



**BSc (PCM)**

**DETAILED SYLLABUS**

**Semester-III  
Physics**

<b>BPH 301</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Statistical Physics</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Unit I**

Statistical Method: Particle States, distribution of particles in two particle states, Probability of a given distribution, distribution corresponding to maximum probability, relative probability curve with increasing number of particles, binomial distribution, Standard deviation, micro-states and macro-states of a system, reversibility and irreversibility, States of a particle inside a box,

**Unit II**

Boltzmann

canonical distribution, partition function, a two state system, paramagnetic susceptibility, heat capacity, Boltzmann formula for entropy, average energy and fluctuations, enthalpy, general interaction, Gibbs free energy, first law of thermodynamics, phase transitions, Clausius-Clapeyron equation.

**Unit III**

Ideal Classical Gas, Maxwell velocity and speed distributions, partition function, entropy (Sackur-Tetrode relation), Gibbs paradox; equation of state, ideal gas temperature scale, Vender-Waal's equation of state; heat capacities of monatomic and diatomic gases, ortho and para hydrogen.

**Unit IV**

Systems with variable Energy and Particle Number: Chemical potentials, grand canonical distribution, Partition function, number fluctuations, grand potential, equation of state of an ideal classical gas, Saha's ionization formula, Maxwell-Boltzmann, Fermi-Dirac Statistics, Fermi gas at 0K temperature; thermionic emission,

**Reference Books:**

1. Lokanathan and Gambhir: Statistical and Thermal Physics, Prentice Hall.
2. Mandl : Statistical Physics, ELBS and Wiley.
3. Reif : Fundamentals of Statistical and Thermal Physics, McGraw Hill.
4. Reif : Statistical Physics, Berkely, Vol. 3, McGraw Hill.

<b>BPH 302</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Electromagnetism</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **Unit I- Electrostatics**

Electric field  $\mathbf{E}$  and Electric Flux; Gauss's law & its applications; Electric Potential Difference and Electric Potential  $V$ ; Electrostatic Potential Energy of a System of Charges; Force and Torque on a Dipole; Conductors in an Electrostatic Field; Electrostatic Energy; Dielectric Constant; Parallel Plate Capacitor with a Dielectric; Polarization, Polarization Charges and Polarization Vector; Electric Susceptibility; Gauss's law in Dielectrics; Displacement vector  $\mathbf{D}$ ; Relations between the three Electric Vectors ; Capacitors filled with Dielectrics.

### **Unit II- Magneto statics**

Magnetic Field  $\mathbf{B}$  and Magnetic Flux; Biot-Savart's Law:  $\mathbf{B}$  due to (i) a Straight Current Carrying Conductor & (ii) Current Loop; Current Loop as a Magnetic Dipole & its Dipole Moment; Ampere's Circuital law and its applications; Curl & Divergence of  $\mathbf{B}$ ; Modified Ampere's Law; Vector Potential; Torque on a Current Loop in a Uniform Magnetic Field; Gauss's law of magnetism; Magnetization current; Relative Permeability of a Material; Magnetic Susceptibility; Magnetization Vector ( $\mathbf{M}$ ); Magnetic Intensity ( $\mathbf{H}$ ); Faraday's law (Differential & Integral forms).

### **Unit III- Maxwell Equations**

Maxwell Equations; Displacement Current; Vector and Scalar Potentials; Wave Equations; Plane Waves in Dielectric Media; Poynting Theorem and Poynting Vector. Electromagnetic (EM) Energy Density.

### **Unit IV- Plane EM Waves**

Plane EM waves through vacuum and isotropic dielectric medium, transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance; Propagation through conducting media, relaxation time, skin depth

### **Reference Books:**

1. Electricity and Magnetism by Edward M. Purcell (McGraw-Hill Education)
2. David J. Griffiths, Introduction to Electrodynamics, 5<sup>th</sup> Edition.
3. Fundamentals of Electricity and Magnetism by Arthur F. Kip (McGraw-Hill, 1968).
4. Electricity and Magnetism by J. H. Fewkes & John Yarwood. Vol. I (Oxford UnivPress).

