



**SCHOOL OF BASIC AND APPLIED SCIENCES**  
**Department of Physics**  
**(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)**  
**B.Sc. (PCM) I Year (I Semester)**

Lectures	: 3 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Subject	: Mechanics	Paper Code	: PHY-101

**Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

**UNIT-I**

Background of Vector calculus: Concepts of gradient, Divergence and curl ; Line, Surface and Volume Integrals, Frame of Reference, Galilean transformation, Galilean Invariance, Inertial and Non Inertial frames, Pseudo forces, Rotating reference frame, Centrifugal force, Coriolis force, motion under central force, Kepler's law, Conservative and Non-conservative force.

**UNIT-II**

Ideal fluids, Equation of continuity, Streamline flow, Rotational and irrotational flows, Euler's equation, Bernoulli's Theorem, Viscous fluids, Poiseuille's equation, Viscosity by rotating cylinder method. Elasticity Hooke's law and elastic constant of isotropic solid.

**UNIT-III**

Strain and Stress in an isotropic homogeneous medium, Elastic moduli and relations between them, Torsion of cylinders, Bending of beams, Internal energy of a strained body, surface tension and surface energy.

**UNIT-IV**

Inference of Michelson-Morley Experiment, Postulates of special relativity, Lorentz transformations, Length contraction, Time dilation, Simultaneity in relativity theory, Addition of velocities, Relativistic dynamics, Variation of mass with velocity, Mass-Energy relation.

**Books Recommended:**

1. Berkeley Physics Course. Vol. 1. Mechanics by E.M.Purcell
2. Concepts of Modern Physics by Arthur Beiser
3. Properties of Matter by D.S. Mathur.



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**B.Sc. (PCM) I Year (I Semester)**

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks:	50(20+30)
Subject	: Thermodynamics	Paper Code	: PHY-103

**Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

**UNIT-I**

First Law of Thermodynamics and Internal Energy, Joule's Law, Applications of First Law, Carnot Cycle, Carnot Engine and Refrigerator, Reversible and Irreversible Process, Carnot Theorem, Thermodynamically Scale of Temperature

**UNIT-II**

Entropy, Calculation of Entropy in various processes, Entropy and unavailable energy, Physical Significance of Entropy, Second law of Thermodynamics, Thermodynamic Potentials and Maxwell's Equations, Application of Maxwell's equations, Phase diagram and triple point of a substance, Joule's Thomson effect.

**UNIT-III**

Maxwell-Boltzmann Law of Distribution of Molecular Velocities, Evaluation of *r.m.s.* velocity, Average and Most Probable Speeds, Mean Free Path, Transport Phenomenon .Degree of freedom, equi-partition of energy and its application for specific heat of gases.

**UNIT-IV**

Emissive and Absorptive Powers, Black Body Radiation, Kirchoff's Law , Intensity and Energy Density, Pressure and Energy density, Stefan-Boltzmann Law, Distribution of energy in the spectrum of black body radiation, Wein's Distribution Law, Wein's displacement law, Wein's formula, Rayleigh- Jean's law, Plank's law

**Books Recommended:**

1. Thermodynamics By Enrico Fermi (Courier Dover Publications, 1956)
2. A Treatise on Heat : Including Kinetic Theory of Gases, Thermodynamics and Recent Advances in Statistical Thermodynamics By Meghnad Saha, B. N. Srivastava (Indian Press, 1958)
3. Heat and Thermodynamics: An Intermediate Textbook By Mark Waldo Zemansky, Richard Dittman (McGraw-Hill, 1981)
4. Thermal Physics by Garg, Bansal and Ghosh (Tata McGra-Hill, 1993)



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<b>Lectures</b>	<b>: 2 Hrs</b>		
<b>Examination Time</b>	<b>: 3 Hrs</b>	<b>Maximum Marks: 50(20+30)</b>	
<b>Subject</b>	<b>: Wave &amp; Oscillations</b>	<b>Paper Code</b>	<b>: PHY-105</b>

**Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

**UNIT-I**

Simple Harmonic Oscillations. Differential Equation of SHM and its Solution. Amplitude, Frequency, Time Period and Phase. Velocity and Acceleration. Kinetic, Potential and Total Energy and their Time Average Values. Reference Circle. Rotating Vector Representation of SHM.

**UNIT –II**

Free Oscillations of Systems with One Degree of Freedom :- (1) Mass-Spring system, (2) Simple Pendulum, (3) Torsional Pendulum, (4) Oscillations in a U-Tube, (5) Compound pendulum: Centres of Percussion and Oscillation, and (6) Bar Pendulum.

