc. PCM - Semester – VI**

S. No.	Course Code	Title of the Course	Credit Hrs.		
			L	T	P
1	PHY - 532	SOLID STATE PHYSICS	3	1	0
2	PHY - 534	ELECTRONICS – II	3	0	0
3	PHY - 530	PHYSICS LAB – III	0	0	4
4	MAS - 551	PARTIAL DIFFERENTIAL EQUATIONS	3	0	0
5	MAS - 552	NUMBER THEORY	3	0	0
6	MAS- 553	OPTIMIZATION TECHNIQUES	3	0	0
7	CHEM - 560	ADVANCED ORGANIC CHEMISTRY	2	0	2
8	CHEM - 561	SPECTROSCOPY	2	0	2
9	CHEM-562	PHOTO CHEMISTRY & ADVANCED WAVE MECHANICS	2	0	2
10	COMP - 410	COMPUTER LANGUAGES	3	0	2
11	ENV– 416	ENVIRONMENTAL STUDIES – II	2	0	0

**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

## B.Sc. (PCM/PMCS) Semester – I

### Course Name: Differential Equations & Vector Calculus

Course Code: MAS - 321

Credit: 3-0-0

Equations of first order & first degree, general & particular solutions, equations in which variables separable, homogeneous equations, reducible forms, linear equations, reducible forms, exact differential equations, Integrating- factors.

Equations of first order & but not of the first degree, Clairaut- Equations. Geometrical -interpretation, linear equations with constant coefficient, Particular- integrals.  
Special methods.

Homogeneous linear differential equations.

Vector Differentiation, Point Function, Partial Derivatives, Gradient, Divergence & Curl.

Line & Surface Integral, Gauss-Theorem, Green-Theorem & Stokes- Theorem.

Reference Books:

1. Differential-Calculus: Gorakh-Prasad
2. Integral-Calculus: Gorakh-Prasad
3. A Course in Vector Analysis with Applications: Mata Ambar Tiwari & R S Sengar

## B.Sc. (PCM/PMCS) Semester – I

### Course Name: Differential & Integral Calculus

Course Code: MAS-322

Credit : 3-0-0

#### Differential- Calculus:

Successive differentiation, nth order derivative, Leibnitz theorem, Maclaurin theorem, Taylor theorem & concerned problems, partial derivatives, total differential coefficient, Euler- theorem, application of p RTII derivatives in errors, approximations, maxima – minima etc. Jacobians Curvature, Indeterminate-forms, Expansion of functions of two variables.

**Integral- Calculus** : Properties of definite- integrals & their applications reduction formulae, Multiple-integrals & their applications. Gamma & Beta functions & their applications Change of order of integration.

- Reference Books:
1. Differential & Integral Calculus: Gorakh- Prasad.
  2. Calculus (Vol I & II): T M Apostol

**B.Sc. (PCM\PMCS) SEMESTER – I**  
**Course Name: Real Analysis – I**

**Course Code: MAS-323**

**Credit: 3-0-0**

Real number system: Natural number, Peano's postulates for natural numbers, The first principle of induction, Ordered relation and Well ordering property of the set  $\mathbb{N}$ , Second principle of induction, Integers, [Embedding of natural numbers in  $\mathbb{Z}$ , Division Algorithm theorem, Euclidean Algorithm, Unique factorization theorem for integers](without proof), Rational and Irrational numbers, Axioms of real number, The field axioms, The order axioms, The Archimedian-principle, rational density theorem, irrational density theorem, bounds of a set, The completeness axiom.

Sequence: Sequence of a real numbers, Finite and Infinite sequences, Bounded sequence, monotonic sequence and Cauchy sequence, Limit of a sequence, Convergence and Divergence of a sequence, Cauchy's general principle of convergence, Cauchy's theorems on limits.

