COURSE STRUCTURE

YEARLY SCHEME OF EXAMINATION B.SC. COURSE-I YEAR

Paper Code	Paper Title	Duration	Marks	
			Max.	Min.
PH-101	Mechanics	3 Hrs.	100	35
PH-102	Wave & Oscillation	3 Hrs.	100	35
PH-103	Electromagnetism	3 Hrs.	100	35
CH-101	Inorganic Chemistry	3 Hrs.	100	35
CH-102	Organic Chemistry	3 Hrs.	100	35
CH-103	Physical Chemistry	3 Hrs.	100	35
CH-104	Chemistry Lab (for both Maths & Biology Streams)	3 Hrs.	50	17
MT-101	Algebra & Matrices	3 Hrs.	100	35
MT-102	Calculas	3 Hrs.	100	35
MT-103	Vector Calculus & Geometry	3 Hrs.	100	35
BO-101	Algae, Lichens & Brypphytes	3 Hrs.	100	35
BO-102	Microbiology Mycology & Plant pathology	3 Hrs.	100	35
BO-103	Pteridophytes, Gymnosperms & paleobotony	3 Hrs.	100	35
BO-104	Practical Botany	3 Hrs.	50	17
ZO-101	Diversity of Animals & Evolutions	3 Hrs.	100	35
ZO-102	Cell Biology & Genetics	3 Hrs.	100	35
ZO-103	Gametes & Developmental Biology	3 Hrs.	100	35
ZO-104	Practical Zoology	3 Hrs.	50	17
PH-201	Thermal and Statistical Physics	3 Hrs.	100	35
PH-202	Optics	3 Hrs.	100	35
PH-203	Electronics	3 Hrs.	100	35
PH-204	Practical Physics	3 Hrs	50	17
CH-201	Inorganic Chemistry	3 Hrs.	100	35
CH-202	Organic Chemistry	3 Hrs.	100	35
CH-203	Physical Chemistry	3 Hrs.	100	35
CH-204	Practical Chemistry	3 Hrs.	50	17
MT-201	Real Analysis & Metrric Space	3 Hrs.	100	35
MT-202	Differential Equation	3 Hrs.	100	35
MT-203	Numerical analysis and vector Calculus	3 Hrs.	100	35
BO-201	Plant Morphology and Anatomy	3 Hrs.	100	35
BO-202	Cell Biology Genetics and Plant Breeding	3 Hrs.	100	35
BO-203	Plant Physiology and Biochemistry	3 Hrs.	100	35
BO-204	Practical Botany	3 Hrs.	50	17
ZO-201	Invertebrates	3 Hrs.	100	35
ZO-202	Animal Physiology and Immunology	3 Hrs.	100	35
ZO-203	Microbiology and Biotechnology	3 Hrs.	100	35
ZO-204	Practical Zoology	3 Hrs.	50	17
PH-301	Elementary Quantum Mechanics and Spectroscopy	3 Hrs.	100	35
PH-302	Solid State Physics	3 Hrs.	100	35
PH-303	Nuclear Physics	3 Hrs.	100	35
PH-204	Practical Physics	3 Hrs.	50	17
CH-301	Inorganic Chemistry	3 Hrs.	100	35
CH-302	Organic Chemistry	3 Hrs.	100	35
CH-303	Physical Chemistry	3 Hrs.	100	35
CH-304	Practical Chemistry	3 Hrs.	50	17
BO-301	Taxonomy & Embryology of Angiosperms	3 Hrs.	100	35
BO-302	Molecular Biology & Technology	3 Hrs.	100	35
BO-303	Plant Ecology & Economic Botany	3 Hrs.	100	35
BO-304	Practical Botany	3 Hrs.	50	17
ZO-301	Structure & Functions of Vertibrates	3 Hrs.	100	35
ZO-302	Ecology & Environmental Biology	3 Hrs.	100	35
ZO-303	Applied Zology	3 Hrs.	100	35
ZO-304	Practical Zoology	3 Hrs.	50	17
MT-301	Algebra	3 Hrs.	100	35
MT-302	Complex Analysis	3 Hrs.	100	35
MT-303	Mechanics	3 Hrs.	100	35

SYLLABUS 2015-16
B.Sc.-I YEAR

Duration : 3Hrs. **PH-101** **Marks (Max. 100, Min. 35)**

MECHANICS

Unit 1: Reference Frames: Inertial frames, Galilean transformation.

Unit 2: Non-inertial frames, fictitious forces, Displacement, velocity and acceleration in rotating co-ordinate systems, centrifugal acceleration,

Unit 3: Coriolis Force: Coriolis force and its applications, Focault pendulum, Invariance of velocity of light.

Unit 4: Relativity: Postulates of special theory of relativity, Lorentz transformations, relativistic addition of velocities, length contraction, time dilation, Variation of mass with velocity, mass energy relation.

Unit 5: Motion under central force: Kepler's laws, Gravitational law and field. Potential due to a spherical body, Gauss and Poisson equations for gravitational self energy.

Unit 6: System of particles: centre of mass, motion of centre of mass, concept of reduced mass, single stage and multistage rocket, energy and momentum conservation,

Unit 7: Collisions: Concepts of elastic and inelastic collisions, Analysis of collision in centre of mass frame.

Unit 8: Angular momentum: Angular momentum of a system of particles. Conservation of angular momentum: angular momentum about an arbitrary point.

Unit 9: Rotation Dynamic: rigid body motion. Rotational motion, equation of motion of a rotating body, inertial coefficients, case of J not parallel to w, kinetic energy of rotation and idea of principles axes, Euler's Equations, Processional motion of Spinning top, Spin precession in constant magnetic field.

Unit 10: Moment of inertia: Calculation of moment of inertia of a spherical shell, hollow and solid spheres and cylindrical objects (cylindrical shell, solid cylinder) about their symmetric axes through centre of mass.

Unit 11: Fluids: Properties of Matter, Kinematics of moving fluids, Equation of continuity, Euler's equation, Bernoulli's theorem, Viscous fluids,

Unit 12: Stream line and Turbulent flow: Poiseuille's law, Capillary tube flow, Reynolds's number, Stokes law.

Unit 13: Surface Tension: Surface tension and surface energy, molecular interpretation of surface tension, Pressure on a curved liquid surface, wetting.

Unit 14: Elasticity: Small deformations, Young's modulus, Bulk modulus and Modulus of rigidity for an isotropic solid, Poisson ratio, relation between elastic constants.

Unit 15: Bending of Beams: Theory of bending of beams and Cantilever, Torsion of a cylinder, Bending moments and Shearing forces. Experimental determination of elastic constants by bending of beam.

Duration : 3Hrs. **PH-102** **Marks (Max. 100, Min. 35)**

WAVE AND OSCILLATION

Unit 1: Basic of Oscillations: Introduction, Potential Well and Periodic Oscillations, Differential Equations and Its Solution, Kinetic and Potential Energy, Simple Harmonic Oscillations In-Spring and Mass System

Unit 2: Pendulum Oscillations: Introduction, Simple and Compound Pendulum**,** Torsional Pendulum, Bifilar, Oscillations, Helmholtz Resonator**,** LC circuits, Oscillation of magnet

Unit 3: Oscillations of Mass: Introduction, Oscillation of Two Masses Connected by a Spring, Superposition of two Simple Harmonic Motions, Interference

Unit 4: Damped Harmonic Oscillators: Introduction, Damped Harmonic Oscillators, About Quality Factor, Driven Damped Harmonic Oscillation, Power Dissipation, Power Absorption, About Transient and Steady State

Unit 5: Motion of Coupled Oscillators: Introduction, Motion of two Coupled Oscillators, Normal Modes, Motion in Mixed Mode, Mechanical Systems, N Coupled Oscillators

Unit 6: Waves in Media: Introduction, Speed of Transverse Waves on a Uniform String, Speed of Longitudinal Waves in a Fluid.

Unit 7: Transmission in Waves: Introduction, Energy Density, Energy Transmission in Waves, Typical Measurement, Waves over Liquid Surface, Gravity Waves and Ripples

Unit 8: Group Velocity: Introduction, Group Velocity, Phase Velocity Measurements, Superposition Principle of Wave's Linear Homogeneous Equations, Nonlinear Superposition and Consequences.

Unit 9: Standing Waves: Introduction, Standing Waves as Normal Modes of Bounded Systems, Harmonics, Quality of sound examples, Chladni's Figures and Vibrations of a Drum, Production and Detection of Ultrasonic and Infrasonic Waves and Applications.

Unit 10: Noise and Music: Introduction, The Human Ear and Its Responses, Intensity and Loudness, Bel and Decibel, The Musical Scale, Temperament and Musical Instruments

Unit 11: Reflection, Refraction, and Diffraction of Sound: Introduction, Acoustic impedance of a medium, Percentage reflection and refraction at a boundary, Impedance matching for transducers, Diffraction of sound, Principle of a sonar system, Sound ranging

Unit 12: Applied Acoustics: Introduction, Transducers and Their Characteristics, Recording and Reproduction of Sounds, Applied Acoustics Various Systems, Measurements of Frequency

Unit 13: Waveform: Introduction, Intensity and velocity, The acoustics of halls, Reverberation period, Sabine's formula.

Unit 14: Electromagnetic Waves: Introduction, Plane electromagnetic waves in vacuum, Wave equation for E and B of linearly, Circularly and elliptically polarized electromagnetic waves, Poynting vector

Unit 15: Reflection and Refraction at Dielectrics: Introduction, Reflection and Refraction at a Plane Boundary of Dielectrics, Polarization by Reflection and Total Internal Reflection, Faraday Effect, Wave in Conducting Medium, Reflection and Refraction by the Ionosphere

Duration : 3Hrs. **PH-103** **Marks (Max. 100, Min. 35)**

ELECTROMAGNETISM

Unit 1: Scalars and Vectors: Concept of Scalars and Vectors, Dot Product and Triple Vector Product, Gradient of Scalar Field, Geometrical Interpretation, Divergence and Curl of a Vector Field, Line, Surface and Volume Integral, Flux of Vector Field.

Unit 2: General Theorem of Vector: Gauss's Divergence Theorem, Green's Theorem and Stokes Theorem, Gauss's Law and its Integral and Differential Form.

Unit 3: Electrostatics: Coulomb's law, Electric Fields and Lines of Force, Electric Flux, Electric Field, Electric Potential.

Unit 4: Concept of Poles: Define the Concept of Poles, Concept of Multi Poles, Dipole and Quadruple Potentials and Field, Charges in an Electrostatic Field.

Unit 5: Nature of Electrostatics: Conservative Nature of the Electrostatic Field and Relation with Electric Potential F, Torques on a Dipole in a Uniform Electric Field and its Energy, Electrostatic Energy of Uniformly Charged Sphere, Classical Radius of an Electron.

Unit 6: Capacitors: Concepts of Capacitor, Capacitors in Series and Parallel, Method for Finding Equivalent Resistance and Capacitance, Dielectrics, Polarization, Capacity of Parallel Plate Capacitor with Partially or Completely Filled Dielectric, Electric Displacement, Clausius-mossotti Equation.

Unit 9: Electrostatic Field: Conductors in Electrostatic Field, Boundary Conditions for Potential and Field at Dielectric Surface, Uniqueness Theorem, Method of Images and Its Applications for System of a Point Charge near a Grounded Conducting Plane.

Unit 10: Methods of Solution Electrostatics: Laplace's Equation and Poisson's Equation**,** Poisson's Equation for Cylindrical Coordinate System, Poisson's Equation for Spherical Polar Coordinates, Laplace's Equation in Cylindrical Polar Coordinates, Laplace's Equation in Spherical Coordinates, Solution of Laplace's Equation in Cartesian Coordinates.

Unit 11: Magnetics: Ampere's Circuital Law, Divergence of Magnetic Field, Force on a Current Carrying Wire, Torques on a Current Carrying Loop, Magnetic Dipole Moment, Magnetization Vector, Magnetization Current, Magnetic Permeability.

Unit 12: Electro Magnetic Plain Wave: Maxwell's Equations, E as an Accelerating Field, Electron Gun, Case of Discharge Tube, Linear Accelerator, E as Deflecting Field: CRO, Sensitivity of CRO.

Unit 13: Electromagnetic Induction: Faraday's Law of Induction, Lenz's Law of Electromagnetic Induction, Self and Mutual Inductance, Charging and Discharging of a Capacitor, Rise and Decay of Current in L-R Circuit, Transient in LCR Circuit.

Unit 14: AC Circuit: Complex Number and Their Application in Solving AC Circuits, Complex Impedance and Reactance, Q-factor and Sharpness of Resonance.

Unit 15: Series Circuit: Series L-R Circuits, Series C-R Circuits, Series L-C-R Circuits, Parallel circuit (Rejecter Circuit), Power in AC Circuit, Chocking Coil.

SYLLABUS 2015-16
B.Sc.-I YEAR

Duration : 3Hrs. **PH-104** **Marks (Max. 50, Min. 17)**

Practical

Duration : 3Hrs. **CH-101** **Marks (Max. 100, Min. 35)**

INORGANIC CHEMISTRY

Unit 1: Atomic Structure: Introduction, Idea of de Brogile matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of ø and ø2, quantum numbers, radial and angular wave functions and probability distribution curves

Unit 2: Orbitals: Introduction, Shapes of s, p, and d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule, Electronic configuration of the elements, effective nuclear charge.

Unit 3: Chemical Bonding: Introduction, Covalent Bond and Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions.

Unit 4: Nature of Covalent Bond and Shapes of Molecules: Introduction, Valence shell 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.

Unit 5: Electron Deficient Molecules: Introduction, Multicentre Bonding In Electron Deficient Molecules, Bond Strength And Bond Energy, Percentage Ionic Character From Dipole Moment And Electronegativity Difference.

Unit 6: Periodic Properties: Introduction, Atomic and ionic radii, ionization energy, electron affinity and electronegativity- definition,

Unit 7: Trends in Periodic Table: Introduction, Methods of Determination And Trends In Periodic Table, Applications In Predicting And Explaining The Chemical Behaviour.

Unit 8: S-Block Elements: Introduction, Comparative Study of S-Block Element, group 1 (alkali metals), group 2 (alkaline earth metals)

Unit 9: P-Block Elements: Introduction, Comparative study of groups 13-17 elements, Compounds like hydrides, oxides and halides

Unit 10: Hydrides: Introduction, Compounds of boron, Hydrides of Boran and Diborane, Borazine (b3n3h6), Properties of borohydrides

Unit 11: Ionic Solids: Introduction, Ionic structures, radius ratio and coordination number, limitation of radius ratio rule, lattice defects, semiconductors

Unit 12: Lattice Energy: Introduction, Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions

Unit 13: Weak Interactions: Introduction, Hydrogen bonding, van der Waals forces. Fullerenes, carbides, flurocarbons, silicates (Structural principle), tetrasulphur tetranitride

Unit 14: Halogens: Introduction, basic properties of halogens, interhalogens and polyhalides.