**UNIT –III**

System with Two Degrees of Freedom : Coupled Oscillators. Normal Coordinates and Normal Modes. Energy Relation and Energy Transfer. Normal Modes of N Coupled Oscillators.

**UNIT –IV**

Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Water Waves : Ripple and Gravity Waves.

**Books Recommended:**

1. Vibrations and Waves by A. P. French.(CBS Pub. & Dist., 1987)
2. The Physics of Waves and Oscillations by N.K. Bajaj (Tata McGraw-Hill, 1988)
3. Fundamentals of Waves & Oscillations By K. Uno Ingard (Cambridge University Press, 1988)
4. An Introduction to Mechanics by Daniel Kleppner, Robert J. Kolenkow (McGraw-Hill, 1973)
5. Waves: BERKELEY PHYSICS COURSE (SIE) by Franks Crawford (Tata McGrawHill, 2007).



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**B.Sc. (PCM) I Year (I Semester)**

Schedule per week Practical	: 4 Hrs	
Examination Time	: 4 Hrs	Maximum Marks: 50(20+30)
Subject	: Physics Lab-I	Paper Code : PHY-107

**Special Note:-** Minimum six experiments from given list of experiment are required to complete. The students are required to calculate the error involved in a particular experiment.

- I. Each student has to perform a minimum number of experiments prescribed in the syllabus.
- II. After the completion of a practical the teacher concerned will check the note book and conduct the Viva – voce of each student to find out how much concepts related to the theoretical and experimental part of the experiment he/ she has understood. According to his/her performance marks will be recorded on their practical note-book. These marks will constitute the lab. Record.
- III. To compute the final marks for lab. Record, a separate register will be maintained. Each student will be assigned separate page on this register. On this page the marks obtained by the student in different practical's will be entered. This record will be signed by the concerned teacher.
- IV. The lab. Record register will be presented to external practical examiners for Lab. Record marks. These external examiners will verify the record randomly.

#### **List of Experiments**

**Note: Students are required to perform minimum five experiments from given list.**

1. To determine the height of terrestrial object using sextant.
  2. Determination of Stefan's Constant.
  3. To study the variation of semiconductor resistance with temperature and hence to Determine the Band Gap of semiconductor in the form of reverse biased P-N junction.
  4. Moment of Inertia of a fly-wheel.
  5. 'g' by Bar pendulum.
- M.I. of an irregular body using a torsion pendulum.



**SCHOOL OF BASIC AND APPLIED SCIENCES**  
**Department of Chemistry**  
**(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)**  
**B.Sc. (PCM) I Year (I Semester)**

**Schedule per week Lectures: 2**

**Examination Time : 3 Hrs**

**Maximum Marks: 50(20+30)**

**Subject : Inorganic Chemistry**

**Paper Code : CH-101**

***Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

#### **UNIT-I**

**Atomic Structure:** Idea of de-Broglie matter waves, Heisenberg uncertainty principle, atomic orbital's, quantum numbers, Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements, radial and angular wave functions and probability distribution curves, shapes of s, p, and d orbitals.

#### **UNIT-II**

**Periodic Table:** General principles of periodic table, effective nuclear charge, Slater's rules. and Atomic ionic radii, ionization energy, electron affinity and electronegativity definition, methods of determination or evaluation, trends in periodic table (s & p block elements).

#### **UNIT-III**

**Covalent Bond:** Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions ( BeF<sub>2</sub>, BF<sub>3</sub>, CH<sub>4</sub>, PF<sub>5</sub>, SF<sub>6</sub>, IF<sub>7</sub>, SO<sub>4</sub><sup>-2</sup>, ClO<sub>4</sub><sup>-1</sup>) Valence shell electron pair repulsion (VSEPR) theory to NH<sub>3</sub>, H<sub>3</sub>O<sup>+</sup>, SF<sub>4</sub>, ClF<sub>3</sub>, ICl<sub>2</sub><sup>-</sup> and H<sub>2</sub>O. MO theory of heteronuclear (CO and NO) diatomic molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

#### **UNIT-IV**

**Ionic Solids:** Ionic structures (NaCl, CsCl, ZnS (Zinc Blende), CaF<sub>2</sub>) radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy (mathematical derivation excluded) and Born- Haber cycle, solvation energy and its relation with solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule.

#### **Suggested books:**

1. Inorganic Chemistry, by Malik, Tulji Madan, S.Chand . & company.
2. A text book of Inorganic Chemistry, O P Tandon, G R Bathla Publication pvt Ltd
3. Inorganic Chemistry, by James E. Huheey, E.A. Keiter, R. L. Keiter, O. K. Medhi
4. Concise Inorganic Chemistry, by J. D. Lee, Oxford



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### Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)

B.Sc. (PCM) I Year (I Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Organic Chemistry

Paper Code : CH-103

**Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

#### UNIT-I

**Structure and Bonding:** Localized and delocalized chemical bond, vander Waals interactions, and resonance conditions, resonance effect and its applications, hyperconjugation, inductive effect, Electromeric effect & their comparison.