Series: Infinite-series, Tests for convergence. Cauchy's general principle of convergence of series, Series of +ve terms, Comparison theorem, Comparison test, D' Alembert ratio test, Raabe-test, Logarithmic test, De-Morgan test, Bertand test, Cauchy root-Test, Cauchy Condensation Test, Absolute and conditional convergence, Uniform convergence, Cauchy criterion for uniform convergence, Tests for uniform convergence of series, term by term integration, term by term differentiation, The integral test for convergence.

Reference Books:

1. Real Analysis- John M. Howie
2. Principles of Mathematical Analysis Walter –Rudin.
3. Sequence and series- K. K. Azad and Kavita Srivastava.
4. Mathematics Analysis- Somusundaram and B. Chodhury.

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

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

**Course Code: GPT-301**

**Credit Hrs.2-0-0**

**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: 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.

## **B. Sc. (PCM\PMCS) SEMESTER – II**

### **Course Name: Real Analysis – II**

**Course Code: MAS-351**

**Credit: 3-0-0**

Functions- Concept of limit, theorem on limits & evaluations of limits, Indeterminate forms, Continuity of a function, types of discontinuities & properties, Bolzano's theorem, Intermediate value theorem & Differentiability, algebra of derivatives, chain rule for differentiation, derivative of inverse function, Intermediate value theorem for differentiability, successive differentiation, Leibnitz's theorem, Maclaurin's theorem, Taylor's theorem, Rolle's theorem, Lagrange's theorem, Cauchy's theorem, deduction of Lagrange's theorem from Cauchy's theorem, general Mean-Value Theorem.

Maxima and Minima: Maximum, minimum value, conditions of maxima and minima, critical point, stationary point, test for maximum and minimum values.

Reference Books:

1. Real Analysis- John M. Howie
2. Mathematics Analysis: Somusundaram and B. Chodhury
3. Principles of Mathematical Analysis Walter –Rudin

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

### **Course Name: Algebra – I**

**Course Code: MAS 352**

**Credit 3-0-0**

Language of Mathematics, Propositional connectives, Quantifiers, Tautology & logically equivalences, Set, subset, Ordered pair, Cartesian product, Relations, Equivalence relation, Functions, De Morgan's Law, Fundamental theorem of functions, Well order, Complete order, Zorn's Lemma, Natural numbers, Peano Axioms, Recursion Theorem, Integers, Division Algorithm (only statement), Greatest common divisor, Least common multiple, Euclidean Algorithm (only statement), Rational numbers, Real numbers, Complex numbers.

Groupoid, Monoid, Semigroup, Group, Klein group, Hamiltonian group, General linear group, properties of groups, Law of Exponents, Homomorphism between groups.

Ring, Subring, Integral domain, Division Ring, Field, Homomorphism between Rings.

Reference Books:-

- 1) An Introduction to Abstract Algebra: Zero
- 2) Algebra (Vol I): Ramji Lal
- 3) Undergraduate Algebra: Serge Lang.
- 4) A first course in Abstract Algebra: John B. Fraleigh.

**B. Sc. (PCM\PMCS) SEMESTER-II**  
**Course Name: 3D Coordinate Geometry**

**Course Code: MAS-353**

**Credit: 3-0-0**

**Straight Line:** Direction cosines, Direction ratios, Projection of a point on a line, Projection of line to another line, Angle between two lines.

**Plane:** Normal Form of equation of Plane, Intercept form of equation of plane, General equation of plane ( $ax+by+cz+d=0$ ), equation of plane when two points or three points on plane is given, angle between two planes, position of points relative to plane, distance of a point from a plane, plane through intersection of two planes, the equation of pair of planes.

**Straight line and the plane:** Equation of plane in symmetrical and non-symmetrical form. Line through two points. To transform the non-symmetrical form into symmetrical form, Coplaner lines, Skew lines, Length and the equation of shortest distance. Relation between direction cosines of three mutually perpendicular lines.

**Surface of Second Degree:** General Equation of second degree, Intersection of line and the surface, Tangent Plane, Polar Plane, The enveloping Cone & Cylinder (Definition), Section with given center, Diametral Plane, Principal Plane, Transform of General equation, Classification of Conicoids.