Unit 15: Chemistry of Noble Gases: Introduction, Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

Duration : 3Hrs. **CH-102** **Marks (Max. 100, Min. 35)**

ORGANIC CHEMISTRY

Unit 1: Structure and Bonding: Introduction**,** Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, van der Waals interactions, inclusion compounds, clatherates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

Unit 2: Mechanism of Organic Reactions: Introduction, Curved arrow notation, drawing electron movements with arrows, halfheaded and double headed arrows, homolytic and heterolytic bond breaking.

Unit 3: Reagents: Introduction, electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediatescarbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with example). Assigning formal charges on intermediates and other ionic species.

Unit 4: Stereochemistry of Organic Compounds I: Introduction, Isomerism: Concept of isomerism. Types of isomerism. Optical isomerism-elements of symmetry, molecular chirality, enatiomers, stereogenic centre, optical activity, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of ennantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

Unit 5. Stereochemistry of Organic Compounds II: Introduction, Determination of Configuration of Geometric Isomers, E and Z system of nomenclature, Geometric Isomerism in Oximes and Alicyclic Compounds, Conformational Isomerism, Fischer, Newman Projection and Sawhorse Formulae, Difference between Configuration and Conformation

Unit 6. Alkanes and Cycloalkanes I: Introduction, IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes. Isomerism in alkanes, sources, methods of formation (withspecial reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes.

Unit 7. Alkanes and Cycloalkanes II: Introduction, 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 strainless rings. The case of cyclopropane ring: banana bonds.

Unit 8. Alkenes: Introduction, Nomenclature of alkenes, methods of formation, mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes.

Unit 9. Chemical reactions of alkenes: Introduction, mechanisms involved in hydrogenation, electrophilic and free radical additions. Markownikoff 's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration hydroxylation and oxidation with KMnO4. Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene.

Unit 10. Cycloalkenes, Dienes and Alkynes: Introduction, Formation of Cycloalkene, Structure and Preparation Methods of Diensex and Alkynes, Acidity of Alkynes, Conformation of Cycloalkenes, Allenes and Butadiene, Electrophilic and Nucleophilic Addition Reactions of Alkynes

Unit 11. Arenes and aromaticity: Introduction, Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene: molecular formula and Kekule structure. Stability

and carbon- carbon bond lengths of benzene, resonance structure, MO picture. Aromaticity: the Huckle rule, aromatic ions.

Unit 12. Aromatic electrophilic substitution: Introduction, General Pattern of the Mechanism, Role of σ and π Complexes, Mechanism of Nitration, Halogenation, Sulphonation, Mercuration, and Friedel-Crafts Reaction, Energy Profile Diagrams, Activating and Deactivating Substituent's, Orientation and Ortho/ Para Ratio, Side Chain Reactions of Benzene Berivatives and Birch Reduction, Methods of Formation and Chemical Reactions of Alkyl benzenes, Alkynylbenzenes, and biphenyl.

Unit 13. Alkyl and Aryl Halides-I: Introduction, Nomenclature and classes of alkyl halides, Methods of formation, chemical reaction. Mechanisms of nucleophilic substitution reactions of alkyl halides, SN^2 and SN^1 reactions with energy profile diagrams. Polyhalogen compounds: chloroform, carbon tetrachloride.

Unit 14. Alkyl and Aryl Halides-II: Introduction, Methods of formation of aryl halides, nuclear and side chain reactions. The addition elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides. Synthesis and uses of DDT and BHC.

Unit 15. Functional Group Chemistry: Introduction, Functional Group, Orientation Effect in Aromatic Substitution, Groups

SYLLABUS 2015-16
B.Sc.-I YEAR

Duration : 3Hrs. **CH-103** **Marks (Max. 100, Min. 35)**

PHYSICAL CHEMISTRY

Unit 1. Mathematical Concepts and Computers I: Introduction, Logarithmic Relations, Curve Sketching, Linear Graphs and Calculation of Slopes, Differentiation of Functions, Maxima and Minima, Partial Differentiation and Reciprocity Relations, Integration of Some Useful/ Relevant Functions, Permutations and Combinations, Factorials, Probability

Unit 2. Mathematical Concepts and Computers II: Introduction, Computers - General Introduction to Computers, Different Components of a Computer, Hardware and Software, Input-Output Devices; Binary Numbers and Arithmetic

Unit 3. Introduction to Computer Language: Programming, operating systems.

Unit 4. Colloidal State: Introduction, Definition of Colloids, Classification of Colloids, Solids in Liquids (Sols): Properties-Kinetic, Optical and Electrical, Stability of Colloids, Protective Action and Gold Number

Unit 5. Emulsions: Introduction, types of emulsions, preparation. emulsifier. liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloids.

Unit 6. Gaseous States: Introduction, Postulates of kinetic theory of gases, deviation from ideal behavior, van der Waals equation of state.

Unit 7. Critical Phenomena: Introduction, PV isotherms of real gases, continuity of states, the isotherms of van der Waals equation, relationship between critical constant and van der Waals constants, the law of corresponding states, reduced equation of state.

Unit 8. Molecular Velocities: Introduction, 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, Liquefaction of Gases (Based On Joule-Thomson Effect)

Unit 9. Liquid State: Introduction, Intermolecular forces, structure of liquids (a qualitative description)Structural differences between solids, liquids and gases.

Unit 10. Liquids Crystals: Introduction, Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven segment cell.

Unit 11. Solid State: Introduction, 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.

Unit 12. Derivation of Bragg Equation: Introduction, Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).

Unit 13. Catalysis: Introduction, Defination of Catalysis, Characteristics of catalyzed reactions, classification of catalysis, miscellaneous examples.

Unit 14. Solutions: Introduction, Non-Ideal Solutions, Methods of Expressing Concentration of Solutions, ctivity and Activity Coefficient, Dilute Solution and Colligative Properties, Raoult's Law, Molecular Weight Determination

Unit 15. Osmosis: Introduction, Law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure, Elevation of boiling point and depression in freezing point. Experimental methods for determining various colligative properties.Abnormal molar mass, degree of dissociation and association of solutes.

SYLLABUS 2015-16
B.Sc.-I YEAR

Duration : 3Hrs. **CH-104** **Marks (Max. 50, Min. 17)**

Chemistry Lab (for both Maths & Biology Streams)

SYLLABUS 2015-16
B.Sc.-I YEAR

Duration : 3Hrs. **MT-101** **Marks (Max. 100, Min. 35)**

ALGEBRA AND MATRICES

Unit 1: Matrices Algebra: Introduction, Definition of matrices, Hermitian and skew Hermitian matrices.

Unit 2: Elementary Operations on Matrices: Introduction, Properties of Matrices, Elementary Operation on Matrices

Unit 3: Inverse of a Matrix: Introduction, Singular matrix, adjoint and inverse of a matrix Linear independence of row and column matrices. Cayley- Hamilton theorem and its use in finding inverse of a matrix.

Unit 4: Determinant: Introduction, Permutation and inversion, determinant cofactor and minor, properties of determinant, Evaluation of determinant.

Unit 5: Rank: Introduction, Row rank, column rank and rank of a matrix. Equivalence of column and row ranks.

Unit 6: Eigen Values and Eigen Vectors: Introduction, Eigen values, Eigen vectors and the characteristic equation of an Eigen values and Eigen vectors.

Unit 7: Linear Equations: Introduction, Applications of matrices to solve a system of linear (both homogeneous and non homogeneous) equations. Theorems on consistency of a system of linear equations.

Unit 8: Theory of Equations: Introduction, Relation between the roots and coefficients of general polynomial equation in one variable, Transformation of equations. Descartes' rule of signs. Solution of Cubic equations (Cardon method), Bi-quadratic equations.

Unit 9: Mapping Binary Composition and Relation: Introduction, Definition of Mapping, Binary Composition and Relation

Unit 10: Group Theory: Introduction, Definition of a group with examples. Order of a finite group.

Unit 11: Subsets: Introduction, The basic idea, Subgroups, Lagrange's Theorem on the order of subgroup, Subspaces, Sub rings, ideals

Unit 12: General Properties of Groups: Introduction, Integral powers of an element of a group. Order of an element of a group.

Unit 13: Subgroups: Introduction, Generation of groups. Cyclic groups, Coset Decomposition, Lagrange's theorem and its consequences, Fermats and Euler's theorems.

Unit 14: Normal Subgroups and Quotient Groups: Introduction, Permutation, Permutation groups, Cyclic permutations, Even and odd permutations. The alternating group An, Cayley's theorem.

Unit 15: Morphism: Introduction, Morphism of Groups, Homomorphism and Isomorphism, The fundamental theorem of homomorphism.

Duration : 3Hrs. **MT-102** **Marks (Max. 100, Min. 35)**

CALCULAS

Unit 1: Curvature: Introduction, Derivative of the Length of an Arc, Curvature, Centre of Curvature, Chord of Curvature, Related Problems based on Curvature.

Unit 2: Asymptotes: Definition of Asymptotes, Types of Asymptotes, Rational Functions.

Unit 3: Concavity and Convexity: Introduction, Concavity and Convexity, Singular Point and Double Point.

Unit 4: Curve Tracing: Introduction, Curve Tracing (in Cartesian and Polar Co-ordinates.), Rules for Tracing Cartesian Curves, Properties of Curve Tracing.

Unit 5: Quadrature: Introduction, Gauss Quadrature Rule, Derivation of Two-Point Gauss Quadrature Rule, Higher point gauss quadrature formula, Arguments and Weighing Factors for N-Point Gauss Quadrature Rules.

Unit 6: Rectification: Introduction, Rectification (Length of a Curve), Different Forms of Rectification.

Unit 7: Intrinsic Equations: Introduction, Intrinsic Equations form

Unit 8: Volumes and Surfaces of Solids of Revolution: Introduction, Volumes and Surfaces of Solids of Revolution, Surface of Revolution.

Unit 9: Ordinary Differential Equations: Introduction, Concept and Formation of a Differential Equation, Order and Degree of a Differential equation.

Unit 10: Equations of First Order and First Degree: Introduction, Equations of First Order and First Degree, Linear Differential Equations, Bernoulli Equations, Homogeneous Equations.

Unit 11: Variable Separable: Separable Variable Equations, Procedure for Solving Separable Differential Equations, Homogeneous Equations.

Unit 12: Linear Equations: Introduction, Linear Equations, Equations Reducible to the linear form.

Unit 13: Exact Differential Equations: Introduction, Exact Differential Equations, Non Exact Differential Equation.

Unit 14: Differential Equations of First Order and Higher Degree: Introduction, Differential Equation of First Order and Higher Degree, Clairaut's Equations, Singular Solutions.

Unit 15: Geometrical Meaning of a Differential Equation: Introduction, Geometrical meaning of a Differential Equation, Orthogonal Trajectories, Linear Differential Equations with Constant Coefficients, Ordinary Homogeneous Linear Differential Equations.

Duration : 3Hrs. **MT-103** **Marks (Max. 100, Min. 35)**

VECTOR CALCULUS AND GEOMETRY

Unit 1: Vector Calculus: Introduction, Vector differentiation, Gradient, Divergence and Curl. Identities involving these operators and related problems. Vector Integration.

Unit 2: Line Surface and Volume Integral: Introduction, Applications and methods of integration, Examples of the use of integration, Integration by substitution, Integration by parts, **Line integral**s Introductory example: work done against a force, Evaluation of line integrals, Conservative vector fields, Other forms of line integrals, **Surface integrals** Introductory example: flow through a pipe, Evaluation of surface integrals, Other forms of surface integrals, **Volume integrals** Evaluation of volume integral.

Unit 3: Vector Theorem: Introduction, Theorems of Gauss, Green's and Stokes's (Statements and verification only) and problems based on these theorems.

Unit 4: Equation of Second Degree Geometry: Introduction, General equation of second degree. Tracing of conics, Centre of a conic, Co-ordinates of the centre. Equation of the conic referred to centre as origin, Asymptotes of a conic. Lengths and position of axes of a standard conic. Eccentricity, Foci, Directrices, Axis, Latus rectum of a conic,

Unit 5: Polar Equation of a Straight Line: Introduction, Polar co-ordinates, general equation of a line, different form equation of straight line, polar equation of a straight line of a two given points, Vertex and focus of the parabola, Tracing of Ellipse and Hyperbola.

Unit 6: Circle: Introduction, Focal chord, Auxiliary circle. Polar equation of circle, Equation of the tangent to the circle

Unit 7: Conic: Introduction, The polar equation of a conic, Tracing of conic, Tangents to conic, Asymptotes, perpendicular lines, Normal, Polar to a conic.

Unit 8: Plane: Introduction, Coordinate Plane, General Equation of a Plane, General Equation of a Plane Passing through a given Point, Equation of a Plane Passing through three given Points, Equation of a Plane in the Intercept Form, Equation of a Plane in the Normal Form, Angle between Two Planes, Distance of a Point from a Plane, Equation of a Plane Bisecting the Angle between Two Planes, Homogeneous Equation of Second Degree Representing Two.

Unit 9: Sphere: Introduction, Sphere, Plane section of a sphere, Tangent plane, Pole and Polar Plane, Orthogonal spheres, Radical plane, Radical Centre.

Unit 10: Cone: Introduction, Definition of cone, Reciprocal cone, Right circular cone, Enveloping cone

Unit 11: Cylinder: Introduction, Cylinder Right circular cylinder, enveloping cylinder.

Unit 12: Central Conicoids: Introduction, Ellipsoid, Tangent plane, Polar, Polar lines, Section with a given centre, Normals.

Unit 13: Second Degree In Three Dimensions: Introduction, General equation of second degree in three dimensions. Intersection of a line and a conicoid. Tangent lines and tangent plane. Condition of tangency. Plane section with a given centre.

Unit 14: Conjugate Diameters: Diametral plane Conjugate diameters and diametral planes and their properties.

Unit 15: Plane Sections of Conicoids: Principal planes and Principal directions. Paraboloids, Plane sections of central conicoids, Umbilics.