<b>BPH 3L</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Physics Lab-I</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **List of Experiments**

1. To plot forward bias and reverse bias characteristics of p-n junction diode.
2. To plot Zener Diode Characteristics.
3. Bread Board implementation of the Basic Logic gates (AND, OR & NOT).
4. Bread Board implementation of the Universal gates (NAND & NOR).
5. To study half wave Rectifier and determine Ripple factor, efficiency and TUF.
6. To study full wave Rectifier and determine Ripple factor, efficiency and TUF.
7. To plot input output characteristics of NPN transistor in common base configuration

## **Chemistry**

<b>BCH-301</b>	<b>L</b>	<b>P</b>	<b>T</b>	<b>C</b>
<b>Saturated and Unsaturated Aliphatic Compounds</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

### **Unit-I: Alkanes and Cycloalkanes**

IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atom 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 and chemical reactions of alkanes, Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity. Cycloalkanes – Nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strain less rings. The case of cyclopropane ring, banana bonds.

### **Unit-II: Alkenes, Cycloalkenes, Dienes and Alkynes-I**

Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halids, regioselectivity in alcohol dehydration, The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes –

mechanism involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroborationoxidation, oxymercuration-reduction.

### **Unit-III: Alkenes, Cycloalkenes, Dienes and Alkynes-II**

Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with  $\text{KMnO}_4$ , Polymerization of alkenes, Substitution at the allylic and vinylic positions of alkenes, Industrial applications of ethylene and propene. Methods of formation, conformation and chemical reactions of cycloalkenes; Nomenclature and classification of dienes : isolated, conjugated and cumulated dienes, Structure of allenes and butadiene, methods of formation, polymerization, chemical reaction – 1, 2 and 1, 4 additions, 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, metal-ammonia reductions, oxidation and polymerization.

### **Unit-IV: Organic Synthesis via Enolates**

Acidity of  $\alpha$ -hydrogens, alkylation of diethyl malonate and ethyl acetoacetate, Synthesis of ethyl acetoacetate: the Claisen condensation, Keto-enol tautomerism of ethyl acetoacetate. Alkylation of 1, 3-dithianes, Alkylation and acylation of enamines.

### **Recommended Books**

McMurry, J.E. *Fundamentals of Organic Chemistry*, 7<sup>th</sup> Ed. Cengage Learning India Edition, 2013.

Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).

Eliel, E.L. *Stereochemistry of Carbon Compounds*, Tata McGraw Hill education, 2000.

Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.

Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.

Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.

<b>BCH-302</b>	<b>L</b>	<b>P</b>	<b>T</b>	<b>C</b>
<b>Structural Chemistry</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **Unit-I: Gaseous States**

Postulates of kinetic theory of gases, deviation from ideal behavior, Vander Waals equation of state; Critical Phenomena : PV isotherms of real gases, continuity of states, the isotherms of vander Waals equation, relationship between critical constants and vander Waals constants, the law of corresponding

states, reduced equation of state. Molecular velocities : Root mean square, average and most probable velocities, Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, Liquification of gases (based on Joule – Thomson effect).

### **Unit-II: Liquid State**

Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases; Liquid crystals: Difference between liquid crystal, solid and liquid, Classification, structure of nematic and cholestric phases, Thermography and seven segment cells. **Unit-III: Solid States**

Definition of space lattice, unit cell; Laws of crystallography – (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices (iii) Law of symmetry, Symmetry elements in crystals. X-ray diffraction by crystals, Derivation of Bragg equation, Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).

### **Unit-IV: Colloidal State**

Definition of colloids, classification of colloids; Solids in liquids (sols): properties – kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number. Liquids in liquids (emulsions): types of emulsions, preparation, Emulsifier, Liquids in solids (gels) : classification, preparation and properties, inhibition, general application of colloids, colloidal electrolytes.

### **Recommended Books**

1. Puri Sharma and Pathania. *Principles of Physical Chemistry*, S. Chand & Co., 2010.
2. K.L. Kapoor. *Textbook of Physical Chemistry*, McGraw Hill, 2004.

