BSc (PCM)

DETAILED SYLLABUS

Semester-I
Physics

BPH 101	L	T	P	C
Mechanics	**3**	**0**	**0**	**3**

Unit I - Fundamentals of Dynamics

Newton's Laws of motion, Dynamics of a System of Particles; Centre of Mass; Conservation of Momentum; Idea of Conservation of Momentum from Newton's Third Law; Impulse; Work and Kinetic Energy Theorem; Conservative and Non-Conservative Forces; Potential Energy; Gravitational Potential Energy; Force as Gradient of Potential Energy; Work and Potential energy; Work done by Non-conservative Forces; Law of Conservation of Energy; Elastic and Inelastic Collisions between particles; Centre of Mass and Laboratory Frames.

Unit II - Rotational Dynamics

Angular Momentum of a Particle and System of Particles; Torque; Conservation of Angular Momentum; Rotation about a Fixed Axis; Moment of Inertia; Calculation of Moment of Inertia for Rectangular, Cylindrical and Spherical Bodies; Kinetic Energy of Rotation; Motion involving both Translation and Rotation; centrifugal and Coriolis forces.

Unit III - Gravitation and Central Force Motion

Law of gravitation; Inertial and Gravitational Mass; Potential and Field due to Spherical Shell and Solid Sphere; angular momentum conservation, The Energy Equation and Energy Diagram; Kepler's Laws (Ideas Only); Orbits of Artificial Satellites.

Unit IV - Special Theory of Relativity

Michelson-Morley Experiment and its outcome; Postulates of Special Theory of Relativity, Lorentz Transformations; Lorentz Contraction; Time Dilation; Relativistic Transformation of Velocity; Relativistic Addition of Velocities; Variation of Mass with Velocity; Rest Mass; Mass less Particles; Mass energy Equivalence.

Reference Books:
1. Mechanics Berkeley physics course, vol.1, by Charles Kittel, W. Knight, M. Ruderman,
2. Carl Helmholz, Burton Moyer, (Tata McGraw-Hill).
3. Mechanics by Keith R. Symon (Addison Wesley).
4. An introduction to Mechanics by D. Kleppner, R. J. Kolenkow (McGraw-Hill).

BPH 102	L	T	P	C
Modern Physics	3	0	0	3

Unit I- Quantum Mechanics

Photoelectric effect. Quantum Theory of Light. Compton effect. Pair production. X-Ray Diffraction. De Broglie waves. Davisson-Germer experiment, De- Broglie hypothesis of matter waves, Uncertainty principle, Wave function and wave mechanics, Schrodinger equation: steady state form, one dimensional solution, potential barrier and potential well.

Unit II- Laser

Some remarkable properties of light beam, stimulated absorption, Spontaneous and stimulated emission of radiation, pumping, population inversion, concept of 3 and 4 level Laser, construction and working of Ruby, He-Ne lasers and laser applications.

Unit III- Nuclear Physics and Elementary Particles

Radioactive decay, half-life, radiometric dating, alpha decay, beta decay, gamma decay, nuclear fission, nuclear reactors, fusion reactors, Interactions and particles, leptons, hadrons, elementary particle quantum numbers, quarks.

Unit IV- Solid State Physics

Formation of Energy Bands in solids. Intrinsic & Extrinsic Semiconductor, Donor &Acceptor Impurities, Fermi level And Fermi Energy, P-N Junction formation, Temperature Dependence of Conductivity and Mobility, Hall Effect, Origin of Superconductivity , Meissner Effect, Type-I & Type-II Superconductors, Application of Superconductors

Reference Books:
1. Concepts of Modern Physics - Aurthur Beiser (Mc-Graw Hill)
2. Solid State Physics - by C. Kittel, 5th edition (Wiley Eastern)
3. Optical Fibre & Laser - Anuradha De. (New Age)
4. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New Delhi)

BPH 1L	L	T	P	C
Physics Lab-I	0	0	2	1

List of Experiments

1. To determine the frequency of AC by using sonometer.
2. To determine η of the material of a wire by statistical method.
3. To determine η, Y and K by Searle's method.
4. To determine the momentum of inertia of a fly wheel.
5. To determine the force constant of a spring.
6. To determine the value of g using Bar Pendulum.
7. To study the Motion of Spring and calculate Spring constant by static and dynamic method.
8. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling.

Chemistry

BCH-101	L	P	T	C
Introductory Inorganic Chemistry	**3**	**1**	**0**	**4**

Unit-I: Atomic Structure

Idea of de-Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrödinger wave equation, significance of Ψ and Ψ^2, quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, d, orbitals, Aufbau and Pauli exclusion principles, Hund's multiplicity rule, Electronic configurations of the elements, effective nuclear charge, Slater's Rule.

Unit-II: Periodic Properties

Atomic and ionic radii, ionization energy, electron affinity and electronegativity definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviour.

Unit-III: Chemical Bonding-I (Covalent Bonding)

Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions, valence shall electron pair repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, CIF_3, ICl_2^- and H_2O; MO theory, homonuclear and heteronuclear (CO and NO) diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electro-negativity difference.

Unit-IV: Chemical Bonding-II (Ionic Solids)

Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born-Haber cycle, salvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule, Metallic bond-free electron, valence bond and bond theories.