Duration : 3Hrs. **BO-101** **Marks (Max. 100, Min. 35)**

ALGAE, LICHENS & BRYPPHYTES

1. **Algae:** Introduction, Algae Description and Types, Economic importance of Algae, Algae Structure and Reproduction, Symbiotic Algae, The Morphology of Algae
2. **Structure, Reproduction, Life History of Algae**: Introduction, Life History of Algae, Oedogonium, Systematic position of Coleochaete, Systematic position of Chara, Life history and Systematic position of Ectocarpus, Life history and Systematic position of Polysiphonia.
3. **The Characteristics and Life Cycles of Algae:** Introduction, Cyanophyta Microcystis, Oscillatoria, Chlorophyta Volvox, Bacillariophyta Navicula
4. **Lichens:** Introduction, Structure and Reproduction of Lichen, Economic Importance of Lichen, Facts and figures, The Lichen Symbiosis, Lichen Fungi, Lichen Photobionts
5. **Classification of Lichenslife**: Introduction, Classification of Lichens, Thallus Organization, Reproduction of Lichens, Physiology and Role in Environmental Pollution
6. **Fungi**: Introduction, General Characters of Fungi, Classification and Economic Importance of Fungi, Structure and Reproduction of Fungi
7. **Brief of Fungi**: Introduction, Systematic Position of Fungi, Structure of Mycelium, Asexual Reproduction Sexual Reproductions of Fungi, Graphic Life Cycle of Different Fungal Types
8. **Life history of Fungi**: Introduction, Life history of Albugo, Life history of Saccharomyces, Life history of Penicillium, Life history of Puccinia, Life history of Alternaria
9. **Bryophyta**: Introduction, Definition of Bryophyte, Mosses, General Characters of Bryophytes
10. **Classification of Bryophytes**: Introduction, Classification of Bryophytes, Mosses (Phylum Bryophyta), Liverworts (Phylum Marchantiophyta), Hornworts (Phylum Anthocerotophyta)
11. **Life History of Riccia, Marchantia, Liverworts, and Anthoceros**: Introduction, Life History of Riccia, Life History of Marchantia, Life History of Liverworts, Life History of Anthoceros
12. **Economic Importance of Bryophytes**: Introduction, Economic Importance of Bryophytes, Ecological Uses of Bryophytes, Horticultural Uses of Bryophytes, Moss Industry, House Construction through Bryophytes, Medicinal uses of Bryophytes
13. **Hepaticopsida**: Introduction, Classification of Hepaticopsida, Calobryales, Jungermanniales, Metzgeriales, Monocleales, Sphaerocarpales, Marchantiales
14. **Anthocerotopsida**: Introduction, Structure of Anthocerotopsida, Reproduction of Anthocerotopsida, Classification of Anthocerotopsida
15. **Bryopsida**: Introduction, Structure of Bryopsida, Reproduction of Bryopsida, Classification of Bryopsida

Duration : 3Hrs. **BO-102** **Marks (Max. 100, Min. 35)**

MICROBIOLOGY MYCOLOGY & PLANT PATHOLOGY

Unit 1: Overview of history of Microbiology: Introduction, History of Microbiology, Scope of microbiology, Theory of Spontaneous Generation

Unit 2: Anatomy of prokaryotes: Introduction, The Cell Wall, The Cytoplasmic Membrane, Cilia and Flagella, Cytoplasmic Inclusions

Unit 3: Microbial Evolution and Diversity: Introduction, Binomial nomenclature

Unit 4: Microbes in Extreme Environment: Introduction, Microbes, Thermophilic Archaea, Halophilic Archaea, Methanogenic Archaea, Photosynthetic Bacteria, Cyanobacteria

Unit 5: Sterilization: Introduction, Definition of Sterilization, Dry and Moist heat Sterilization, Pasteurization, Ultrasonication, Disinfection Sanitization, Physical and Chemical methods of sterilization

Units 6: Fungi: Introduction, General Characters of Fungi, Classification and Economic Importance of Fungi, Structure and Reproduction of Fungi

Units 7: Brief of Fungi: Introduction, Systematic Position of Fungi, Structure of Mycelium, Asexual Reproduction Sexual Reproductions of Fungi, Graphic Life Cycle of Different Fungal Types

Units 8: Life history of Fungi: Introduction, Life history of Albugo, Life history of Saccharomyces, Life history of Penicillium, Life history of Puccinia, Life history of Alternaria

Units 9: Lichens: Introduction, Structure and Reproduction of Lichen, Economic Importance of Lichen, Facts and Figures, The Lichen Symbiosis, Lichen Fungi, Lichen Photobionts

Units 10: Plant Pathology: Introduction, History of Plant Pathology, Classification of Plant Disease, Parasitism and Pathogenesis, Koch's Postulates, Symptoms of Plant Diseases, Development of epidemics

Units 11: Mechanism of Infection: Introduction, Transmission of Plant Diseases, Disease Triangle, The Cyclical Nature of Plant Disease

Units 12: Plant Diseases: Introduction, Disease Diagnosis, Measures of Disease Cycle and Control

Units13: Host – Parasite Interaction: Introduction, Mechanism of Infection, Pathotoxins, Resistance

Units 14: Disease Management: Introduction, Concept of Disease Management, Disease Management of Quarantine, Disease Management of Chemical Control, Detection and Diagnosis of Plant Disease

Units 15: Physiological and Molecular Plant Pathology: Introduction, Plant Basal Disease Resistance, Enzymes and Toxins, Bacterial Mechanisms of Antibiotic Resistance, Elementary Genetic Engineering, Cell and Tissue Culture

Duration : 3Hrs. **BO-103** **Marks (Max. 100, Min. 35)**

PTERIDOPHYTES, GYMNOSPERMS & PALEOBOTONY

Unit 1: Pteridophyta: Introduction, First Vascular Plants**,** General Characteristics of Pteridophyta

Unit 2: Broad Classification of Pteridophyta: Introduction, Classification of Pteridophyta**,** Rhyniopsida**,** Psilotopsida**,** Sphenopsida**,** Filicopsida

Unit 3: Stelar System in Pteridophyta: Introduction, Stelar System in Pteridophyta, Pteridophyte Vascular Anatomy, Stelar System in Pteridophyta in India

Unit 4: Lycopsida and Psilopsida: Introduction, Classification of Lycopsida, Classification of Psilotopsida

Unit 5: Sphenopsida and Pteropsida: Introduction, Classification of Sphenopsida, Classification of Pteropsida

Unit 6: Rhynia and Selaginella: Introduction, Classification of Rhynia, Classification of Selaginella

Unit 7: Lycopodium and Equisetum: Introduction, Classification of Lycopodium, Classification of Equisetum

Unit 8: Classification of Pteris and Marsilea: Introduction, Classification of Pteris, External Morphology of Pteris, Classification of Marsilea

Unit 9: Gymnosperms: Introduction, Classification of Vascular Plants, Types of Gymnosperms, Division Gnetophyta

Unit 10: Progymnosperms: Introduction, Diagnostic Features of Progymnosperms**,** Reproductive of Progymnosperms**,** Male Reproductive System Diseases

Unit 11: General and Comparative Account of Gametophytic and Sprophytic System: Introduction, Filicopsida –Pteridium, Nephrolepis, Marsilea, Heterospory and Seed Habit

Unit 12: Economic Importance of Gymnosperms: Introduction, Wood of Economic Importance, Resins of Economic Importance, Drugs of Economic Importance, Essential oils of Economic Importance

Unit 13: Fossil Gymnosperms: Introduction, Cordaites of Fossil Gymnosperms, Female Fructification, Affinites of the Group

Unit 14: Plant Fossil: Introduction, Types of Plant Fossil, Different Modes of Preservation, Conditions Favouring Fossilization, Nomenclature and Reconstruction, Importance of Fossil Study

Unit 15: Palynology: Introduction, Spore and Pollen, Pollen Aperture Types, Pollen wall- Sporopollenin

SYLLABUS 2015-16
B.Sc.-I YEAR

Duration : 3Hrs. **BO-104** **Marks (Max. 50, Min. 17)**

Practical Botany

SYLLABUS 2015-16
B.Sc.-I YEAR

Duration : 3Hrs. **ZO-101** **Marks (Max. 100, Min. 35)**

DIVERSITY OF AMINALS & EVOLUTIONS

Unit 1: Introduction of Non-Chordates: Introduction, Natural and Unnatural Group**,** Animal Habitat**,** Body Symmetry**,** General Characters of Some Phyla of Invertebrate

Unit 2: Protozoa: Introduction, General Characters**,** Recent Classification Scheme of Protista**,** Type Studies

Unit 3: Euglena: Introduction, Habit and Habitat**,** Morphology**,** Reproduction**,** Reasons of Inclusion of Euglena in the Animal Kingdom**,** Physiology

Unit 4: Monocystis: Introduction, Habit and Habitat**,** Morphology**,** Life Cycle**,** Parasitic Adaptations

Unit 5: Scypha (sycon): Introduction, External Features**,** Microscopic Organization**,** Canal System or Aquiferous System**,** Nutrition**,** Reproduction and Development in Scypha**,** Gemmules

Unit 6: Obelia: Introduction, Habit and Habitat**,** Structure**,** Reproduction and Life Cycle

Unit 7: Phylum Annelid: Introduction, General Characters**,** Outline Classification**,** Type Studies

Unit 8: Scorpion (phylum arthropoda): Introduction, External Features**,** Appendages**,** Digestive System**,** Blood Vascular System**,** Respiratory System**,** Excretory System**,** Nervous System

Unit 9: Phylum Mollusca: Introduction, General Characters, Outline Classification, Detailed Classification, Type Studies

Unit 10: Phylum Platyhelminthes: Introduction, General Characters, Outline Classification Classification, Type Studies

Unit 11: Introduction of Evolution: Introduction, Theories of evolution Neo-Lamarckism**,** Darwin-Wallace theory of natural selection**,** Darwin's theory of evolution statements**,** Neo-Darwinism, Modern Synthetic theory

Unit 12: Evidences of Evolution: Introduction, Paleontological evidences**,** Molecular evidences**,** Phylogeny of horse

Unit 13: Process of Evolutionary Change: Introduction, Organic variations**,** Population genetics**,** Natural selection

Unit 14: Products of Evolutionary Change: Introduction, Species concept**,** Isolating mechanisms**,** Modes of speciation

Unit 15: Life's Beginning: Introduction, An overview Homogeny**,** Biogenic, RNA World

Duration : 3Hrs. **ZO-102** **Marks (Max. 100, Min. 35)**

CELL BIOLOGY & GENETICS

Unit 1: Cell Biological Techniques: Introduction, Cell Theory, Cell Fractionation Centrifugation, Optical and Electron Microscopy, Chromatography

Unit 2: Prokaryotic Cell and Eukaryotic Cell: Introduction, Three Cellular Domains, Prokaryotic Cell, Bacteria, Eukaryotic Cell

Unit 3: The Macromolecules of the Cell (Cytosol and Bio-molecules): Introduction, Physical Nature of Cytosol, physical and biological properties of cytoplasmic matrix

Unit 4 Viruses: Introduction, Types of Viruses**,** Life Cycle of the Bacteriophage**,** Viroids**,** Prions

Unit 5: Plasma Membrane and Cell Wall: Introduction, Plasma Membrane, Membrane Transport, Cell Wall

Units 6: Golgi Apparatus: Introduction, Occurrence**,** Ultrastructure (Electron Microscopic Structure)**,** Chemical Composition**,** Origin

Units 7: Lysosomes: Introduction, Occurrence**,** Chemical Composion**,** Kind of Lysosomes (Polymorpillsm in Lysosomes)**,** Origin**,** Functions of Lysosomes**,** Lysosomal storage disorders•(lysosomes and disease)

Units 8: Peroxisomes and Ribosomes: Introduction, Historical**,** Isolation and Chemical Composition**,** Biogenesis of Peroxisomes**,** Ribosomes**,** Structure of Ribosomes

Units 9: Chromosomes: Introduction, Chemical Composition of Chromosomes**,** Structure of Chromosomes**,** Ultrastructure and Molecular Organization**,** Giant Chromosomes

Units 10: Cell Cycle and Mechanics of Division: Introduction, Cell Cycle**,** Mitosis**,** Mechanism of Mitotic Apparatus**,** Meiosis and Reproductive Cycle**,** Comparison between Mitosis and Meiosis

Units 11: Cell Transformation and Cancer: Introduction, Types of Cancer**,** Growth Properties of Normal and Cancerous Cells**,** Characteristics of Cancer Cells**,** Causes of Cancer**,** Genes Involved in Cancers**,** Diagnosis, Screening and Treatment of Cancer

Units 12: Linkage and Linkage Maps: Introduction, Difference between Linkage and Independent Assortment**,** Theories of Linkage**,** Kinds of Linkage**,** Linkage Groups**,** Interference**,** Crossing Over among Three Linked Genes

Units13: Varieties of Gene Expression: Introduction, Interactions of Genes (Factor Hypothesis)**,** Polygenic Inheritance**,** Lethal genes**,** Pleiotropism

Units 14: Sex Chromosomes, Sex Determination and Sex Differentiation: Introduction, Genetically Controlled Sex Determining Mechanisms**,** Metabolically Controlled Sex Determining Mechanism**,** Environmentally Controlled Sex Determining Mechanism**,** Sex Differentiation

Units 15: Chromosomal Mutations: Introduction, Structural Changes in Chromosomes**,** Numerical Mutations**,** Euploidy**,** Aneuploidy

Duration : 3Hrs. **ZO-103** **Marks (Max. 100, Min. 35)**

GAMETES & DEVELOPMENTAL BIOLOGY

Unit 1: Genomic Equivalence Differential: Introduction, Gene Expression**,** Proto-oncogenes**,** Briggs and King's Experiment**,** Gurdon's Experiment

Unit 2: Embryonic Induction and Competence: Introduction, Spemann's Experiments on Organizers**,** Neural Induction**,** Secondary, Tertiary and Quaternary Organizers**,** Organizers in Different Chordate Groups**,** Competence

Unit 3: Nucleocytoplasmic Interactions: Introduction, Cytoplasmic Influence of Nucleus, Nucleocytoplasmic Interaction in Differentiation, Nuclear Transplantation

Unit 4: Embryology of Amphioxus: Introduction, Fertilization of Embryology of Amphioxus, Embryogenesis, Arrangement of Organ Forming Subtances during Blastulation, Post Gastrular Development

Unit 5: Embryology of Frog: Introduction, Sex Organs and Gametes Deposition of Tertiary Egg Membranes, Structure of Unfertilized Egg, Early Development, Gastrulation

Unit 6: Developmental Biology: Introduction, Descriptive and Comparative Embryology, Experimental Embryology, Methods in the Study of Embryonic Development, Application of Developmental Biology

Unit 7: Gametogenesis: Introduction, Spermatogenesis, Structure of Spermatozoon, Variations in Sperm Structure, Significance of Spermatogenesis

Unit 8: Oogenesis: Introduction, Maturation of Ovum, Amount and Distribution of Yolk and Types of Eggs, Differentiation of Oocyte, Cortical Differentiation, Maturation, Formation of Egg Membranes

Unit 9: Polarity: Introduction, Bipolar Differentiation, Factors Determining Polarity in Eggs, Gradients, Planar Cell Polarity

Unit 10: Fertilization : Introduction, The Mechanism of Fertilization, Changes in the Organization of Egg Cytoplasm after Fertilization, Parthenogenesls

Unit 11: Differentiation: Introduction, Types of Differentiation, Role of Egg Cytoplasm during Differentiation, Differentiation Effected In the Genome, Control of Differentiation during Transcription, Controls at Translation Level, Levels of Differentiation, Stem Cell, Effect of Microenvironment on Differentiation

Unit 12: Metamorphosis: Introduction, Types of Metamorphosis, Metamorphosis in Chordates, Insect Metamorphosis

Unit 13: Embryonic Nutrition: Introduction, Food Reserve and Embryonic Nutrition, Embryonic Nutrition from Mother, Physiology of Placenta

Unit 14: Embryology of Simple Ascidian (Herdmania): Introduction, Gonads (Ovotestes)**,** Fertilization**,** Postgastrular Development**,** Ascidian Tadpole

Unit 15: Embryogenesis of Mammal: Introduction, Male Reproductive Organs, Sexual Cycle in Mammals, Oviparity, Ovoviviparity and Viviparity, Ovulation, Development of Foetal Membranes

SYLLABUS 2015-16
B.Sc.-II YEAR

Duration : 3Hrs. **PH-204** **Marks (Max. 50, Min. 17)**

Practical Physics

Duration : 3Hrs. **PH-201** **Marks (Max. 100, Min. 35)**

THERMAL AND STATISTICAL PHYSICS

Unit 1: Thermo chemistry*:* Introduction, Standard state, standard enthalpy of formation – Hess's Law of heat summation and its applications, Heat of reaction at constant pressure and at constant volume, Enthalpy of neutralization, Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy, Kirchhoff's equation.