**Stereochemistry of Organic Compounds-I:** Concept of isomerism. Types of isomerism. Optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeniccentres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization.

#### UNIT-II

**Stereochemistry of Organic Compounds-II:** Relative and absolute configuration, sequence rules, R & S systems of nomenclature, Geometric isomerism, determination of configuration of geometrical isomers, E & Z system of nomenclature, Conformational isomerism conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds, Newman projection and Sawhorse formulae, Difference between configuration and conformation.

#### UNIT-III

**Mechanism of Organic Reactions:** Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents – electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates carbocations, carbanions, freeradicals, carbenes , arynes and nitrenes (formation, structure & stability). Assigning formal charges on intermediates and other ionic species.

#### UNIT-IV

**Alkanes and Cycloalkanes:** IUPAC nomenclature of branched and unbranched alkanes , the alkyl group, classification of carbon atoms in alkanes. Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties. Cycloalkanes nomenclature, synthesis of cycloalkanes and their derivatives–photochemical (2+2) cycloaddition reactions, dehalogenation of dihalides, pyrolysis of calcium or barium salts of dicarboxylic acids, Baeyer's strain theory and its limitations, theory of strainless rings.



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**Schedule per week Lectures: 2**

**Examination Time : 3 Hrs**

**Maximum Marks: 50(20+30)**

**Subject : Physical Chemistry**

**Paper Code : CH-105**

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### UNIT-I

**Gaseous States:** Maxwell's distribution of velocities and energies (derivation excluded) Calculation of root mean square velocity, average velocity and most probable velocity. Collision diameter, collision number, collision frequency and mean free path. Deviation of Real gases from ideal behaviour. Derivation of Vander Waal's Equation of State, its application in the calculation of Boyle's temperature (compression factor) Explanation of behavior of real gases using Vander Waal's equation.

### UNIT-II

**Critical Phenomenon:** Critical temperature, Critical pressure, critical volume and their determination. PV isotherms of real gases, continuity of states, the isotherms of Vander Waal's equation, relationship between critical constants and Vander Waal's constants. Critical compressibility factor. The Law of corresponding states. Lequifaction of gases.

### UNIT-III

**Liquid States:** Structure of liquids. Properties of liquids – surface tension, viscosity vapour pressure and optical rotations and their determination.

### UNIT-IV

**Solid State:** Classification of solids, Laws of crystallography – (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry. Symmetry elements of crystals, Definition of unit cell & space lattice. Bravais lattices, crystal system. X-ray diffraction by crystals. Derivation of Bragg equation. Determination of crystal structure of NaCl, KCl.

**Liquid crystals:** Difference between solids, liquids and liquid crystals, types of liquid crystals, Applications of liquid crystals.



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Schedule per week Practical: 6

Examination Time : 4 Hrs

Subject : Chemistry Lab-I

Maximum Marks: 50 (20+30)

Paper Code : CH-107

**UNIT-I (Inorganic)**

**Volumetric Analysis**

- 1. Redo titrations:** Determination of  $\text{Fe}^{2+}$ ,  $\text{C}_2\text{O}_4^{2-}$  (using  $\text{KMnO}_4$ ,  $\text{K}_2\text{Cr}_2\text{O}_7$ )
- 2. Iodometric titrations:** Determination of  $\text{Cu}^{2+}$  (using standard hypo solution).
- 3. Complexometric titrations:** Determination of  $\text{Mg}^{2+}$ ,  $\text{Zn}^{2+}$  by EDTA.

**UNIT-II (Physical)**

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To prepare arsenious sulphide sol and compare the precipitating power of mono, bi and trivalent anions.