Unit-V: Chemical Bonding-III (Weak Interactions)

Hydrogen bonding, Vander Waals forces.

Recommended Books

1. Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J.J. *Concepts and Models in Inorganic Chemistry*, John Wiley & Sons.
4. Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006.
5. Graham Solomon, T.W., Fryhle, C.B. & Dnyder, S.A. *Organic Chemistry,* John Wiley & Sons (2014).
6. Puri, Sharma and Kalia. *Principles of Inorganic Chemistry*, S. Chand & Co., 2010.

BCH-102	L	P	T	C
Structure and Reactivity in Organic Chemistry	3	0	0	4

Unit-I: Structure and Bonding

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bonding, van der Waals interactions, inclusion compounds, clatherates, charge transfer complexes, resonances, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

Unit-II: Mechanism of Organic Reactions

Curved arrow notation, drawing electron movements with allows, half-headed and double-headed arrows, homolytic and heterolytic bond fission, Types of reagents – electrophiles and nucleophiles, Types of organic reactions, Energy considerations.

Unit-III: Reactive intermediates

Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species. Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

Unit – IV: Isomerism and Stereochemistry

Concept of isomerism, Types of isomerism; Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, disasteromers, threo and erythro diastereomers, meso compounds, resolution of enantionmer, inversion, retention and recemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature. Geometric isomerism – determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism – conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives, Newman projection and Sawhorse formulae, Fischer and flying wedge formulae, Difference between configuration and conformation.

Recommended Books

1. McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.

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

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

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

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

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

BCH 1L	L	T	P	C
Chemistry Lab-I	0	0	2	1

List of Experiments

1. Detection of elements by dry tests.

2. Detection of elements by flame test.

3. Detection of cations and anions by semi-micro analysis.

   Anions: Carbonate, bicarbonate, sulphite, nitrite, sulphide, phosphate., sulphate, chloride, bromide, iodide, acetate, nitrate, borate

   Cations: Lead, copper, iron, aluminum, zinc, manganese, nickel, calcium, strontium, barium, potassium and ammonium.

4. Identification of ions from Grops I, II, III, IV, V and VI using Group analysis.

5. To determine the melting point of Phenol (40 °C) Naphthalene (80-82 °C), Acetanilide (113-114 °C) and Urea (132-133 °C).

6. To determine boiling point of simple compounds like, Ethanol (78 °C), Benzene (80 °C), Cyclohexane (82 °C), Toluene (110 °C).

Mathematics

BMH-101	L	P	T	C
Differential and Integral Calculus	3	0	0	3

Unit 1. Definition of the limit of a function, Continuous functions and classification of discontinuities, Differentiability, Chain rule of differentiability, Rolle's theorem, Lagrange'svaluetheorems, Indeterminate forms.

Unit2. Successive differentiation and Leibnitz's theorem. Taylor's theorems with Lagrange's and Cauchy's forms of remainder, Mclauren's Theorem, Partial differentiation and Euler'stheorem, Jacobians.

Unit 3. Asymptotes, Test of concavity and convexity, Points of inflexion, multiple points, Tracing of curves in Cartesian and polar coordinates.

Unit 4. Beta and Gamma functions. Reduction formulae, Double and triple integrals, Change of order of integration, Volumes and surfaces of solids of revolution, Pappus theorem, Dirichlet's and Liouville's integral formulae.

Books Recommended

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi,2005.
2. M.J. Strauss, G.L. Bradley and K. J. Smith, *Calculus,* 3rd Ed., Dorling Kindersley (India) P.Ltd. (Pearson Education), Delhi,2007.
3. H. Anton, I. Bivens and S. Davis, *Calculus,* 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore,2002.
4. Gorakh Prasad, Differential Calculus, Pothishala Pvt.Ltd.
5. Khalil Ahmad, Text Book of Calculus, World Education Publishers,2012.

BMH-102	L	P	T	C
Basic Set and Number Theory	**3**	**0**	**0**	**3**

Unit I: Basic Set Theory: Union and Intersection of Sets, Set Difference, Set Complement and the Power Set, Relations and Functions, Composition of Functions, Equivalence Relations, Families of Sets .

Unit II: Peano Axioms and Countability: Peano Axioms and the set of Natural Numbers, Addition, Multiplication and its properties, Well Ordering in set of natural numbers, Finite and Infinite sets, Countable and Uncountable sets, Cantor's Lemma, Construction of Integers, Construction of Rational Numbers.

Unit III: Basic Number Theory: Division algorithm, Lame's theorem, linear Diophantine equation, fundamental theorem of arithmetic, prime counting function, statement of prime number theorem, Goldbach conjecture, binary and decimal representation of integers,

Unit IV: Linear congruences, complete set of residues. Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of the Dirichlet product, the Möbius inversion formula, the greatest integer function, Euler's phi-function.

Books Recommended:

1. David M. Burton: *Elementary Number Theory*, 6th Ed., Tata McGraw-Hill, Indian reprint, 2007.

2. Neville Robinns: *Beginning Number Theory, 2nd Ed*., Narosa Publishing House Pvt. Ltd., Delhi, 2007.

3. Seymour Lipschutz :*Set Theory and related topics*. McGraw-Hill Education; 2nd edition, 1998.

4. J. Hunter: *Number Theory*, Oliver & Boyd, Edinburgh and London, 1964