Unit 2: Entropy: Introduction, concepts of entropy and temperature, entropy maximum and energy minimum principles. Multiplicity and disorder, Thermodynamic potentials.

Unit 3: Thermal equilibrium: Introduction, conditions of equilibrium, concepts of stability, Maxwell's equations, metastable and unstable equilibrium; components and phases, Gibbs- Duhem relations; first order phase transitions and Clausius-Clapeyron equation; critical phenomena, some chosen applications from magnetic, dielectric and superconducting; black body radiation.

Unit 4: Thermodynamics of Irreversible Processes: Introduction, entropy production; Elementary kinetic theory of gases; transport phenomena.

Unit 5: First and Second Laws of Thermodynamics: Introduction, Internal Energy and Enthalpy, Heat capacity, Joule's Law, Need for the Second Law, Different Statements of the Second Law.

Unit 6: Interacting Systems in Equilibrium: Introduction, Van der Waals Equation Cluster expansions and related techniques.

Unit 7: Critical Phenomena and Phase Transitions: Introduction, First Order Transitions and Phase Equilibria, Critical Points, Magnetic Transitions, Weiss Mean Field Theory, Phase Transitions of the Second Kind, Landau Theory.

Unit 8: Theories of Classical Gases and Liquids: Introduction, The Free Energy of an Interacting System, Second Virial Coefficient, High Temperature Expansion, Density Expansion, Computer Simulation of Liquids.

Unit 9: Statistical Mechanics: Introduction to statistical mechanics and distribution functions. Occupation M-B, B-E, F-D statistics, distribution functions, criteria for applicability of classical statistics.

Unit 10: The Methodology of Statistical Mechanics: Introduction, The Fundamental Principles, Thermodynamic Averages, Thermodynamic Variables, Classical Statistical Mechanics.

Unit 11: Magnetic Systems: Introduction, No interacting Magnetic Moments, Thermodynamics of Magnetism, The Ising Model, The Ising Chain, Mean-Field Theory.

Unit 12: Many Particle Systems: Introduction, Classical Statistical Mechanics, Occupation Numbers and Bose and Fermi Statistics, Distribution Functions of Ideal Bose and Fermi Gases, Single Particle Density of States, The Equation of State of an Ideal Classical Gas Application of the Grand Canonical Ensemble, Blackbody Radiation.

Unit 13: Critical Phenomena and the Renormalization Group: Introduction, The One-Dimensional Model, Recursion Relations, Critical Phenomena, Phase Transitions, Critical Behaviour.

Unit 14: Specific Heat: Introduction, Specific Heat of Classical Gas, Fermi Gas, Electronic Contribution to Specific Heat of Metals, Energy Bands in Conductors, Modifications at Metal-Metal Contact.

Unit 15: Thermodynamic Quantities in Equilibrium: Introduction, The Concept of an Ensemble, The Micro Canonical Ensemble, Canonical Ensemble, Macro Canonical (Grand Canonical) Ensemble, Other Ensembles.

Duration : 3Hrs. **PH-202** **Marks (Max. 100, Min. 35)**

OPTICS

Unit 1: Interference of Light: Introduction, Types of Interference, Interference by the Division of the Wave Front, Experimental Procedure, Colour of a Thin Film in Reflected and Transmitted Light, Thin Film Measurement.

Unit 2: **Theory of Newton's Rings:** Introduction, Radius of Rings, Newton's Fringes and Haidinger Fringes, Determination of the Wavelength of Sodium Light Using Newton's Rings, Newton's Rings Formed By Two Curved Surfaces, Newton's Rings with White Light.

Unit 3: **Interferometer:** Introduction, Concept of Interferometer, The Michelson Interferometer, Wavelength Meter on Michelson Interferometer, Measurements of Michelson's interferometer.

Unit 4: **Diffraction of light:** Introduction, The Fraunhofer and Fresnel approximations, Single-Slit Diffraction, Diffraction of a Circular Aperture, Reflection Grating Systems.

Unit 5: **Dispersion:** Introduction, Thin Prism, Thin Prism Dispersion, Direct Vision Prism.

Unit 6: **Dispersive and Resolving Power of Optical System:** Introduction, Rayleigh's Criterion of Resolution of Two Spectral Lines, Expression of Resolving Power, Telescope and Microscope, Dispersive Power of Grating.

Unit 7: **Polarization of light:** Introduction, Production of Polarized Light, Plane Polarised Light and Nicol Prism, Babinets Soleil Compensator.

Unit 8: **Analysis of Polarized Light:** Introduction, Characteristics of Polarization and Polarization Techniques, Optical Activity, Fresnel's Experiment, Fresnel Measurement of Optical Activity, Half Shade Plate.

Unit 9: **Interference and Diffraction of Light:** Introduction, Energy Distribution in Interference, Conditions for Interference, Young's Double Slit Experiment, Diffraction from Narrow Slits, Diffraction of X-Rays by Crystals.

Unit 10: **Laser:** Introduction, Laser Action and Quantum Theory, The Helium-Neon Laser, Ruby Laser, Principle of Holography, Applications of Laser.

Unit 11: **Elements of Fibre Optics:** Introduction, Construction of Optical Fibres, Image Formation, Numerical aperture, Optical Fibre Structures.

Unit 12: **Optical Instruments:** Introduction, Defects of Vision, The Compound Microscope, Telescope, Binocular Vision.

Unit 13: **Microscope Properties of optical Materials:** Introduction, Optical constants, Deriving the Fresnel Equations, Surface Roughness, Multicomponent Glasses.

Unit 14: Thick Lenses: Introduction, Convex Lens, Principle Axic, Thick Lens Formula, Optic Centre of a Lens.

Unit 15: **Spherical Aberration and Lenses** : Introduction, Concept of Spherical Aberration and Lenses, Chromatic Aberration in Lenses, Curvature of the Field, Coma and Astigmatism.

Duration : 3Hrs. **PH-203** **Marks (Max. 100, Min. 35)**

ELECTRONICS

Unit 1: Basic Semiconductor Physics: Basic features of energy band theory of solids; energy band pictures of semiconductors, electron-hole densities.

Unit 2: Electrical conductivity of intrinsic and extrinsic semiconductors: minority and majority charge carriers drift and diffusion currents, concept of continuity equation for minority charge carrier.

Unit 3: P-N Junction: Built in potential, width and capacitance of depletion region; Current flow in biased p-n junction, Varactor diode; Zener breakdown mechanism, Zener diode and its characteristics, Photo diode and Solar cell.

Unit 4: Transistors: n-p-n and p-n-p transistors, current flow in transistors, potential divider biasing of transistors, characteristics in all three configurations; á, â and hybrid parameters and their relationship, FET and MOSFET, Principle of operation, characteristics and parameters.

Unit 5: Amplifiers: Small signal hybrid equivalent circuit of BJT, RC coupled CE amplifiers, frequency and phase response. Amplifier circuit using FET.

Unit 6: Oscillators: Oscillator as positive feedback amplifier, Barkhausen criteria of sustained oscillation, LC tuned collector oscillator, Hartley and Colpitts transistor oscillator.

Unit 7: Modulation and Demodulation: Definition of three kinds of modulations, expression for AM, FM and PM waves, Vander-Brijl modulator, linear diode detector.

Unit 8: Radio Transmitter and Receiver: AM transmitter (block diagram and function of different blocks); Principle of simple and super heterodyne radio receiver, Qualities of radio receiver (selectivity, sensitivity, and fidelity), Standard broadcast radio receiver, Image frequency, AVC and tuning indicator.

Unit 9: Number system: Introduction, binary numbers, Decimal Number System, Bi-stable Devices, Octal number System, Hexadecimal Number System, conversion.

Unit 10: Boolean algebra: Introduction, De Morgan's theorem.

Unit 11: Logic Gates: Introduction, OR, AND, NOT, NAND, NOR and XOR gates. Universality of NOR and NAND gates.

Unit 12: Introduction to Semiconductor diode: transistor - LED - LCD - Photo diode -Photo transistor - their uses.

Unit 13: Diode rectifiers: half wave and full wave - regulated power supply, TV receivers - TV antenna's - Dish antenna.

Unit 14: Transformer: principle - construction details - classification of transformers -testing of transformers.

Unit 15: TV antennas: Resonance antennas and their characteristics - Dipole antenna - Folded dipole - Yagi antenna - Yagi antenna design - Dish antenna - DTH system - Mobile communication system - MODEM.

SYLLABUS 2015-16
B.Sc.-II YEAR

Duration : 3Hrs. **PH-204** **Marks (Max. 50, Min.17)**

Practical Physics

Duration : 3Hrs. **CH-201** **Marks (Max. 100, Min. 35)**

INORGANIC CHEMISTRY

Unit 1: Chemistry of Elements of First Transition Series: Introduction, general properties of d-block elements, oxidation states, binary compounds (hydrides, carbides and oxides) of the elements of the first transition series, coordination number and structure.

Unit 2: Chemistry of Elements of Second and Third Transition Series: Introduction, physical properties of second and third transition series, oxidation states, zirconium and hafnium, niobium and tantalum, molybdenum and tungsten.

Unit 3: Coordination Compounds: Introduction, nomenclature of coordination compounds, isomerism in coordination compounds, werner's coordination theory, valence bond theory of transition metal complexes, nomenclature of coordination compounds.

Unit 4: Chemistry of Lanthanide Elements: Introduction, electronic structure of lanthanide elements, oxidation states and ionic radii, ceric ammonium sulphate and its analytical uses.

Unit 5: Chemistry of Actinides: Introduction, sources of actinide elements, electronic configuration, oxidation states and magnetic properties, separation of uranium, neptunium, plutonium, and americium.

Unit 6: Oxidation and Reduction: Introduction, electrode potential of oxidation and reduction, use of redox potential data, electrochemical series, principles involved in the extraction of the elements.

Unit 7: Acids and Bases: Introduction, arrhenius concept, bronsted – lowry concept of acids and bases, solvent –system concept, lewis acids and bases, lux- flood acid- base concepts.

Unit 8: Non-Aqueous Solvents: Introduction, solvent, properties of solvents and solvent classification, reactions in non-aqueous solvents, discrimination in non-aqueous solvents.

Unit 9: Gravimetric Analysis: Introduction, supersaturation and nucleation, rate of precipitation, co precipitation, post precipitation, precipitation from homogeneous solution, washing of precipitate, organic precipitants, their advantages and disadvantages.

Unit 10: Chemistry of Transition Metals: Introduction, structures of metal complexes, electronic structure of complexes, organometallic chemistry of d block metals, reactions of complexes.

Unit 11: Nature of Metal-Ligand Bonding in Complexes: Introduction, valence bond theory, outer orbital and inner- orbital octahedral complexes, formation of tetrahedral and square planar complexes, limitations of valence bond theory.

Unit 12: Crystal Field Theory: Introduction, basic concept of crystal field theory, determining how electrons are placed into their orbital's, description of the d-orbital's, factors which influence the magnitude of ä, applications of crystal field theory.

Unit 13: Isomerism Among Inorganic Complexes: Introduction, structural isomers, stereoisomerism or space isomerism, to distinguish between cis-and trans-isomers, optical isomerism in 4-and 6-coordination compounds.

Unit 14: Stability of Complexes in Aqueous Solution: Introduction, kinetic *vs* thermodynamic stability, labile and inert octahedral complexes according to VBT, labile and inert octahedral complexes according to CFT.

Unit 15: Ligand Substitution-Reactions in Octahedral Complexes: Introduction, ligand substitution-reactions, octahedral substitution, substitution reactions of metal complexes, tetrahedral substitution, trigonal bipyramidal substitution.

Duration : 3Hrs. **CH-202** **Marks (Max. 100, Min. 35)**

ORGANIC CHEMISTRY

Unit 1: Electromagnetic Spectrum: Introduction, UV-Visible Absorption Spectra, Ultraviolet and Visible Absorption Spectroscopy, UV Transition Types, Concept of Chromospheres and Auxochrome. Bathoehrognie, Hypsocromle, Hyperehromic and Hypochromic Shifts.

Unit 2: Infrared (I.R.) Absorption Spectroscopy: Introduction, Molecular Vibrations, Hooke's Law for Infrared Absorption Spectroscopy, Intensity and Position of I.R. Bands, Functional Groups of I.R. Spectra.

Unit 3: Monohydric Alcohols: Introduction, Nomenclature of Monohydric Alcohols, Reduction of Aldehydes and Ketones, Methods of Formation by Reduction of Aldehydes and Ketones, Carboxylic acids and Esters, Reactions of Alcohols.

Unit 4: Dihydric Alcohols: Introduction, Preparation of Glycols, Physical Properties and Chemical Properties, Oxidative Cleavage, Pinacol Rearrangement.

Unit 5: Trihydric Alcohols: Introduction, Preparation and Properties of Thiols, Chemical Properties of Trihydric Alcohols, Glycerol (1, 2, 3-Propantriol), Reactions of Trihydric Alcohols.

Unit 6: Phenols: Introduction, Classification and Nomenclature, Structure and Bonding, Physical Properties, Methods of Formation.

Unit 7: Reactions of Phenols: Introduction, Electrophilic Substitution, Mechanisms of Fries Rearrangement, Claisen Rearrangement, Gatterman Syntheis, Lederer-Manasse Reaction, Reimer-Tiemann Reaction.

Unit 8: Ethers: Introduction, Nomenclature of Ethers, Methods of Preparation of Ethers, Physical Properties of Ethers, Chemical Properties of Ethers, Zeisel's Method.

Unit 9: Epoxides: Introduction, Methods of Preparation, Synthesis of Epoxides, Reactions of Epoxides, Acid Catalyzed Ring Opening, Grignard and Organolithium Reagents.

Unit 10: Aldehydes and Ketones: Introduction, Nomenclature of Aldehydes and Ketones, Synthetic Preparation of Aldehydes and Ketones, Physical Properties of Aldehydes and Ketones.

Unit 11: Carboxylic Acids: Introduction, Nomenclature of Carboxylic Acids, Structure of Carboxylic Acids, Acidity of Carboxylic Acids, Uses of Carboxylic Acids, Reactions of Carboxylic Acids.

Unit 12: Methods of Formation and Chemical Reactions of Halo Acids, Hydroxy Acids: Introduction, Methods of Preparation of Unsaturated Monocarboxylic Acids, Malic, Trartaric and Citric Acids.