**UNIT-III (Organic)**

1. Preparation and purification through crystallization or distillation and ascertaining their purity through melting point or boiling point
  - (i) Iodoform from ethanol (or acetone)
  - (ii) *m*-Dinitrobenzene from nitrobenzene (use 1:2 conc.  $\text{HNO}_3$   $\text{H}_2\text{SO}_4$  mixture if fuming  $\text{HNO}_3$  is not available)
  - (iii) *p*-Bromoacetanilide from acetanilide
  - (iv) Dibenzalacetone from acetone and benzaldehyde
  - (v) Aspirin from salicylic acid

**Distribution of marks**

- |               |                |
|---------------|----------------|
| 1. UNIT-I     | 10 (6+4) marks |
| 2. UNIT-II    | 10 (6+4) marks |
| 3. UNIT-III   | 10 (6+4) marks |
| 4. Viva-voce  | 10 (6+4) marks |
| 5. Lab Record | 10 (6+4) marks |





**SCHOOL OF BASIC AND APPLIED SCIENCE**  
**Department of Mathematics**  
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**B.Sc. (PCM) I Year (I Semester)**

Lectures : 2 Hrs

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Paper Title : **Matrices and Statistics**

Paper Code : **MA-101**

*Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

**UNIT-I**

Symmetric, Skew symmetric, Hermitian and skew Hermitian matrices. Elementary Operations on matrices. Rank of a matrices. Inverse of a matrix. Linear dependence and independence of rows and columns of matrices. Row rank and column rank of a matrix. Eigen values, eigenvectors and the characteristic equation of a matrix. Minimal polynomial of a matrix. Cayley Hamilton theorem and its use in finding the inverse of a matrix.

**UNIT-II**

Applications of matrices to a system of linear (both homogeneous and non-homogeneous) equations. Theorems on consistency of a system of linear equations. Unitary and Orthogonal Matrices, Bilinear and Quadratic forms.

**UNIT-III**

Meaning of correlation and regression. Coefficient of correlation, Rank correlation, lines of regression. Properties of regression coefficients.

**UNIT-IV**

Probability distribution of random variables, Binomial distribution, Poisson's distribution, Normal distribution, Mean, Variance and Fitting.

**Books Recommended:**

4. S. S Seth: A Text Books Mathematical Statistics
5. Shanti Narayan : A Text Books of Matrices.
6. Chandrika Prasad : Text Book on Algebra and Theory of Equations. Pothishala Private Ltd., Allahabad.



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**B.Sc. (PCM) I Year (I Semester)**

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Paper Title	: Calculus	Paper Code	: MA-103

**Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

**UNIT-I**

Definition of the limit of a function. Basic properties of limits, Continuous functions and classification of discontinuities. Differentiability. Successive differentiation. Leibnitz theorem. Maclaurin and Taylor series expansions.

**UNIT-II**

Asymptotes in Cartesian coordinates, intersection of curve and its asymptotes, asymptotes in polar coordinates. Curvature, radius of curvature for Cartesian curves, parametric curves, polar curves. Radius of curvature for pedal curves. Tangential polar equations. Centre of curvature. Chord of curvature..

**UNIT-III**

Tests for concavity and convexity. Points of inflexion. Multiple points. Cusps, nodes & conjugate points. Type of cusps Tracing of curves in Cartesian, parametric and polar co-ordinates. Intrinsic equations of curves.

**UNIT-IV**

Indeterminate forms, Partial differentiation, Homogenous function and Euler's theorem, Jacobians, Total differentials Chain rule of partial differentiation.

**Books Recommended:**

1. Differential and Integral Calculus: Shanti Narayan.
2. Murray R. Spiegel: Theory and Problems of Advanced Calculus. Schaun's Outline series. Schaum Publishing Co., New York.
3. N. Piskunov: Differential and integral Calculus. Peace Publishers, Moscow.
4. Gorakh Prasad: Differential Calculus. Pothishasla Pvt. Ltd., Allahabad.
5. Gorakh Prasad: Integral Calculus. Pothishala Pvt. Ltd., Allahabad.



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**B.Sc. (PCM) I Year (I Semester)**

Lectures : 2 Hrs  
Examination Time : 3 Hrs  
Marks: 50(20+30) Paper Title : Three- Dimensional Geometry  
Paper Code : MA-105

***Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

**UNIT -I**

General equation of second degree, System of conics, Confocal conics, Polar equation of a conic and its properties.

**UNIT -II**

Three dimensional systems of co-ordinates, Projection and direction cosines, plane and Straight line.

**UNIT-III**

Sphere: Plane section of a sphere. Sphere through a given circle. Cones: Right circular cone, enveloping cone and reciprocal cone. Cylinder: Right circular cylinder and enveloping cylinder

**UNIT-IV**

Central Conicoids, Reduction of general equation of second degree, Tangent plane and Normal to conicoid, Generating lines, Plane sections.

**Books Recommended:**

1. S. P. Nigam S. S. Gangwar, Coordinary Geometry of Three Dimensions
2. R.J.T. Bill, Elementary Treatise on Coordinary Geometry of Three Dimensions, MacMillan India Ltd. 1994.

P.K. Jain and Khalil Ahmad: A Textbook of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd. 1999.