**Sphere:** The equation of Sphere, Sphere through four points, Intersection of two spheres, Intersection of sphere and plane, Sphere through a given circle, Intersection of a straight line and sphere, Equation of the tangent plane, Plane of contact, Polar plane, Angle of intersection of two spheres, Power of a point.

**Cone and Cylinder:** The equation of cone, Equation of a cone with given conic base, Angle between the lines in which plane cuts a cone, three mutually perpendicular generators, Right circular cone.

Equation of cylinder through a given conic, Cylinder with axis parallel to coordinate axes, equation of right circular cylinder, Surface of Revolution.

**Central Conicoids:** The Standard equation, the ellipsoid, The hyperboloid of one sheet, The hyperboloid of two sheets, Diametral planes and conjugate diameter, Tangent planes, Normal, Cubic curve through the feet of the normals.

**Reference Books:** Analytical Geometry of Three Dimensions: Saran & Gupta

**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, Langmur and Gibbs Adsorption isotherm, B.E.T. Theory.

**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, Isospin, 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 price (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

## **B.Sc. (PCM/PMCS) Semester – III**

### **Course Name: Linear Algebra – I**

**Course-Code: MAS: 421**

**Credit: 3-0-0**

Basic concepts of rings, Sub rings, Integral Domains, Fields, System of Linear Equations, Matrices and Elementary Row Operations, Row Reduced Echelon Matrices, Matrix Multiplication, Invertible Matrices.

Vector Spaces, Subspaces, Quotient Spaces, Linear Independence, Bases, Dimension, Coordinates, Computations Concerning Subspaces.

Linear Transformation, The Algebra of Linear Transformations, Kernel, Range, Isomorphism, Matrix Representation of a Linear Transformation, Change of Base, Linear Functionals, Dual Space, The Transpose of a Linear Transformation.

Algebra, The Algebra of Polynomials, Lagrange Interpolation, Polynomial Ideals, The Prime Factorization of a Polynomial.

#### Reference Books:

1. Algebra (Vol. I & II) – Ramji Lal
2. Linear Algebra – Serge Lang
3. Finite dimensional vector space – P.R. Halmos
4. Linear Algebra- Hoffman & Kunze
5. Linear Algebra (a geometrical approach) - Kumaresan

## **B. Sc. (PCM \ PMCS) SEMESTER – III**

### **Course Name: Real Analysis – III**

**Course Code: MAS -422**

**Credit: 3-0-0**

Explicit and implicit functions, the neighbourhood of a point, maps from  $\mathbb{R}^m$  to  $\mathbb{R}^n$ , Limit and continuity, Algebra of limits and continuity, Sequences, Total derivatives, Partial derivatives, Directional derivatives, Algebra of differentiation, Chain rule, The mean value theorem, Repeated partial derivatives, Taylor's formula, Maxima and minima, The inverse function theorem and The implicit function theorem.

Integration & Step- Function, Upper & lower integrals of a bounded function. Riemann integral & its properties, Mean- Value Theorem for integrals, Improper integrals.

#### Reference Books:

1. Principles of Mathematical Analysis Walter –Rudin
2. Real Analysis- John M. Howie
3. Mathematical Analysis : T.M. Apostol
4. Mathematics Analysis: Somusundaram and B. Chodhury.
5. Elementary Analysis-2 (Functional of several variables): K. K. Azad and Kavita Srivastava.

**B. Sc. (PCM \ PMCS) SEMESTER – III**  
**Course Name: Statics**

**Course Code: MAS – 423**

**Credit 3-0-0**

Common catenary, Intrinsic & Cartesian equations, Approximation to the common catenary centre of gravity, Centre of parallel forces, Centre of gravity of the curves, Centre of gravity of plane area, Centre of gravity of a solid of revolution, Centre of gravity of the sum or difference of two bodies, Centre gravity of three dimensional bodies, k Forces in three dimension, Central axis, Wrench, Pitch, screw, theorem on forces, reciprocal screw, null lines and null planes, Stable and unstable equilibrium, a body resting upon inside another body.