Unit 13: Carboxylic Acid Derivatives: Introduction, Nomenclature of Carboxylic Acid Derivatives, Esters, Amides, Physical Properties of Carboxylic Acids, Preparation of Carboxylic Acids, Chemical Properties of Carboxylic Acids

Unit 14: Organic Compounds of Nitrogen: Introduction, Preparation of Nitroalkanes and Nitroarenes, Chemical Reactions of Nitro Alkanes, Chemical Properties of Nitroalkanes, Nitro Arenes, Picric acid (2,4,6-trinitro-phenol)

Unit 15: Halonitroarenes: Introduction, Nomenclature and Structure of Amines, Physical Properties of Amines, Separation of a Mixture of Primary, Secondary and Tertiary Amines, Structural Features, Effecting basicity of Amines, Mechanism of the Gabriel Synthesis, Preparation of 2º & 3º-Amines

Duration : 3Hrs. **CH-203** **Marks (Max. 100, Min. 35)**

PHYSICAL CHEMISTRY

Unit 1: Thermodynamic Terms: Introduction, System and Surroundings, Thermodynamic Properties, State and Path Functions, Thermodynamic Processes.

Unit 2: First Law of Thermodynamics: Introduction, Statement of the First Law of Thermodynamics, Internal Energy and Enthalpy, Heat capacity, Joule's Law, Calculation of w, q, dU and dH for the Expansion of Ideal Gases under Isotheral

Unit 3: Thermochemistry: Introduction, Standard State, Hess's Law, Enthalpy of Neutralization, Bond Dissociation Energy, Temperature Dependence of Enthalpy.

Unit 4: Chemical Equilibrium: Introduction, Equilibrium Constant and Free Energy, Thermodynamic Derivation of Law of Mass Action, Le Chatelier's Principle, Clapeyron-Clausius Equation.

Unit 5: Second Law of Thermodynamics: Introduction, Need for The law, Different Statements of the Law, Cornot's Cycle and Its Efficiency, Carnot's Theorem, Thermodynamic Scale of Temperature

Unit 6: Concept of Entropy: Introduction, Entropy as a State Function, Entropy as a Function of V and T, Entropy as a Function of P and T, Entropy Change in Phase Change, Clausius Inequality, Entropy as Criteria of Spontaneity and Equilibrium, Equilibrium Change in Ideal Gases and Mixing Of Gases

Unit 7: Gibbs and Helmholtz Functions: Introduction, Gibbs Function (G) as Thermodynamic Quantities, A and G as Criteria for Thermodynamic Equilibrium and Spontaneity, Advantage over Entropy Change, Variation of G and A with P, V and T

Unit 8: Third Law of Thermodynamics: Introduction, Absolute Entropies of Solids, Liquids and Gases, Nernst Heat Theorem, Residual Entropy, Nernst Distribution law, Applications of Third Law of Thermodynamics

Unit 9: Electrochemistry: Introduction, Conduction in Metals and in Electrolyte Solutions, Specific Conductance and Molar Conductance, Variation of Molar Equivalent

Unit 10: Electrolytes: Introduction, Migration of ions and Kohlrausch's law, Arrhenius Theory of Electrolyte Dissociation, Ostwald's Dilution Law, Debye-Huckel-Onsager's Equation for Strong Electrolytes, Transport Number

Unit 11: Conductivity: Introduction, Applications of Conductivity Measurements, Determination of Solubility Product of a Sparingly Soluble Salt, Conductometric Titrations

Unit 12: Solutions: Introduction, Liquid–Liquid Mixtures, Raoult's Law, Azeotropes, Partially Miscible Liquids, Triethylamine-Water System

Unit 13: Electrochemistry: Introduction, Types of Reversible Electrodes, Electrode Reactions, Derivation of Cell E.M.F, Standard Hydrogen Electrode-Reference Electrodes, Electrochemical Series, Electrolytic and Galvanic Cells

Unit 14: EMF of a Cell: Introduction, EMF of a Cell and its Measurements, Thermodynamic Quantities of Cell Reactions (HG, HH and K), Concentration Cell, Liquid Junction Potential (LJP), Valency of Ions, Definition of pH and pKa, Buffer Solutions

Unit 15: Phase Equilibrium: Introduction, Phase Equilibrium, Gibb's Phase Rule, Phase Equilibrium of Two Component System, The Magnesium-Zinc system, The Sodium chloride-water system

SYLLABUS 2015-16
B.Sc.-II YEAR

Duration : 3Hrs. **CH-204** **Marks (Max. 50, Min. 17)**

Practical Chemistry

Duration : 3Hrs. **MT-201** **Marks (Max. 100, Min. 35)**

REAL ANALYSIS & METRIC SPACE

Unit 1: Properties of the Real Numbers: Introduction, The Real Number System, Order Structure, Bounds, Sups and Infs, the Rational Numbers Are Dense, Inductive Property of IN, The Metric Structure of R.

Unit 2: Elementary Topology: Introduction, Compactness Arguments, Bolzano-Weierstrass Property, Cantors Intersection Property, Cousins Property, Heine-Borel Property, Compact Sets.

Unit 3: Infinite Sum: Finite Sums, Infinite Unordered Sums, Ordered Sums: Series.

Unit 4: Sets of Real Numbers: Introduction, Points, Sets, Elementary Topology.

Unit 5: Contraction Maps: Introduction, Applications of Contraction Maps (I), Applications of Contraction Maps (II), Compactness, Continuous Functions on Compact Sets, Total Boundedness, Compact Sets in C [a, b].

Unit 6: The Integral: Introduction, Cauchy's First Method, Scope of Cauchy's First Method, Properties of the Integral, Cauchy's Second Method, Cauchy's Second Method (Continued), The Riemann Integral, The Improper Riemann Integral.

Unit 7: Differentiation: Introduction, Defined the Derivative, Mean Value Theorem, Monotonicity, Dini Derivates, Convexity.

Unit 8: Sequences: Introduction, Sequences, Divergence, Convergence, Sub sequences.

Unit 9: Sequences and Series of Functions: Introduction, Point-wise Limits, Uniform Limits, Uniform Convergence and Continuity.

Unit 10: Continuous Functions: Introduction, Limits (å-ä Definition), Limits (Sequential Definition), Limits (Mapping Definition), One-Sided Limits, Infinite Limits, Properties of Limits.

Unit 11: More on Continuous Functions and Sets: Introduction, the Baire Category Theorem, Cantor Sets, An Arithmetic Construction of K, The Cantor Function, Borel Sets.

Unit 12: Metric Spaces: Introduction, Metric Spaces, Additional Examples, Function Spaces, Convergence, Functions.

Unit 13: The LP Spaces: Introduction, The Basic Inequalities, The l_p and L_p Spaces (1 d" p < "), The Spaces l" and L", Separability, The Spaces l_2 and L_2, Continuous Linear Functional, The L_p Spaces (0 < p < 1).

Unit 14: The Euclidean Spaces: Introduction, The Algebraic Structure of R^n, The Metric Structure of R^n, Elementary Topology of R^n, Sequences in R^n, Coordinate-Wise Convergence, Functions and Mappings, Limits of Functions from R^n '! R^m, Coordinate-Wise Convergence.

Unit 15: Differentiation on Euclidean Spaces: Introduction, Partial and Directional Derivatives, Integrals Depending on a Parameter, Differentiable Functions.

Duration : 3Hrs. **MT-202** **Marks (Max. 100, Min. 35)**

DIFFERENTIAL EQUATION

Unit 1: Equations of First Order and First Degree: Introduction, Homogeneous Equations, Non-homogeneous Equations of First Degree in x and y, Exact Differential Equations, Integrating Factors (I.F).

Unit 2: Equations of First Order but not of First Degree: Introduction, Equations which can be factorised into Factors of First Degree, Equations which cannot be factorised into Factors of First Degree, Equations Solvable for y, Equations Solvable for x, Equations in which either x or y is absent, Equations Homogeneous in x and y, Equations of First Degree in x and y.

Unit 3: Linear Equations with Constant Coefficients: Introduction, Symbolic Operator, Method of finding C. F, Methods of finding Particular Integral, To Find Particular Integral when X= e^{ax} where 'a' is constant, To Find Particular Integral when X=cos ax or sin ax, To Find the value of $\frac{1}{f(D)}x^m$ where m is a positive integer.

Unit 4: Homogeneous Linear Equations with Variable Coefficients: Introduction, Method of Solution, To Find Complementary Function, Symbolic Notation in 5ØÉÞ, To find Particular Integral, Particular case to find $\frac{1}{f(x)}x^m$, Equations Reducible to Homogeneous Linear Equations.

Unit 5: Exact Differential Equations and Equations of Particular Forms: Introduction, Condition for the Exactness of the Linear Differential Equation, Solution of Non-linear Equations which are Exact, Equations of the form $y^{(n)}$ =f(x), Equations of the form $y^{(2)}$ =f(y), Equations that do not contain y directly, Equations that do not Contain x Directly, Equations in which y Appears in only Two Derivatives whose Orders Differ by Two, Homogeneous Equations.

Unit 6: Linear Equations of Second Order: Introduction, Method of solving Equation when an integral included in the C.F. is known, Method of Solving Equation by Changing the Dependent Variable, Method of Solving Equation by Changing the Independent Variable, Solution by Factorization of the Operator, Method of Variation of Parameters, Method of Undetermined Coefficients.

Unit 7: Simultaneous Differential Equations: Introduction, Simultaneous Equations with Constant Coefficients, Simultaneous Equations with Variable Coefficients, Method of Solution of Equations in Symmetrical Form, Method of Introduction of a New Variable.

Unit 8: Total Differential Equations: Introduction, Condition of Integrability, Method of Obtaining the Primitive, Solution by Inspection, Non-Integrable Single Differential Equations, Equations Containing More Than Three Variables, Equations Containing More Than Three Variables of Method of Solution.

Unit 9: Partial Differential Equations of First Order: Introduction, Classification of Integrals, Singular Integral, Geometrical Interpretation of three Types of Integrals, Singular Integral from the Partial Differential Equation Directly, Derivation of Partial Differential Equations by the Elimination of Arbitrary Functions, Solution of Partial Differential Equations.

Unit 10: Linear Partial Differential Equations With Constant Co-efficient: Introduction, To find Complementary Function, Particular Integral.

Unit 11: Partial Diff Equations of Order Two with Variable Co-efficient: Introduction, Laplace's Transformation, Non-Linear Partial Differential Equations of order two, Monge's Method of integrating Rr+Ss+Tt=V.

Unit 12: Legendre's Equation and Simple Properties of P_n (x): Introduction, Solution of Legendre's Equation, Legendre Polynomial, Rodrigue's Formula, Recurrence Formulae, Laplace's First Integral for $P_n(x)$, Laplace's Second Integral for $P_n(x)$.

Unit 13: Bessel's Equation and Bessel Function: Introduction, Solution of Bessel's Equation, Recurrence Formula for Jn(x).

Unit 14: Laplace Transform and its Application to Differential Equations: Introduction, Laplace Transform of some Elementary Functions, Properties of Laplace Transforms, Laplace Transform of Derivatives, Laplace Transform of Integrals, Properties of Inverse Laplace Transforms, Applications to Differential Equations.

Unit 15: Fourier Transform and Its Application to Partial Differential Equations: Introduction, Derivative of Fourier Transform, Fourier Sine and Cosine-Transforms, Finite Fourier Transform, Application to Partial Differential Equations.

Duration : 3Hrs. **MT-203** **Marks (Max. 100, Min. 35)**

NUMERICAL ANALYSIS AND VECTOR CALCULUS

Unit 1: Approximations and Errors in Computation: Introduction, Accuracy of Numbers, Error in the Approximation of a Function, Error in a Series Approximation, Order of Approximation, Propagation of Error.

Unit 2: Finite Differences: Introduction, Finite Differences, Differences of a Polynomial, Factorial Notation, Effect of an Error on a Difference Table, Relations between the Operators, Application to Summation of Series.

Unit 3: Interpolation: Introduction, Newton's Forward Interpolation Formula, Newton's Backward Interpolation Formula.

Unit 4: Central Differences Interpolation Formula: Introduction, Central Difference Interpolation Formulae, Gauss's Forward Interpolation Formula, Gauss's Backward Interpolation Formula, Stirling's Formula, Bessel's Formula, Laplace-Everett's Formula, Choice of an Interpolation Formula.

Unit 5: Interpolation for Unequal Intervals: Introduction, Lagrange's Interpolation Formula, Divided Differences, Newton's Divided Difference Formula, Hermite's Interpolation Formula, Spline Interpolation, Lagrange's Method, Iterative Method.

Unit 6: Inverse Interpolation: Introduction, Lagrange's Method, Summation of a Series, Cubic-Spline Interpolation Formulas, Bivariate Interpolation, Least Square Approximation.

Unit 7: Solution of Algebraic And Transcendental Equations: Introduction, Basic Properties of Equations, Transformation of Equations, Bisection (Or Bolzano) Method, Method of False Position or Regula-Falsi-Method, Newton-Raphson Method.

Unit 8: Solutions of Simultaneous Linear Equations: Introduction, Direct Methods of Solution, Comparison of Various Methods.

Unit 9: Numerical Solution of Differential Equations: Introduction, Formulae for Derivatives, Numerical Integration, Newton-Cotes Quadrature Formula, Euler-Maclaurin Formula.

Unit 10: Numerical Solution of Linear Differential Equations: Introduction, Picard's Method, Taylor's Series Method, Euler's Method, Runge's Method, Runge-Kutta Method.

Unit 11: Numerical Solution of Ordinary Differential Equations: Introduction, Classification of Second Order Equations, Finite Difference Approximations to Partial Derivatives, Elliptic Equations, Solution of Laplace Equation, Solution of Poisson's Equation, Solution of Elliptic Equations by Relaxation Method, Parabolic Equations.

Unit 12: Vector: Introduction, Addition of Vectors, Rectangular Resolution of a Vector, Unit Vector, Position Vector of a Point, Ratio Formula, Vector Product or Cross Product, Moment of a Force, Angular Velocity.

Unit 13: Vector Calculus: Introduction, Vector Differentiation, Gradient, Divergence and Curl, More Identities Involving, Vector Integration.

Unit 14: Vector Theorem: Introduction, Theorems of Gauss, Green's Theorems, Stokes's Theorems, Verification of Stocks and Gauss Theorem.

Unit 15: Ordinary Differential Equations: Introduction, Concept and Formation of a Differential Equation, Order and Degree of a Differential Equation.