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**B.Sc. (PCM) I Year (II Semester)**

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Subject	: <b>Mathematical Physics</b>	Paper Code	: PHY-102

**Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

**UNIT-I**

Transformation properties of vectors; scalar and vector products; Differentiation and integration of vectors; Concept of tensors; Line integral, volume integral and surface integral involving vector fields; Gradient, divergence and curl of a vector field; Gauss's divergence theorem, Stokes' theorem, Green's theorem - application to simple problems.

**UNIT-II**

Orthogonal curvilinear coordinates; concept of a metric, spherical and cylindrical coordinates and their unit vectors. Hermitian, orthogonal and unitary matrices, inverse of a matrix, similarity transformations, Eigenvalue problems and diagonalization of matrices

**UNIT-III**

Infinite sequences and series - convergence and divergence, conditional and absolute convergence, ratio test for convergence. Complex-valued functions - analytic functions defined in terms of Taylor series expansion. Functions of several real variables - partial differentiation.

**UNIT-IV**

Solution of second order linear differential equation with constant coefficients and variable coefficients by Frobenius' method; Solution of Legendre and Hermite equations about  $x = 0$ ; Legendre and Hermite polynomials - orthonormality properties.

**Books Recommended:**

1. Matrices and Tensors in Physics by A.W.Joshi.(New Age Int.Pub., 1995).
2. Linear Algebra Theory and Applications by Ward Cheney and David Kincaid (Jones & Bartlett)
3. Vector Spaces and Matrices in Physics by M. C. Jain (Alpha Science International Ltd, 2007).
4. Partial Differential Equations for Scientists and Engineers By Stanley J. Farlow (Dover Publishers, 1993).



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**B.Sc. (PCM) I Year (II Semester)**

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Subject	: Semiconductor Devices	Paper Code	: PHY-104

**Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

**UNIT-I**

Energy bands in solids, Intrinsic and extrinsic semiconductors, p-n junction diode and their characteristics, Zener and Avalanche breakdown, Zener diode, Light emitting diodes (LED), Photodiode, Solar Cell, P-n junction, half wave and full wave rectifiers, Zener diode as a voltage regulator. Logic gates and its combination.

**UNIT -II**

Junction transistors, Working of NPN and PNP transistors, Three configurations of transistor (C-B, C-E, C-C modes), Constants of a transistor, Relation between alpha and beta, Common base, Common emitter and common collector characteristics of transistor, Advantages and disadvantages of C-E configuration, Emitter follower.

**UNIT -III**

Transistor amplifier, Methods of transistor biasing and stabilization, D.C. load line, Common base and Common emitter biasing, Common base and common emitter amplifiers, Classification of amplifiers, Feedback in amplifiers, Positive and negative feedback. Advantages of negative feedback,.

**UNIT -IV**

Oscillators, Principle of oscillation, classification of oscillators, Condition for self sustained oscillation: Barkhausen criterion for oscillation, Tuned collector common emitter oscillator, Hartley oscillator, RC oscillator, Phase shift and Wein-Bridge oscillator, Advantage of RC oscillator over LC oscillator.

**Books Recommended:**

1. Integrated Electronics – J. Millman and C. C. Halkias (Mc Graw Hill).
2. Electronic Fundamentals and Applications – D. Chattopadhyay and P. C. Rakshit.
3. Digital Logic and Computer Design – M. Moris Mano, (PHI (Pvt.) Ltd.).
4. Microprocessor Architecture, Programming and Application – R. A. Gaonkar (Wiley Eastern Ltd.).
5. Introduction to Microprocessor – Software, Hardware Programming – Laventhal (PHI Ltd.).
6. Electronics – R.K. Kar



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**B.Sc. (PCM) I Year (II Semester)**

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Subject	: Laser & Fiber Optics	Paper Code	: PHY-106

**Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

**UNIT-I**

Laser: Principle of Laser action, Population Inversion, Einstein's A and B coefficients, feedback of energy in a resonator, Threshold condition of laser formation. 3 level and 4 level laser systems.

**UNIT -II**

Characteristics of laser radiation. He-Ne , Nd-YAG Laser, Ruby Laser, Semiconductor Lasers and Dye lasers. Application of Laser. Significance of non-linear polarization of lasers: Second harmonic generation using non-linear optical methods.

**UNIT -III**

Principle of holography (basic principle), isotope separation. Precision measurements (frequency and distance). Optical fiber, core and cladding, total internal reflection, optical fiber as waveguide, step index and graded index fiber.

**UNIT -IV**

communication through optical fibers, energy loss, band width and channel capacity for a typical system, attenuation and dispersion, splicing and couplers, Fiber optic sensors.