**Reference Books:**

1. Statics- R. S. Verma
2. Statics- P. Singh
3. Statics- S. L. Loney

**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**

**Course Code: 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.

**Course Title: MODERN OPTICS**

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

**Semester-IV**

**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

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

**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 Boltzmann, 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.

**B.Sc. (PCM/PMCS) Semester – IV**

**Course Name: Linear Algebra – II**

**Course Code: MAS: 451**

**Credit: 3-0-0**

Determinant Functions, Permutations and Uniqueness of Determinants, Modules, Multilinear Functions, The Grassman Ring.

Characteristic Values, Annihilating Polynomials, Invariant Subspaces, Simultaneous Triangulation, Simultaneous Diagonalization, Direct Sum Decompositions, Invariant Direct Sums, The Primary Decomposition Theorem.

Inner Products, Inner Product spaces, Linear Functionals and Adjoint, Unitary Operators, Normal Operators, Forms on Inner Product spaces, Positive Forms, Spectral Theory.

Reference Books:

1. Algebra (Vol. I & II) – Ramji Lal
2. Linear Algebra – Serge Lang
3. Finite dimensional vector space – P.R. Halmos
4. Linear Algebra- Hoffman & Kunze
5. Linear Algebra (a geometrical approach) - Kumaresan

**B. Sc. (PCM/PMCS) Semester – IV**

**Course Name: Numerical- Analysis**

**Course-Code: MAS 452**

**Credit: 3-0-0**

Numerical solution of algebraic equations- Bisection Method, Regula – Falsi Method, Iteration Method, Newton- Raphson Method, Muller’s Method, Solution to the System of Nonlinear Equations

Interpolation- Finite differences, Newton’s formulae for interpolation, Gauss’s central difference formula, Stirling-formula

Numerical differentiation & integration, Trapezoidal-rule, Simpson’s 1/3 & 3/8 rules.

Numerical solution of ordinary differential equations– Picard’s method, Euler’s-method.

Reference Books:

1. Introductory methods of Numerical Methods: S.S. Sastry
2. Engineering Mathematics: E. Kreyszig.



**B. Sc. (PCM/ PMCS) Semester – IV**  
**Course Name: Dynamics**

**Course- Code: MAS – 453**

**Credit 3-0-0**

Kinematics and Kinetics: Motion in two dimension, Radial and transversal velocities and accelerations, Tangential and normal velocities and accelerations, Angular velocity, Relative motion.

Rectilinear Motion: Motion in a straight line, Simple Harmonic Motion (SHM), Geometrical representation, Motion under inverse square law, motion under other laws of force, Terminal velocity, Motion under gravity in a resisting medium.

Constrained Motion: Uniform circular motion, Satellite describing a circular orbit, Smooth hollow sphere rotating with uniform angular velocity, Cycloidal Motion, Cycloidal pendulum.

Central orbit: Motion of a particle under central forces, parabolic orbit, Elliptic orbit, Hyperbolic orbit, Apse, Apsidal distance, Apsidal angle, Kepler's laws of planetary motion, relative motion of the planet about the sun. Three dimensional motion, Velocity & acceleration (in polar & cylindrical co-ordinates).

Reference Books:

Elementary Dynamics- P. L. Srivastava

Dynamics- Ramsay

Dynamics- P. Singh

Dynamics- S. L. Loney

**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 Sulphur), bi-component system ( $Ag + Pb$ ),  $KI + H_2O$ ).

**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.

**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

**Course Title: ELECTRONICS – I**

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

**Semester-V**

**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

**B. Sc. (PCM/PMCS) Semester – V**  
**Course Name: Algebra – II**

**Course Code: MAS 521**

**Credit 3-0-0**

Groups, Euler's  $\phi$  function, Group of residue classes modulo  $m$ , Matrix groups, Dihedral groups, properties of Groups, Wilson Theorem, Homomorphism, Epimorphism, Monomorphism, Isomorphism, Endomorphism, Automorphism, Torsion Free groups, Coset decomposition, Lagrange Theorem, Poincare Theorem, Euler-Fermat theorem, External direct product, Internal direct product, Normal subgroups, Quotient groups, Fundamental Theorem of homomorphism, First and No other Second Isomorphism Theorem, Symmetric groups, Alternating groups, Cayley's Theorem.