Duration : 3Hrs. **BO-201** **Marks (Max. 100, Min. 35)**

PLANT MORPHOLOGY AND ANATOMY

Unit 1: Flowering Plants: Introduction, The Tissues, The Tissue System, Complete Information on the Types and Structure of Permanent Tissues, Vascular Tissues

Unit 2: Bracts and Inflorescence: Introduction, Definition and Types of Bracts**,** Morphological Features and Inheritance of Foliaceous**,** Involucre of Bracts, Inflorescence**,** Racemose Inflorescence

Unit 3: Floral Morphology: Introduction, Detailed Structure of a Typical Flower and the Function of Its Parts, Types of Placentation in Flowers

Unit 4: Vegetative Morphology: Introduction, Plant Habit, The Stem, The Leaf, The Fruit, The Seed

Unit 5: Plant Anatomy-Stems and Roots: Introduction, Theories on Apical Organization, Anatomy of Dicotyledonous and Monocotyledonous Plants, Secondary Growth

Unit 6: The Flower: Introduction, Parts of a Flower, Hypogynous Flowers, Mean Unity of Flower

Unit 7: Diversity in Plant Forms: Introduction, Annuals, Biennials and Perennials, Tissues-Meristematic and Permanent, Special Secretory Tissue

Unit 8: The Shoot System: Introduction, Shoot Apical Meristem, The Two Classes of Flowering Plants, Cambium-structure and Functions

Unit 9: Secondary Growth in Dicots Stem: Introduction, Characteristics of Growth Rings, Sap Wood and Heart Wood, Periderm, Anomalous secondary growth

Unit 10: Leaf-types of Leaves (Simple and Compound): Introduction, Phyllotaxy**,** Epidermis-uniseriate and Ultiseriate**,** Epidermal Appendages**,** Stomatal Apparatus and their Morphological Types

Unit 11: Cell Wall and Cell Membrane: Introduction, Cell Wall, Chemical Constituents and Functions of Cell Wall, Models of Cell Membrane and Organization

Unit 12: Tissues and their Classification: Introduction, Classification of Tissues, Structural Development and Differentiation of Roots, Structural Development and Differentiation of Shoots

Unit 13: Different Tissue Systems and their Functions: Introduction, Anatomy of Primary Monocot and Dicot Roots, Secondary Growth of Roots and Stems, Anomalous Secondary Growth in Thickness in Dracaena

Unit 14: Autoimmune Diseases: Introduction, Genetics of Autoimmune Diseases, Systemic Lupus Erythematosus, Rhesus Incompatibility, Pregnancy Generates Maternal Immune-Suppressive Cells That Protect the Fetus, Myasthenia gravis: clinical, immunological, and therapeutic advances

Unit 15: Ecological Anatomy: Introduction, The Leaf: Ecological Anatomy, Adaptive Anatomical Features of Hydrophytes, Adaptive Anatomical Features of Xerophytes

Duration : 3Hrs. **BO-202** **Marks (Max. 100, Min. 35)**

CELL BIOLOGY GENETICS AND PLANT BREEDING

Unit 1: Plant Cell Envelops: Introduction, Ultra structure of cell wall, Molecular organisation of cell membranes, Ecological factors.

Unit 2: Nucleus: Introduction, Ultrastructure, Nucleic acids - Structure and replication of DNA; types and functions of RNA.

Unit 3: Chromosomes: Introduction, Morphology, Organization of DNA in a chromosome, euchromatin and heterochromatin. karyotype.

Unit 4: Chromosome Alterations: Introduction, Deletions, Duplications, Translocations, inversions, Variations in chromosome number-aneuploidy, polyploidy. sex chromosomes.

Unit 5: Cell Division: Introduction, cell cycle and its regulation; mitosis, meiosis and their significance.

Unit 6: Mendelism: Introduction, Laws of inheritance, Genetic interactions - epistasis, complementary, supplementary and inhibitory genes.

Unit 7: Linkage and Crossing over: Introduction, construction of genetic maps - 2 point and 3 point test cross data.

Unit 8: Mutations: Introduction, chromosomal aberrations - structural and numerical changes; gene mutations, transposable elements.

Unit 9: Gene Expression: Introduction, organisation of gene, transcription, translation, mechanism and regulation of gene expression in prokaryotes (lac.and trp operons).

Unit 10: Extra Nuclear Genome: Introduction, mitochondrial and plastid dna, plasmids.

Unit 11: Plant Breeding: Introduction, principles of plant breeding, creating a new variety, plant breeding in the future, who pays for plant breeding?, plant breeding for a world community, objectives of plant breeding.

Unit 12: General Methods of Plant Breeding: Introduction, Conventional methods, biotechnological methods, genetic engineering.

Unit 13: Hybrid Vigour and Inbreedifta Depression: Introduction, role of mutation, polyploidy in plant breeding, alterations associated with polyploidy, implications of ploidy in plant breeding.

Unit 14: Famous Indian and International Plant: Introduction, Molecular plant breeding, the contribution of plant breeding to global food security, national and international agricultural research institutes, green revolution

Unit 15: Methods of Breeding: Introduction, conventional methods: biotechnological methods, mating systems, plant breeding in self-pollinated, breeding cross-pollinated species, vegetative propagated crop plants

Duration : 3Hrs. **BO-203** **Marks (Max. 100, Min. 35)**

PLANT PHYSIOLOGY AND BIOCHEMISTRY

Unit 1: Plant Water Relations: Introduction, Importance of water in plant life, Permeability and its importance, Definition of diffusion, Osmosis (exosmosises, endosmosis) plasmolysis.

Unit 2: Absorption of Water: Introduction, Mechanism of Water Absorption, Factors Affecting Absorption of Water**,** Absorption of Water through Roots in Flowering Plants**,** Pathway of Water in Root

Unit 3: Ascent of Sap: Definition of Ascent of sap, Mechanism of Root Pressure Theory, Imbibitions and Transpiration Pull Theories

Unit 4: Transpiration: Introduction, Concept of Transpiration, Types of Transpiration, Structures of Stomata, Mechanisms of Opening and Closing of Stomata

Unit 5: Essential Elements: Introduction, Concept of Major elements (macro nutrients), Trace elements (micro nutrients), Roles of essential elements (deficiency symptoms)

Unit 6: Growth and Growth Hormones: Introduction, Phases of growth, Measurement of growth (arc indicator and Pffefer's auxanometer), Factors affecting growth

Unit 7: Plant Growth Substances and Hormones: Introduction, Auxins, Gibberellins, Cytokinins, Abscisic acid

Unit 8: Seed Dormancy and Seed Germination: Introduction, Methods of breaking seed dormancy, Factors affecting seed dormancy, Types of Seed germination, Factors affecting seed germination

Unit 9: Physiology of flowering: Introduction, Discovery of flowering response, Photoperiodism, Vernalization, Devernalization, Mechanism of floral induction in verbalized plants

Unit 10: Plant Movements: Introduction, Classification of Movement, Movements of Curvature, Paratonic Tropic Movements, Nastic Movements

Unit 11: Carbohydrates: Introduction, Classification of Carbohydrates, Occurrence of Carbohydrates, Chemical reactions of Carbohydrates, Disaccharides, Glycolysis, Krebs

Unit 12: Bioenergetics: Introduction, Energy, Free Energy, Laws of Thermodynamics, Enthalpy and Entropy, Redox Potential, Redox Coupling and ATP Bioenergetics

Unit 13: Nucleic acids: Introduction, The Chemical Nature of DNA: RNA, a Different Nucleic Acid, The Secondary Structure of DNA, Structure of Purines and Pryimidines, Types of DNA

Unit 14: Proteins: Introduction, Classification of Proteins, Structure of Proteins, Biological function of Proteins

Unit 15: Enzyme: Introduction, Classification of enzymes, mechanism of enzyme action, derivation of michaelis menten equation, factors affecting enzyme activity, enzyme inhibition, allorteric enzymes

SYLLABUS 2015-16
B.Sc.-II YEAR

Duration : 3Hrs. **BO-204** **Marks (Max. 50, Min. 17)**

Practical Botany

Duration : 3Hrs. **ZO-201** **Marks (Max. 100, Min. 35)**

INVERTEBRATES

Unit 1: Zoology: The Science of Animals: Introduction, The Study of Zoology, Principles of Taxonomy and Animal Classification, Natural System of Classification, Nomenclature, Outline Classification of Animals

Unit 2: Cell: Structure and Function: Introduction, Cell Theory, Ultra Structure of a Generalized Cell, Cell Division, Comparison of Mitosis and Meiosis

Unit 3: The Invertebrates: Introduction, Major and Minor Phyla, General Characteristics of Invertebrates, Invertebrates *versus* Vertebrates, Phylogeny of Invertebrates, Euglena, Locomotion, Nutrition

Unit 4: Trypanosoma: Introduction, Polymorphic Forms of Trvpanosoivjes, Life Cycle, Symptoms and Pathogenesis, Amoeba, Locomotion, Respiration and Excretion

Unit 5: Entamoeba: Introduction, Entamoeba Histolytica, Reproduction and Life Cycle, Pathogenesis, Other Entamoebae of Man, Elphidium (= Polystomella), Elphidium Crispum (= Polystornella Crispa), Reproduction

Unit 6: Plasmodium-The Malaria Parasite: Introduction, Life Cycle of Plasmodium Vivax, Human Malaria, Symptoms and Pathogenesis, Control of Malaria, Anti-Malaria Campaign in India

Unit 7: Protozoa: Introduction, Characters, Classification and Types: General Characters, Classification, Few Other Protozoan Types

Unit 8: Protozoa: Introduction, General Account: Body Covering and Skeleton, Cytoplasm, Locomotor Organelles and Locomotion, Nutrition in Protozoa, Contractile Vacuoles and Osmoregulation

Unit 9: Porifera: Introduction, General Account: Body Form and Coloration, Canal System, Skeleton, Reproduction, Regeneration in Sponges, Affinities and Systematic Position

Unit 10: Hydra: Introduction, Habits and Habitat, External Morphology, Internal Structure, Epidermis, Gastrodermis, Behaviour

Unit 11: Coelenterata: Introduction, Characters, Classification and Types: General Characters, Classification, Some Other Important Coelenterate Types

Unit 12: Fasciola: Introduction, A Liver Fluke: Fasciola Hepatica-The Sheep Liver Fluke, Digestive System, Development and Life History, Features of Significance in the Life History

Unit 13: Platyhelminthes: Introduction, Characters, Classification and Types: Phylogenetic Significance, Classification, Some other Types of Platyhelminthes, Evolution of Parasitism in Platyhelminthes, Parasitic Adaptation of Flatworms

Unit 14: Nereis a Clamworm: Introduction, Habits and Habitat, External Morphology, Body Wall and Musculature, Digestive System, Reproductive System

Unit 15: Arthropoda: Characters, Classification and Types: Introduction, General Characters, Classification, A Few Other Arthropodan Types

Duration : 3Hrs. **ZO-202** **Marks (Max. 100, Min. 35)**

ANIMAL PHYSIOLOGY AND IMMUNOLOGY

Unit 1: Osmoregulation: Introduction, Poikilosmotic and Homoiosmotic Animals, Mechanism of Osmoregulation

Unit 2: Digestion and Absorption of Food: Introduction, Digestion in the Mouth, Deglutition or Swallowing, Movements of the Stomach, Intestinal Digestion, The Major Products of Digestion

Unit 3: Physiology of Circulation: Introduction, Types of Circulation, Overall Design of the Circulatory System, The Structure of Heart, Interior of the Heart, The Origin of Heart Beat, Non-Nervous (Other) Factors Regulating Heart Beat, The Electrocardiogram, Blood Pressure

Unit 4: Respiration: Introduction, Nasal Cavity, The Trachea, The Mechanism of Respiration, Inspiration, Physiology of Respiration

Unit 5: Excretion: Introduction, Nature of Excretory Products, Formation of Urine, Threshold Substances, The Countercurrent Mechanism of Urine Concentration

Unit 6: Nerve Physiology: Introduction, Functional Architecture of a Neuron, Morphological Classification of Nerve Cells, Nerve Fibres, The Origin and Propagation of Nerve Impulse, Functional Properties of a Nerve Fibre

Unit 7: Muscle Contraction: Introduction, Functional Architecture of Skeletal Muscle, Chemical Constitution of the Skeletal Muscle, Chemical Events in Muscle Contraction, The Sliding Filament Theory of Muscle Contraction (Biophysical Events), Physical Properties of Striped Muscles

Unit 8: The Endocrine Glands: Introduction, The Pituitary Gland (Hypophysis), Feedback Control of Trophic Hormones, Thyrold, Parathyroids, The Adrenal or Suprarenal Glands

Unit 9: Physiology of Reproduction: Introduction, Male Reproductive System the Testis, Hormonal Control of Testicular Functions, Endocrine Functions of the Testes, Feed Back Inhibition of Testosterone, Menstrual Cycle

Unit 10: The Physiology of Special Sense Organs: Introduction, The Eye, Optic Nerve, Formation of Image on the Retina, Dark Adaptation, And binocular Vision

Unit 11: Immunology: Introduction, Definition and Types of Immunity, The Innate Immune System, Humoral and Cell Mediated of Immunology, The Structure of Antibody Molecules

Unit 12: Antigen-Antibody Reactions: Introduction, Nature of Antigen-Antibody Reactions, Tests for Antigen-Antibody Reactions, Neutralizing Reaction

Unit 13: Hypersensitivity: Introduction, Types of Hypersensitivity, An Allergy of Hypersensitivity, Immunology of Hypersensitivity, Immune Response

Unit 14: Autoimmune Diseases: Introduction, Genetics of Autoimmune Diseases, Systemic Lupus Erythematosus, Rhesus Incompatibility, Pregnancy Generates Maternal Immune-Suppressive Cells That Protect the Fetus, Myasthenia gravis: clinical, immunological, and therapeutic advances

Unit 15: Immunotechniques: Introduction, Immunoelectrophoresis, Analysis of Antibody Responses, Immunoassays, Immunoblotting or Western Blotting

SYLLABUS 2015-16
B.Sc.-II YEAR

Duration : 3Hrs. **ZO-203** **Marks (Max. 100, Min. 35)**

MICROBIOLOGY AND BIOTECHNOLOGY

Unit I: Brief introduction to the History of Microbiology: Introduction, Work of Anatony Van Leeuwenhoek; theory of spontaneous generation: germ theory of fermentation and disease: work of Louis Pasteur, John Tynadal, Robert-Koch and Jenner.

Unit 2: The Prokaryota (Bacteria): Introduction, Structural organization: Size, shapes and patterns of arrangement, Structural organization: Slime layer (capsule): cell envelopes: cytoplasmic membrane (inner membrane). cell wall (outer membrane) of Gram negative and Gram-positive bacteria; mesosomes; cytoplasmic organization; cell projection : flagella and cilia.

Unit 3: Genetic Material of Bacteria: Introduction, (i) Chromosome of Genetic Material (ii) Replication of bacterial DNA

Unit 4: Reproduction in Bacteria: Introduction, Asexual reproduction binary fission, budding, endospore formation, exospore and cyst formation; Sexual reproduction, conjugation.

Unit 5: Microbial Nutrition: Introduction, Culture of Bacteria, Carbon and energy source, Nitrogen and minerals, Organic growth factors, Environmental factors: Temperature and pH

Unit 6: Bacteria of Medical Importance: Introduction, **Gram-Positive:** Cocci Staphylococci, Streptococci, **Bacilli :** Diptheria, Tetanus, **Gram-Negative :** Cocci: Gonnorrhea, Meningitis **Bacilli:** Diarrohea, **Mycobacteria :** Tuberculosis, Leprosy

Unit 7: AIDS and Hepatitis: Introduction, The causative agents, transmission, pathogenecity, laboratory diagnosis, treatment and prevention (elementary idea only).

Unit 8: Biotechnology: Introduction, History of Biotechnology, Biotechnology Applications, Major areas of Biotechnology

Unit 9: Environmental Biotechnology: Introduction, Role of Environmental Biotechnology, Scrap Metal Recovery, Microbial Enhanced Oil Recovery, Improvement of Conventional Wastewater Treatment Processes

Unit 10: Biotechnology in Medicine: Introduction, Polymerase chain reaction (PCR), Antibiotic, Production of Recombinant Vaccines, Enzymes, Vitamins

Unit 11: Applications of Monoclonal Antibodies: Introduction, Production of Monoclonal Antibodies, Drug Selection, Human Hybridomas, And Monoclonal Antibodies as Enzymes Abzymes

Unit 12: Genetic Engineering (outline idea only): Introduction, Applications of genetic engineering, hazards and regulations.