**Books Recommended:**

1. Laser Principles and Applications – A. K. Ghatak and K. Tyagrajan (Tata – Mc Graw Hill).
2. Optics and Atomic Physics – B. P. Khandelwal (Siblal Agarwala).
3. Optical Electronic – A. K. Ghatak and K. Tyagrajan.
4. Introduction to Fibre Optics - R. A. Shotwell (EEE, Prentice Hall).



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**Department of Physics**  
**(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)**  
**B.Sc. (PCM) I Year (II Semester)**

**Practical per Week : 4 Hrs**

**Examination Time : 4 Hrs**

**Subject : Physics Lab-II**

**Maximum Marks: 50(20+30)**

**Paper Code : PHY-108**

**Note: Students are required to perform minimum five experiments from given list.**

- (1) To study and plot V-I characteristics of PN junction diode.
- (2) To Study and plot V-I characteristics Zener Diode.
- (3) To draw common emitter characteristics of a transistor and calculate transistor characteristics parameters.
- (4) To draw common base characteristics of a transistor and calculate transistor characteristics parameters.
- (5) To plot the waveform of the half wave rectifier and find the ripple factor for H.W.R.
- (6) To plot the waveform of the full wave bridge rectifier and analyze its output.
- (7) To study verify the truth table of all the logic gate.
- (8) To study Cathode Ray Oscilloscope (CRO).



## SCHOOL OF BASIC AND APPLIED SCIENCES

### Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)

B.Sc. (PCM) I Year (II Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Subject : Inorganic Chemistry

Maximum Marks: 50(20+30)

Paper Code : CH-102

**Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

#### UNIT-I

**Hydrogen Bonding & Vander Waals Forces:** Hydrogen Bonding-Definition, Types, effects of hydrogen bonding on properties of substances, application Brief discussion of various types of Vander Waals Forces. Metallic Bond and Semiconductors Metallic Bond- Brief introduction to metallic bond, band theory of metallic bond Semiconductors- types and applications.

#### UNIT-II

**s-Block Elements:** Comparative study of the elements including, diagonal relationships, salient features of hydrides (methods of preparation excluded), solvation and complexation tendencies including their function in biosystems.

**Chemistry of Noble Gases:** Chemical properties of the noble gases with emphasis on their low chemical reactivity, chemistry of xenon, structure and bonding of fluorides, oxides & oxyfluorides of xenon.

#### UNIT-III

**p-Block Elements:** Emphasis on comparative study of properties of p-block elements (including diagonal relationship and excluding methods of preparation).

**Boron family (13th gp):** Diborane-properties and structure (as an example of electron-deficient compound and multicentre bonding), Borazene-chemical properties and structure Trihalides of Boron – Trends in few is acid character structure of aluminium (III) chloride.

**Carbon Family (14th group):** Catenation, p-d bonding (an idea), carbides, fluorocarbons, silicates (structural aspects), silicons – general methods of preparations, properties and uses.

#### UNIT-IV

**Nitrogen Family (15th group):** Structures of oxides of N, P. oxyacids–structure and relative acid strengths of oxyacids of N and P. Structure of white, yellow and red phosphorus

**Oxygen Family (16th group):** Oxyacids of sulphur – structures and acidic strength H<sub>2</sub>O<sub>2</sub> structure, properties and uses.

**Halogen Family (17th group):** Basic properties of halogen, interhalogens, types, properties, hydro and oxyacids of chlorine – structure and comparison of acid strength





**SCHOOL OF BASIC AND APPLIED SCIENCES**  
**Department of Chemistry**  
**(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)**  
**B.Sc. (PCM) I Year (II Semester)**

**Schedule per week Lectures: 2**

**Examination Time : 3 Hrs**

**Maximum Marks: 50(20+30)**

**Subject : Organic Chemistry**

**Paper Code : CH-104**

**Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

**UNIT-I**

**Alkenes:** Nomenclature of alkenes, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes and mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction, ozonolysis, hydration, hydroxylation and oxidation with  $\text{KMnO}_4$ ,

**UNIT-II**

**Arenes and Aromaticity:** Nomenclature of benzene derivatives, Aromatic nucleus and side chain. Aromaticity: the Huckel rule, aromatic ions, annulenes up to 10 carbon atoms, aromatic, antiaromatic and non aromatic compounds. Aromatic electrophilic substitution general pattern of the mechanism, mechanism of nitration, halogenation, sulphonation, and Friedel-Crafts reaction. Energy profile diagrams ; Activating , deactivating substituents and orientation.