Rings, Properties of Rings, Binomial Theorem, Integral Domain, Division Ring, Fields, Characteristic of an Integral domain, Ring homomorphism, Field of fractions.

Reference Books:-

- 1) Algebra (Vol I): Ramji Lal
- 2) Basic Algebra: Nathan Jacobson
- 3) Group Theory: I.B.S. Passi
- 4) Ring theory: I.B.S. Passi
- 5) A first course in Abstract Algebra: John B. Farleigh

**B. Sc. (PCM\ PMCS) Semester – V**  
**Course Name: Advanced Analysis**

**Course Code: MAS – 522**

**Credit: 3-0-0**

Metric spaces, Pseudo metric, closed sets, open sets, Separable space, Limit points, Boundary points, Interior of a set, Closure of a set, Continuous maps, Sequence in a Metric space, Homomorphism, Complete metric spaces, Compact metric spaces, Bolzano- Weirstrass property, Borel – Lebesgue Theorem, Total Boundedness, Baire Category theorem, Banach contraction principle, Connected metric space Dense sets  $F_\sigma$  and  $G_\delta$  functions Cantor sets, perfect sets, Lebesgue measure, Lebesgue integral, Differentiation and integration, Uniform continuity connectedness.

Reference Books:

1. Real Analysis- John M. Howie
2. Real Analysis & Complex Analysis: Walter Rudin
3. Principles of Mathematical Analysis Walter –Rudin
4. Mathematical Analysis: T.M. Apostol
5. Elementary Analysis (Metric space): K. K. Azad and Kavita Srivastava.
6. Mathematics Analysis: Somusundaram and B. Chodhury.

**B. Sc. (PCM/ PMCS) Semester – V**  
**Course Name: Hydrodynamics**

**Course Code: MAS- 523**

**Credit: 3-0-0**

Kinematics, characteristic of a fluid, Lagrange's method, Euler's method equation of continuity, equation of continuity in Cartesian co-ordinates, equation of continuity in polar co-ordinates, stream lines, path lines Equation of Motion, Euler's dynamical equations, Euler's momentum theorem, D' Alembert's paradox Application of the Principle of Energy, sources and sinks, Doublets, images in two dimension Motion of Cylinders, general motion of a cylinder in two dimensions, motion of a circular cylinder, stream lines, liquid streaming past a fixed circular cylinder, Two co-axial cylinder (Initial motion), Motion in three dimensions, strength of doublet, motion of a sphere in infinite mass of liquid at rest, Viscosity, coefficient of viscosity, general motion of fluid element, Analysis of stress, Principal Stresses, Stokes' relation, Navier-Stokes' equations.

Reference Books:

1. Hydrodynamics- Ramsay
2. Hydrodynamics- M. Ray & G. C. Chadda
3. Hydrodynamics- Milne & Thomson

**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: Computer Applications  
Semester-V**

**Course Code: CSIT-308**

**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 to 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.

**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 NPN transistor in the Common emitter configuration and evaluate the hybrid parameters.
5. To draw the input and output, characteristic for a NPN transistor in the Common base configuration and evaluate the hybrid parameters.
6. To draw the input and output characteristic for a NPN 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.