Unit 13: Transgenic Animals: Introduction, uses of Transgenic Animals in biotechnology.

Unit 14: Food, Drink and Diary Biotechnology (outline idea only): Introduction, Fermented food production; dairy products, alcoholic beverages and vinegar microbial spoilage and food preservation.

Unit 15: Recombinant DNA Technology: Introduction, hybridomas of Recombinant DNA Technology applications of Recombinant DNA Technology.

SYLLABUS 2015-16

B.Sc.-II YEAR

Duration : 3Hrs. **ZO-204** **Marks (Max. 50, Min. 17)**

Practical Zoology

Duration : 3Hrs. **PH-301** **Marks (Max. 100, Min. 35)**

ELEMENTARY QUANTUM MECHANICS AND SPECTROSCOPY

1. **Origin of Quantum Theory :** Failure of classical Physics to explain the phenomenon such as black body spectrum, Planck's radiation law, photoelectric effect and Einstein explanation, Compton effect deBroglie hypothesis, evidence for diffraction and interference of particles.ncertainty principle and its consequences gamma ray microscope, diffraction at a single slit, Application of uncertainty principle,
(i) Non existence of electron in nucleus. (ii) Ground state energy of H-atom Ground state energy of harmonic oscillator, Energy-time uncertainty.

2. **Classical Theory of Radiation :** Maxwell's equation and electromagnetic waves. Poynting vector. Classical dipole radiation. Simple harmonic oscillator. Absorption cross-section. Thomson and Rayleigh scattering formula. Bremstrahlung, Gyromagnetic, Synchrotron and Cerenkov radiations.

3. **Quantum Mechanics and Spectroscopy :** Bohr-Sommerfeld theory of atomic spectra. Electron spin. LS and JJ coupling. Spectroscopic terminology. de Broglie waves. Schrodinger equation for stationary states. Simple harmonic oscillator in one and three dimensions. Hydrogen atom. Quantum mechanical operators. Angular momentum. Elementary perturbation theory. Semi-classical treatment of Zeeman and Stark effects. Pauli's exclusion principle. Periodic Table.

4. **Molecular Spectra :** Pure rotational spectrum of a diatomic molecule. Vibration-rotation spectrum. Electronic bands and sequences. Frank-Condon principle. Strengths of bands, lines and continuum. Multiple structure of electronic states. Isotope effect in band spectra.

5. **Schrodinger Equation :** time dependent and time independent form, Physical significance of the wave function and its interpretation, probability current density, operators in quantum mechanics, linear and Hermitian operators, Expectation values of dynamical variables, the position, momentum, energy.

6. **Fundamental Postulates of Quantum Mechanics :** eigen function and eigen value, degeneracy, orthogonality of eigen functions, commutation relations . Ehrenfest theorem, concept of group and phase velocities, wave packet

7. **Simple Solutions of Schrodinger Equation :** Time independent Schrodinger equation and stationary state solution, Boundary and continuity conditions on the wave function, particle in one dimensional box, eigen function and eigen values, discrete energy levels, extension of results for three dimensional case and degeneracy of levels. Potential step and rectangular potential barrier, calculation of reflection and transmission coefficient, Qualitative discussion of the application to alpha decay(tunnel effect), square well potential problem, calculation of transmission coefficient

8. **Bound State Problems :** Particle in one dimensional infinite potential well and finite depth potential well, energy value and Eigen functions. Simple harmonic oscillator (one dimensional) eigen function, energy eigen values, zero point energy. Schrodinger equation for a spherically symmetric potential, Separation of variables, Orbital angular momentum and its quantisation, spherical harmonics, energy

levels of H-atom, shape of n=1, n=2 wave functions, comparison with Bohr model and Correspondence principle.

9. **Elementary Spectroscopy :** Quantum features of one electron atoms, Frank-Hertz experiment and discrete energy states, Stern and Gerlach experiment, Spin and Magnetic moment, Spin Orbit coupling and qualitative explanation of fine structure. Atoms in a magnetic field, Zeeman effect, Zeeman splitting

10. **Qualitative Features of Molecular Spectroscopy :** Rigid rotator, discussion of energy eigenvalues and eigenfunctions, Rotational energy levels of diatomic molecules, Rotational spectra, Vibrational energy levels of diatomic molecules, Vibrational spectra, Vibrational Rotational spectra, Raman Mechanics: (Book 1, 2) (16 Periods) (20 aMrks) effect

11. **Applications of Quantum :** The particle in a box energy quantization, wave functions, Momentum Quantization, The particle in a three dimensional box. Schrodinger equation for the hydrogen atom, separation of variables, Quantum numbers –Total quantum number, Orbital quantum number, Magnetic quantum number.

12. **Atomic Physics :** The vector atom model, Quantum numbers associated with the vector atom model, L-S and J-J coupling, The Pauli's exclusion Principle, Selection rules, Intensity rules, Interval rule, Normal Zeeman effect, Anomalous Zeeman effect, Stark effect.

13. **Molecular Spectra :** Theory of pure rotational spectra, Theory of rotation-vibration spectra, Raman Effect, Experimental study, Raman Effect in solids, liquids and gases.

14. **Matter Waves :** Introduction, Compton Effect, de Broglie wave length, Wave function, Relation between Wave and Group velocity, Davisson and Germer experiment, G.P.Thomson's Experiment, Heisenberg's uncertainty principle and its applications

15. **Spectroscopic Techniques :** Electromagnetic Radiation, Visible and Ultraviolet Spectroscopy, Beer-Lambert Law, Recording and Interpreting UV-vis Spectra, Vibrational Spectroscopy, Fundamental Vibrational Modes, Infrared Spectroscopy, Infrared Spectra, Raman Spectroscopy, Origin of Raman Scattering, Raman Scattering, Raman vs. IR, Surface Enhanced Raman Spectroscopy (SERS), Single Molecule SERS, Coherent Anti-Stokes Raman Spectroscopy (CARS), Nuclear Magnetic Resonance Spectroscopy (NMR), Theory of NMR, Theory of NMR, NMR Spectra, Solid State NMR, Electron Spin Resonance (ESR) Spectroscopy, Theory of ESR, ESR Spectrum, NMR vs. ESR, X-ray Spectroscopy, X-ray Emission, Absorption Techniques, X-ray Absorption Near Edge Structure (XANES), Extended X-ray Absorption Fine Structure (EXAFS), Electron Spectroscopics, ESCA and Auger Process, X-ray Photoelectron Spectroscopy (XPS), Mössbauer Spectroscopy, Mass Spectrometry, Instrumentation of Mass Spectrometer, Ionization Methods, MS Spectrum, Thermal Analysis, Applications of Thermal Analysis, Applications of Thermal Analysis,

Duration : 3Hrs. **PH-302** **Marks (Max. 100, Min. 35)**

SOLID STATE PHYSICS

Unit 1: Atomic Structure: Introduction, The Rutherford Model of the Atom, Bohr Model of Atom 1.3 Bohr's Interpretation of Hydrogen Spectrum

Unit 2: Sommerfeld's Relativistic Atom Model: Introduction, Elliptical Orbits for Hydrogen**,** Sommerfeld's Relativistic Correction**,** Fine Structure of H Line**,** The Characteristic Quantum Numbers**,** The Pauli's Exclusion Principle

Unit 3: Inter-Atomic Force and Bonding in Solid: Introduction, Cohesion of Atoms, Cohesive Energy, Properties of Ionic Compoun, 3.4 ionic bonding

Unit 4: Covalent Bond in Solids: Introduction, Saturation in Covalent Bonds, Hybridization, Metallic Bonding, Solid State Structure, Primary Metallic Crystalline Structures (BCC, FCC, HCP)

Unit 5: Crystal Physics : Introduction,, Lattice Points and Space Lattice, Crystal System

Unit 6: Metallic Crystals Structur : Introduction, Other Cubic Structures, Direction, plane and Miller Indices6.3 Summary, Allotropy and Polymorphism

Unit 7: Wave Nature of Matter and X –Ray Diffraction : Introduction, The de Broglie hypothesis, Experimental Study of Matter Waves, The Davisson –Germer Experiment, X- Ray Diffraction

Unit 8: Electrical Properties of Metals : Introduction, Classical Free Electron Theory of Metals**,** Drift Velocity, Mobility, Mean Collision Time, Relaxation Time and Mean Free Path**,** Quantum Free-Electron Theory**,** Heat Capacity**,** Classical Wave Equations

Unit 9: Thermal Conductivity in Metals : Introduction, Thermal Expansion, Mechanical Effects on Electrical Resistance, Thermal Emission, Magnetism in Metal, Classical Wave Equations

Unit 10: Thermal Properties of Solids : Introduction, Lattice Specific Heat, Classical Theory (Dulong and Petit Law), Einsteins Theory of Specific Heat, Debye's Theory

Unit 11: Superconductive : Introduction, A survey of superconductors, Mechanisms of superconductors, Thermal Properties

Unit 12: Thermodynamics of Superconductors : Introduction, BCS Theory, Quantum Theory, New Superconductors

Unit 13: Magnetic Properties of Materials : Introduction, Magnetic Permeability, Magnetization, Demagnetization, Paramagnetism

Unit 14: Ferromagnetism : Introduction, Spontaneous Magnetization in Ferromagnetic Materials, Weiss Molecular Field, Domain theory of Ferromagnetism, Domains, Antiferromagnetism, Magnetic Materials

Unit 15: Semiconductor : Introduction, Preparation of Semiconductor Materials, Intrinsic Semiconductors, Electron and hole Densities, Hall Effect

Duration : 3Hrs. **PH-303** **Marks (Max. 100, Min. 35)**

NUCLEAR PHYSICS

Unit 1: Nuclear Detector: Introduction, Ionization Chamber, Differentiating and Integrating Circuited

Unit 2: Particle Accelerators: Introduction, Ion Sources, High Voltage Acceleration Devices, The Cyclotron, Betatrons, The Principle of Phase Stability

Unit 3: General Properties of Atomic Nuclei: Introduction, Nuclear Size, Nuclear Mass and Mass Spectroscopy, Double Focussing Spectrometer, Mass Synchrometer

Unit 4: Two Body Problem and Nuclear Forces: Introduction, The Deuteron**,** The Meson Theory of Nuclear Forces**,** High Energy Nucleon-Nucleon Scattering. (E > 10 MeV)**,** Interpretation of High Energy Nucleon-Nucleon Scattering-Exchange Forces

Unit 5: Nuclear Models: Introduction, The Degenerate Gas Model, The Liquid Drop Model, Simple Shell Model, Collective Model

Unit 6: Radio Activity: Introduction, Law of Radioactive Decay, Average or mean Life or an Atom, Units of Radioactivity, Radioactive Processes

Unit 7: Alpha Ray Emission : Introduction, Properties or Alpha-Particles, Scattering of Alpha-Particle, Energetic of á Decay, Nuclear Energy Levels

Unit 8: Beta Decay: Introduction, Transverse Type-Spectrometers, General Features of -Ray Spectrum, Fermi's Theory of -Decay, Forms of Interaction and Selection Rules

Unit 9: Gamma-Rays: Introduction, The Absorption of -rays By Matter, Photo-electric Absorption, Compton Scattering, The Measurement of -Rays Energies, Multipole Radiations

Unit 10: Neutron and Reactor Physics: Introduction, Neutron Sources**,** Nuclear Reactors as Neutron Sources**,** Detection of Fast Neutrons**,** Neutron Spectrometers and Mono-Chromators

Unit 11: Nuclear Reactions: Introduction, Conservation Laws for Nuclear Reactions, Reaction Energetic -The Q•Value Equation, Charged Particle Induced Nuclear Reactions, Charged Particle Reaction Spectroscopy

Unit 12: Theories of Nuclear Reactions: Introduction, The Compound Nucleus, Resonance Scattering and Reaction Cross-Sections, Continum Theory of Nuclear Reactions

Unit 13: Nuclear Energy: Introduction, Mass and Energy Distribution of Fission Fragments, Theory of Nuclear Fission and the Liquid Drop Model, Heterogeneous Reactors, Nuclear Fusion-Thermo-Nuclear Energy

Unit 14: Elementary Particles: Introduction, Classification of Elementary Particles, Fundamental Interactions, Response of Particles to Strong, Electromagnetic and Weak Interactions, Conservation Laws and there Validity

Unit 15: Properties of Elementary Particles: Introduction, The Massless Bosons, The Leptons, The Mesons, Resonance States of Elementary Particles

SYLLABUS 2015-16
B.Sc.-II YEAR

Duration : 3Hrs. **PH-304** **Marks (Max. 50, Min. 17)**

Practical Physics

Duration : 3Hrs. **CH-301** **Marks (Max. 100, Min. 35)**

INORGANIC CHEMISTRY

Unit 1: Metal-Ligand Bonding: Introduction, Limitations of Valance Bond Theory, An Elementary Idea of Crystal Field Theory, Crystal-Field Parameters

Unit 2: Thermodynamic and Kinetic Aspects of Metal Complexes: Introduction, Brief Outline of Thermodynamics Stability of Metal Complexes, Stability Constants of Complexes, Substitution Reactions of Square Planar Complexes

Unit 3: Magnetic Properties of Transition Metal Complexes: Introduction, Types of Magnetic Behaviour, Methods of Determining Magnetic Susceptibility, L-S coupling, Orbital Contribution to Magnetic Moments

Unit 4: Electronic Spectra of Transition Metal Complexes: Introduction, Types of Electronic Transitions, Selection Rules for d-d Transitions, Spectroscopic Ground States, Spectrochemical Series, Discussion of the Electronic Spectrum of $[Ti(H_2O)_6]^{3+}$ Complex Ion

Unit 5: Organometallic Chemistry: Introduction, Definition of Organometallic Chemistry, Classification of Organometallic Compounds, Nomenclature of Organometallic Compounds Simplifying the Organometallic Complex

Unit 6: Alkyls and Aryls: Introduction, Preparation of Alkyls, Bonding and Applications of Alkyls, Preparation of Aryl Halides, Feature of Aryls of Lithium (Li), Feature of Aryls of Aluminium (Al)

Unit 7: Metal Carbonyls: Introduction, 18-Electron Rule, Preparation of Metal Carbonyls, Structure and Nature of Bonding in the Mononuclear Carbonyls, Synthesis of Metal Carbonyls

Unit 8: Silicones and Phosphazenes: Introduction, Silicones**,** Phosphazenes**,** Nature of Bonding in Triphosphazenes

Unit 9: Hard and Soft Acids and Bases (HSAB): Introduction, Classification of Acids and Bases as Hard and Soft, Pearson's HSAB Concept, Acid-base Strength and Hardness and Softness, Theoretical Basis of Hardness and Softness

Unit 10: Bioinorganic Chemistry: Introduction, Essential and Trace Elements in Biological Processes, Metalloporphyrins with Special Reference to Hemoglobin and Myoglobin, Biological Role of Alkali and Alkaline Earth Metal Ions with Special Reference to Ca^{2+}