**UNIT-III**

**Dienes and Alkynes:** Nomenclature and classification of dienes isolated, conjugated and cumulated dienes. Structure of butadiene, Chemical reactions 1, 2 and 1, 4 additions (Electrophilic & free radical mechanism), Diels-Alder reaction, Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation of alkynes,

**UNIT-IV**

**Alkyl and Aryl Halides:** Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms and stereochemistry of nucleophilic substitution reactions of alkyl halides,  $\text{SN}^2$  and  $\text{SN}^1$  reactions with energy profile diagrams. Methods of formation and reactions of aryl halides, The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides



**SCHOOL OF BASIC AND APPLIED SCIENCES**  
**Department of Chemistry**  
**(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)**  
**B.Sc. (PCM) I Year (II Semester)**

**Schedule per week Lectures: 2**

**Examination Time : 3 Hrs**

**Maximum Marks: 50(20+30)**

**Subject : Physical Chemistry**

**Paper Code : CH-106**

**Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

**UNIT-I**

**Kinetics-I:** Rate of reaction, rate equation, factors influencing the rate of a reaction concentration, temperature, pressure, solvent, light, catalyst. Order of a reaction, integrated rate expression for zero order, first order, second and third order reaction. Half life period of a reaction. Methods of determination of order of reaction,

**UNIT-II**

**Kinetics-II:** Effect of temperature on the rate of reaction-Arrhenius equation. Theories of reaction rate –Simple collision theory for unimolecular and bimolecular collision, Transition state theory of Bimolecular reactions.

**UNIT-III**

**Electrochemistry-I:** Electrolytic conduction, factors affecting electrolytic conduction, specific conductance, molar conductance, equivalent conductance and relation among them, their variation with concentration. Arrhenius theory of ionization, Ostwald's Dilution Law, Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only) Transport number, definition and determination by Hittorfs methods, (numerical included),

**UNIT-IV**

**Electrochemistry-II:** Kohlrausch's Law, calculation of molar ionic conductance and effect of viscosity temperature & pressure on it. Application of Kohlrausch's Law in calculation of conductance of weak electrolytes at infinite dilution. Applications of conductivity  
**Measurements:** determination of degree of dissociation, determination of  $K_a$  of acids determination of solubility product of sparingly soluble salts, conductometric titrations. Definition of pH and pKa, Buffer solution, Buffer action, Henderson – Hazel equation, Buffer mechanism of buffer action.



**SCHOOL OF BASIC AND APPLIED SCIENCES**  
**Department of Chemistry**  
**(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)**  
**B.Sc. (PCM) I Year (II Semester)**

Schedule per week Practical: 6

Examination Time : 4 Hrs

Subject : Chemistry Lab-II

Maximum Marks: 50 (20+30)

Paper Code : CH-108

**UNIT-I (Inorganic)**

**Volumetric Analysis**

**Complexometric titrations:** Determination of Hardness of Water by EDTA

**Paper Chromatography**

Qualitative Analysis of the any one of the following Inorganic cations and anions by paper chromatography ( $\text{Pb}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$  and  $\text{PO}_4^{3-}$  and  $\text{NO}_3^-$ ).

**UNIT-II (Physical)**

1. To determine the surface tension of a given liquid by drop number method.
2. To determine the viscosity of a given liquid.
3. To determine the specific refractivity of a given liquid

**UNIT-III (Organic)**

To study the process of sublimation of camphor and phthalic acid,



**SCHOOL OF BASIC AND APPLIED SCIENCE**  
**Department of Mathematics**  
**(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)**  
**B.Sc. (PCM) I Year (II Semester)**

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Paper Title	: Sequences and Series and Trigonometry	Paper Code	: MA-102

**Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

**UNIT-I**

Boundedness of the set of real numbers; least upper bound, greatest lower bound of a set, neighborhoods, interior points, isolated points, limit points, open sets, closed set, interior of a set, closure of a set in real numbers and their properties. Bolzano-Weiestrass theorem, Open covers, Compact sets and Heine-Borel Theorem.

**UNIT -II**

Sequence: Real Sequences and their convergence, Theorem on limits of sequence, Bounded and monotonic sequences, Cauchy's sequence, Cauchy general principle of convergence, Subsequences, Sub-sequential limits. Infinite series: Convergence and divergence of Infinite Series, Comparison Tests of positive terms Infinite series: Cauchy's general principle of Convergence of series, Convergence and divergence of geometric series, Hyper Harmonic series or p-series. D-Alembert's ratio test, Raabe's test, Logarithmic test, Cauchy's Nth root test.

**UNIT -III**

De Moivre's Theorem and its Applications. Expansion of trigonometrical functions. Direct circular and hyperbolic functions and their properties.