**B. Sc. (PCM/PMCS) Semester – VI**  
**Course Name: Partial-Differential Equations**

**Course Code: MAS -551**

**Credit 3-0-0**

Partial – Differential equations: Origin, order, Lagrange Linear equation, integral surfaces through given curves, orthogonal surfaces, non-linear partial- differential equations, their solutions, Char pit method, Jacobi-method, Monges-Method, partial-differential equations of second order, origin, equations with variable coefficient, canonical forms, method of separation of variables, applications of partial differential equations, laplace-equation.

Reference Book: Partial Differential Equations: Sneddon

**B.Sc. (PCM/PMCS) Semester – VI**  
**Course Name: Number Theory**

**Course-Code: MAS 552**

**Credit: 3-0-0**

Basic Properties of Divisibility, Fundamental Theorem of Arithmetic, Mersenne Primes and Fermat Numbers, Euclid Algorithm, Division Algorithm.

Diophantine Equations, Linear Diophantine Equations, Pell's Equations

Arithmetic Functions, Functions  $\tau(n), \sigma(n), s(n)$ ; Perfect, Amicable and Sociable Numbers;

Functions  $\phi(n), \lambda(n), \mu(n)$ , Distribution of Prime Numbers

Basic properties of Congruences, Modular Arithmetic, Linear Congruences, The Chinese Remainder Theorem, High Order Congruences, Legendre and Jacobi Symbols, Order and primitive roots, Indices and  $k_{th}$  Power Residues.

Reference Books:

1. Algebra (Vol. I) – Ramji Lal
2. Number Theory for Computing- Song Y. Yan

**B. Sc. (PCM/PMCS) Semester – VI**  
**Course Name: Optimization Techniques**

**Course-Code: MAS 553**

**Credit: 3-0-0**

Convex sets, convex polyhedron.

General Linear Programming Problem, Formulation of LPP, Feasible solutions, Basic Solutions, Optimal solution, Graphical method ,

Algebraic Methods: Simplex method, Degeneracy, Duality in LP problems, Big. M-method

Transportation problems: Least cost method, Vogel's Approximation method, MODI (Modified Distribution) Method

Assignment problems: Hungarian Method, Sequencing, Routing Problem

Game Theory: Matrix (or rectangular) games, Minimax and Maxmin theorem, Saddle point, Game without saddle point, Fundamental theorem of Game theory, Dominance principle.

**Reference Books :**

1. Operation Research: An introduction: H.A. Taha.
2. Optimization methods in operations research and system analysis: K.V. Mital, C. Mohan.
3. A fundamental Approach to Operations Research: Swapnil Srivastava

## 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 mechanisim, free particle, particles in potential barrier, Particle in one dimensional box, Particle in 3 dimentional box, Simple Harmonic Oscillator, Hydrogen Atom.

**Course Title: Computer Languages**  
**Semester-VI**

**Course Code: CSIT-410**

**Credit: 4 (2-1-2)**

**Unit-1**

**Introduction to Computers**

- Need and Role
- Definition, Characteristics and Applications
- Hardware: Basic block diagram & components
- Software: System & Application

**Unit-2**

**Information Concepts**

- Data & its representation
- Introduction to Database

**Operating system**

- Introduction, Functions
- Working with DOS, Windows and linux

**Computer Networks & Internet**

- Introduction
- Types
- OSI reference model
- Internet: History, usage and applications

**Unit-3**

**Computer Languages**

- Generations
- Translators (Assembler, interpreter and compiler)

**Programming Techniques**

- Programming constructs
- Algorithms & Flowcharts

**Unit-4**

**'C' Language**

- Introduction
- History
- Character set
- Expressions & Operators
- Input/Output statements
- Branching Statements (if, if-else, Nested if), switch
- Looping Statements (while, do-while, for)

**Unit-5**

**'C' Language**

- Arrays
- Functions
- Introduction to pointers and structure
- Structured Programming & Software development

**References:**

- J. B. Dixit, "fundamentals of Computers & Programming in 'C'", Laxmi Publications (P) Ltd.
- Yashavant Kanetkar, "Let us C", BPH Publication
- E. Balaguruswamy, "ANSI C", TMH



**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.