<b>BCH 3L</b> <b>Chemistry Lab-I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **List of Experiments**

1. Simple distillation of ethanol-water mixture using water condenser.
2. Distillation of nitrobenzene and aniline using air condenser.
3. To determine the strength of the given acid conductometrically using standard alkali solution.

4. Determination of functional groups present in organic compounds: Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, amines, nitro, Amides and halogens.
5. Effect of NaCl on critical solution temperature (Phenol-Water system).

## Mathematics

<b>BMH-301</b>	<b>L</b>	<b>P</b>	<b>T</b>	<b>C</b>
<b>Partial Differential Equations</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Unit I:** Formation and solution of partial differential equations, Equations easily integrable. Linear partial differential equations of first order- Lagrange's equation, Non-linear partial differential equation of first order- Solution of some standard type of equations, Charpit's method.

**Unit II:** Homogeneous linear partial differential equations of second and higher orders with constant coefficients, Different cases for complimentary functions and particular integrals Non-homogeneous partial differential equations with constant coefficients, Classification of second order linear partial differential equations, Partial differential equations reducible to equations with constant coefficients.

**Unit III :** Variation of a functional, Variational problems, Euler's equations and its various cases, Extremals, Functional depending on n unknown functions, Functionals depending on higher order derivatives, Variational problems in parametric form, Isoperimetric problem.

**Unit IV :** The Heat Equation: Derivation of the heat equation, The maximum and minimum principles, Uniqueness, Continuous dependence, Method of separation of variables, Time-independent boundary conditions, Time-dependent boundary conditions.

The Wave Equation - Derivation of the wave equation, The infinite string problem, The D'Alembert solution of the wave equation, The semi-infinite string problem, The finite vibrating string problem, The method of separation variables, The inhomogeneous wave equation.

### **Books Recommended:**

1. Tyn Mint-U and Lokenath Debnath, Linear Partial Differential Equations  
A.S. Gupta: Calculus of variations with applications, Prentice Hall of India, 1997.
2. I.N. Sneddon: Elements of Partial Differential Equations, McGraw Hill Book Company, 1988.
3. M.D. Raisinghania, Ordinary differential and Partial Differential Equations (19<sup>th</sup>-Edition), S. Chand Publishers, 2017

<b>BMH-302</b>	<b>L</b>	<b>P</b>	<b>T</b>	<b>C</b>
<b>Group Theory</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Unit 1:** Sets, Relations, Functions, Binary operations, Definition of groups with examples and its properties, Subgroups, Order of an element of a group, Cyclic groups, Cosets, Lagrange's theorem and its consequences, Normal subgroup and Commutator subgroups, Factor groups.

**Unit 2:** Group Homomorphism, Isomorphisms, Kernel of a homomorphism, The homomorphism theorems, The Isomorphism theorems, Permutation groups, Even and Odd permutations, Alternating groups, Cayley's theorem and Regular permutation group.

**Unit 3:** Automorphism, Inner automorphism, Automorphism group of finite and infinite cyclic groups, Conjugacy relation, Normalizer and Centre, External direct products, definition and examples of Internal direct products.

**Unit 4:** Class equation of a finite group and its applications, Structure of finite Abelian groups, Cauchy's theorem, Sylow's theorem and consequences, Definition and example of Simple groups, Non-simplicity tests.

#### **Books Recommended:**

1. I. N. Herstein, *Topics in Algebra*, Wiley Eastern Ltd., New Delhi.
2. Joseph A. Gallian, *Contemporary Abstract Algebra (4th Ed)*, Narosa Publishing House, New Delhi.
3. N. Jacobson, *Basic Algebra Vol. I & II*, W. H. Freeman.
4. Surjeet Singh and Qazi Zameeruddin, *Modern Algebra*, Vikas Publishing House Pvt., Ltd., New Delhi.
5. N S Gopalakrishnan, *University Algebra*, New Age International (P) Limited, New Delhi.