**UNIT- IV**

Inverse circular and hyperbolic functions and their properties. Logarithm of a complex quantity. Gregory's series. Summation of Trigonometry series.

**Books Recommended:**

1. R.R. Goldberg : Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970
2. S.C. Malik : Mathematical Analysis, Wiley Eastern Ltd., Allahabad.
3. Shanti Narayan : A Course in Mathematical Analysis, S.Chand and company, New Delhi
4. Murray, R. Spiegel : Theory and Problems of Advanced Calculus, Schaum Publishing co., New York
5. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi, 1985
6. Earl D. Rainville, Infinite Series, The Macmillan Co., New York
7. S.L. Loney : Plane Trigonometry Part – II, Macmillan and Company, London.
8. R.S. Verma and K.S. Sukla : Text Book on Trigonometry, Pothishala Pvt. Ltd. Allahabad.



**SCHOOL OF BASIC AND APPLIED SCIENCE**  
**Department of Mathematics**  
**(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)**  
**B.Sc. (PCM) I Year (II Semester)**

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Paper Title	: Ordinary Differential Equations	Paper Code	: MA-104

**Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

**UNIT- I**

Geometrical meaning of a differential equation. Exact differential equations, integrating factors. First order higher degree equations solvable for  $x, y, p$  Lagrange's equations, Clairaut's equations. Equation reducible to Clairaut's form. Singular solutions.

**UNIT-II**

Orthogonal trajectories: in Cartesian coordinates and polar coordinates. Linear differential equations with constant coefficients. Homogeneous linear ordinary differential equations. Equations reducible to homogeneous linear ordinary differential equations.

**UNIT-III**

Linear differential equations of second order: Reduction to normal form. Transformation of the equation by changing the dependent variable / the independent variable. Solution by operators of non-homogeneous linear differential equations. Reduction of order of a differential equation. Method of variations of parameters. Method of undetermined coefficients.

**UNIT-IV**

Ordinary simultaneous differential equations. Solution of simultaneous differential equations involving operators  $x$  ( $d/dx$ ) or  $t$  ( $d/dt$ ) etc. Simultaneous equation of the form  $dx/P = dy/Q = dz/R$ . Total differential equations. Condition for  $Pdx + Qdy + Rdz = 0$  to be exact. General method of solving  $Pdx + Qdy + Rdz = 0$  by taking one variable constant. Method of auxiliary equations.

**Books Recommended :**

1. D.A. Murray : Introductory Course in Differential Equations. Orient Longaman(India) . 1967
2. A.R.Forsyth : A Treatise on Differential Equations, Machmillan and Co. Ltd. London
3. E.A. Coddington : Introduction to Differential Equations.
4. S.L.Ross: Differential Equations, John Wiley & Sons
5. B.Rai & D.P. Chaudhary : Ordinary Differential Equations; Narosa, Publishing House Pvt. Ltd



**SCHOOL OF BASIC AND APPLIED SCIENCE**  
**Department of Mathematics**  
**(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)**  
**B.Sc. (PCM) I Year (II Semester)**

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs		Maximum Marks: 50(20+30)
Paper Title	: Vector Calculus and Geometry		Paper Code : MA-106

**Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

**UNIT-I**

Scalar and vector product of three vectors, product of four vectors. Reciprocal vectors. Vector differentiation. Scalar Valued point functions, vector valued point functions, derivative along a curve, directional derivatives.

**UNIT-II**

Gradient of a scalar point function, geometrical interpretation of  $\text{grad } \phi$ , character of gradient as a point function. Divergence and curl of vector point function, characters of  $\text{Div } \vec{f}$  and  $\text{Curl } \vec{f}$  as point function, examples. Gradient, divergence and curl of sums and product and their related vector identities. Laplacian operator.

**UNIT-III**

Vector integration; Line integral, Surface integral, Volume integral. Theorems of Gauss, Green & Stokes and problems based on these theorems.

**UNIT-IV**

General equation of second degree, Tracing of conics Parabola, Ellipse and Hyperbola. Polar Equation of conic.

**Books Recommended:**

1. Murraray R. Spiegel: Vector Analysis, Schaum Publisghing Company, New York.
2. N. Saran and S.N. Nigam. Introduction to Vector Analysis, Pothishala Pvt. Ltd., Allahabad.
3. Shanti Narayna : A Text Book of Vector Calculus. S. Chand & Co., New Delhi.
4. S.L.Loney, The Elements of Coordinate Geometry, Macmillan and company, London
5. P. K. Jain and Khalil Ahamad, A text book of Analytic Geometry of Two Dimensions Macmillan India Ltd. 1994.

Sharma and Sharma A Text Book of Vector Calculus Krishna Prakashan Media