Unit 11: Electron-Deficient Compounds: Boranes: Introduction, Hydrides of Boron: Boranes**,** General Properties of Boranes**,** Diborane B_2H_6**,** Types of Bonds Found in Higher Boranes**,** Structure and Bonding in Higher Boranes

Unit 12: Metallic Carbonyls and Metallic Nitrosyls: Introduction, Structure and Nature of M-CO Bonding in Carbonyls**,** Effective Atomic Number (EAN) Rule As Applied to Metallic Carbonyls**,** Metallic Nitrosyls**,** Some Metallic Nitrosyls

Unit 13: Basic Properties of Iodine, Interhalogen Compounds: Introduction, Interhalogen Compounds, Some Important Interhalogen Compounds, Polyhalide Ions and Polyhalides

Unit 14: Pollution and its Effects on the Living World: Introduction, Air Pollution**,** Water Pollution**,** Soil Pollution**,** Radioactive (Radiation) Pollution**,** Industrial Pollution

Unit 15: Electrode Potentials and Their Applications: Introduction, Comparison between Electrolytic and Electrochemical Cells, Electrode Potential of an Electrode ($E_{electrode}$ or E), Types of Electrodes, EMF (E_{cell}) of an Electrochemical Cell

Duration : 3Hrs. **CH-302** **Marks (Max. 100, Min. 35)**

ORGANIC CHEMISTRY

Unit 1: Organ Magnesium Compounds: Introduction, Grignard Reagent and Reactions, Reaction Conditions, Preparation of Different Types of Grignard Reagents

Unit 2: Organic Nomenclature: Introduction, Formulae, Nomenclature, Common Side Groups, Configurational Isomerism, Aromatic Hydrocarbons, Functional Groups, Compounds with more than one functional group, Configurational Isomerism revisited

Unit 3: Organ Lithium Compounds: Introduction, Organ Lithium compounds, properties and structures, Reactions of organ Lithium compounds, Named organic reactions with organ Lithium compounds, Indicators for the titration of organ Lithium compounds

Unit 4: Composition of Organic Compounds: Introduction, Detection of Carbon and Hydrogen, Detection of Halogens, Estimation of C and H, Estimation of Nitrogen, Estimation of Halogens, Estimation of S and P

Unit 5: Hetrocyclic Compounds: Introduction, Nucleophilic Substitution in Pyridine, Basicity of Pyridine, Reactions of Heterocycles, Reduction of Pyridine

Unit 6: Introduction to Condensed Five and Six Membered Heterocycles: Introduction, Source of Pyrrole, Furan, and Thiophene, Saturated Five-Membered Heterocycles, Structure of Pyridine

Unit 7: Carbohydrates Disaccharides and Polysaccharides: Introduction, (+)-maltose, (+)-cellulose, (+)-lactose, and (+)-sucrose, Polysaccharides, Structure of Amylase end Group Analysis, Structure of Amylopectin, Cyclodcxtrins, Structure of Cellulose, Reactions of Cellulose

Unit 8: Macromolecules Polymers and polymerization: Introduction, Macromolecules, Polymers and Polymerization, Copolymerization, Ionic Polymerization Living Polymers

Unit 9: Amino Acids: Introduction, Amino Acids Classification, The Acid-Base Behaviour of Amino Acids, Methods of Preparation of Amino Acids

Unit 10: Peptides and Proteins: Introduction, Proteins, Peptides" Geometry of the Peptide Linkage, Synthesis of Peptides

Unit 11: Nucleic Acids: Introduction, The Chemical Nature of DNA, RNA, a Different Nucleic Acid, The Secondary Structure of DNA, DNA Replication, The Central Dogma and Transcription

Unit 12: Fats, Oils and Detergents: Introduction, The Organic Chemistry of Biomolecules, Hydrolysis of Fats, Soap, Micelles, Detergents, Biosynthesis of Fatty Acids

Unit 13: Synthetic Polymers: Introduction, Shorthand for Writing Polymer Reactions, Classification of polymers, Mechanism of Addition Polymerization, Ionic Polymerization, Condensation Polymer (Step-Growth Polymer), Thermoplastic and Thermosetting Polymers, Natural and Synthetic Rubbers

Unit 14: Synthetic Dyes: Introduction, Colour and Constitution, What is A Dye?, Classification of Dyes by Methods of Application

Unit 15: Organic Synthesis via Enolates: Introduction, Acidity of α-hydrogens, Acetoacetic Ester and Malonic Ester, Keto-Enol Tautomerism, Keto-enol tautomerism of ethyl acetoacetate

SYLLABUS 2015-16
B.Sc.-III YEAR

Duration : 3Hrs. **CH-303** **Marks (Max. 100, Min. 35)**

PHYSICAL CHEMISTRY

1. Introductory Quantum Mechanics: Introduction, Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Compton Effect, de-Broglie's hypothesis, the Heisenberg's uncertainty principle, Hamiltonian Operator.

2. Spectroscopy: Introduction, electromagnetic radiation, regions of the spectrum, basic features of different spectrophotometers, statement of the born-oppenheimer approximation, degrees of freedom.

3. Physical Properties and Molecular Structure: Introduction, Optical activity, polarization – (Clausius – Mossotti equation), orientation of dipoles in an electric field, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules, magnetic properties-paramagnetism, diamagnetism and ferromagnetic, Magnetic susceptibility, its measurements and its importance.

4. Schrödinger Wave Equation: Introduction, Equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box. Schrödinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

5. Molecular Orbital Theory: Introduction, Construction of M.O's by LCAO – H_2^+ ion, calculation of energy levels from wave functions, physical picture of bonding and anti-bonding wave functions, concept of , *, , * orbital's and their characteristics, Hybrid orbital's – sp, sp^3, sp^2, calculation of coefficients of A.O's used in sp and sp^2 hybrid orbital and interpretation of geometry.

6. Rotational Spectrum: Introduction, Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.

7. Infrared Spectrum: Introduction, Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

8. Raman Spectrum: Introduction, Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

9. Electronic Spectrum: Introduction, Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle. Qualitative description of , and η M.O. their energy levels and the respective transition.

10. Photochemistry: Introduction, Interaction of radiation with matter, difference between thermal and photochemical processes, Laws of photochemistry: Grothus – Drapper law, Stark – Einstein law, Jablonski diagram depicting various processes occurring in the excited state.

11. Solutions: Introduction, Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient.

12. Dilute solution: Introduction, Raoult's law, relative lowering of vapour pressure, molecular weight determination, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure, Elevation of boiling point and depression of freezing, Thermodynamic derivation of relation between molecular weight and elevation in boiling point.

13. Colligative Properties: Introduction, Experimental methods for determining various colligative properties. Abnormal molar mass, Van't Hoff factor, Colligative properties of degree of dissociation and association of solutes.

14. Chemistry at surfaces: Introduction, Adsorption, Adsorption isotherms, The Langmuir adsorption isotherm isotherm, Brunauer, Emmett and Teller (B.E.T) equation, Surface films.

15. Oscillatory Chemical Reactions: Introduction, Conditions for oscillatory behaviour, classification of oscillatory reactions, Homogeneous oscillations, Thermo chemical oscillations, electrochemical oscillations, Biochemical oscillations.

SYLLABUS 2015-16
B.Sc.-II YEAR

Duration : 3Hrs. **CH-304** **Marks (Max. 50, Min. 17)**

Practical Chemistry

BO-301

Duration : 3Hrs. **Marks (Max. 100, Min. 35)**

TAXONOMY AND EMBRYOLOGY OF ANGIOSPERMS

1. **Introduction of Angiosperms:** Components of Systematics: Nomenclature, Identification, Classification; Taxonomy and its phases - Pioneer, Consolidation, Biosystematic and Encyclopaedic; alpha- and omega- taxomony.
2. **Nomenclature:** Elementary knowledge of ICBN: Principles; Rank of taxa, Retention and rejection of names; Type method; Principle of priority.
3. **Systems of Classification:** Broad outline of Bentham & Hooker (1862-1883), Cronquist's (1988) system of classification with merits and demerits
4. **Systematics in Practice:** Herbaria and Botanical Gardens – their role; important Indian Herbaria and Botanical Gardens; Dichotomous keys – indented and bracketed.
5. **Phenetics and Cladistics:** Brief idea on Phenetics, Numerical taxonomy; Cladistics; Monophyletic, polyphyletic and paraphyletic groups; Plesiomorphy and apomorphy.
6. **Data sources in Taxonomy:** Supportive evidences from Phytochemistry, Cytology, Anatomy.
7. **Diagnostic Features:** Systematic position (Bentham & Hooker and Cronquist), Economically important plants (parts used and uses) of the following families: **Dicotyledons :** Magnoliaceae, Malvaceae, Leguminosae (subfamilies), Euphorbiaceae, Umbelliferae (Apiaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Labiatae (Lamiaceae), Cucurbitaceae, Rubiaceae, Compositae (Asteraceae). **Monocotyledons :** Alismataceae, Palmae (Arecaceae), Gramineae (Poaceae), Liliaceae, Zingiberaceae, Orchidaceae.
8. **Embryology :** General Account characters.
9. **Microsporangium and Microsporogenesis**
10. **Megasporangium and Megasporogenesis**
11. **Female gametophyte and Fertilization :** (monosporic, bisporic and tetrasporic embryosac) Polygonum type), Double fertilization - Syngamy - triple fusion - post fertilization changes**.**
12. **Endosperm and Embryogeny : (**Different modes of development, functions of endosperm), Embryogeny: (Classification, development of any typical dicot and monocot embryo)
13. **Structure and development of another Embryogeny :** structure of mature pollen and Male gametophyte. Structure and development of ovule. Female gametophyte Monosporic
14. **Endosperm types :** nuclear, cellular - helobial - Ruminate endosperms, function of endosperms
15. **Development of embryology :** Development of embryo in Dicot (Capsella) Monocot (Najas). A brief account on Polyembryony, parthenocarpy.

Duration : 3Hrs. **BO-302** **Marks (Max. 100, Min. 35)**

MOLECULAR BIOLOGY & TECHNOLOGY

Unit 1. Mechanism of Transcription: RNA Polymerase and the transcription unit**,** Transcription in Prokaryotes**,** Transcription in Eukaryotes.

Unit 2. RNA Modifications: Split genes, concept of introns and exons, removal of Introns, spliceosome machinery, splicing pathways, alternative splicing, exon shuffling, RNA editing, and mRNA transport.

Unit 3. Regulatory RNAs: Riboswitches, RNA interference, miRNA, siRNA, Regulatory RNA and X-inactivation.

Unit 4. Structure of B-DNA and its Conformational Variants: Chromosome and genes. Concept of spilt genes, palindromes and transposons. Brief account of organization and packaging of DNA in eukaryotes.

Unit 5. Gene Transfer Methods: outline of cloning a recombinant DNA. Various transgenic animals. GM organisms. Recombinant DNA technology and Gene therapy.

Unit 6. Structure and properties polysaccharides: amino acids, proteins, vitamins and hormones; Enzymes: active sites, specificity, mechanisms, factors, general aspects of enzyme kinetics. Bioenergetics: Laws of thermodynamics, concept of Gibb's free energy, high energy compounds.

Unit 7. Translation (Prokaryotes and Eukaryotes) : Assembly line of polypeptide synthesis - ribosome structure and assembly, various steps in protein synthesis. Charging of tRNA, aminoacyl tRNA synthetases. Proteins involved in initiation, elongation and termination of polypeptides. Fidelity of translation. Inhibitors of protein synthesis. Regulation of translation, Translation-dependent regulation of mRNA and Protein Stability.

Unit 8. Transcription Regulation in Prokaryotes: Principles of transcriptional regulation, regulation at initiation with examples from lac and trp operons

Unit 9. Transcription Regulation in Eukaryotes: Conserved mechanism of regulation, Eukaryotic activators, Signal integration, combinatorial control, transcriptional repressors, signal transduction and control of transcriptional regulator, Gene Silencing

Unit 10. General outline of DNA replication enzymes and proteins involved, basic DNA.

repair system. Point mutations and molecular mechanism. Transcription and translation, post transcriptional modifications of mRNA.

Unit 11. Nucleic acid as genetic material, nucleotides, structure of nucleic acids, properties of genetic code, codons assignments, chain initiation of codons mechanism of protein synthesis and its regulation.

Unit 12. Replication of DNA in prokaryotes and eukaryotes, gene expression and regulation. Hormonal control and second messengers Ca-+, Cyclic AMP, IP3 etc.

Unit 13. Biotechnology: Introduction and Definition, Scope of biotechnology, Multidisciplinary nature of biotechnology.

Unit 14. Biotechnology in Agriculture: Tissue culture – General technique, Applications of tissue culture in Agriculture and Forestry, Biofertilizers – Definition, Necessity, Types – BGA and Rhizobium.

Unit 15. Molecular technologies : an overview of Genetic screening for any predisposition symptoms, Cancer screening, DNA fingerprinting,(Paternity and Forensics) in vitro fertilization, surrogate motherhood, PGD, transgenic organisms, xenotransplantation, GMOs.

Unit 16 : Social issues : public opinions against the molecular technologies. **Legal issues** – legal actions taken by countries for use of the molecular technologies. **Ethical issues** – ethical issues against the molecular technologies. **Bioethics** – Necessity of Bioethics, different paradigms of Bioethics – National & International. **Intellectual Property Rights** – Why IPR is necessary, TRIPS & IPR, IPR – national & international scenario, IPR protection of life forms.

Duration : 3Hrs. **BO-303** **Marks (Max. 100, Min. 35)**

PLANT ECOLOGY & ECONOMIC BOTANY

Unit 1: Introduction to Ecology: Introduction, Definition of Ecology, Scope and Importance of Ecology, Levels of Organization

Unit 2: Environment: Introduction, Environmental Factors, Edaphic (Soil Profile, Physico-chemical Properties), Topographic and Biotic Factors (Species Interaction)

Unit 3: Adaptations of Plants: Introduction, Tropical Rainforest Adaptations, Plants to Water Stress, Plants to Salinity, Xerophytes and Halophytes

Unit 4: Population Ecology: Introduction, Basic Concept of Population Ecology, Characteristics of Population, Biotic Potential, Ecotypes and Ecads

Unit 5: Community Ecology: Introduction, Characteristics of Communities, Community Structure and Composition, Community Features, Methods of Analysis, Ecological Succession

Unit 6: Ecosystem: Introduction, Concept of an Ecosystem, Regulation of Ecosystem Functions, Energy Flow in the Ecosystem, Food Chains, Food Webs, Ecological Pyramids

Unit 7: Biogeochemical Cycles: Introduction, Carbon and Nitrogen, Hydrological (Water) Cycle, Phyto-geography: Phyto-geographical Regions of India, Vegetation Types of India (Forests)

Unit 8: Environmental Pollution: Introduction, Sources of Environmental Pollution, Types of Pollution, Control of Air and Water Pollution, Control of Soil Pollution

Unit 9: Global Change: Introduction, Greenhouse Effect, Greenhouse Gases, Global Warming, Carbon Trading

Unit 10: Biodiversity: Introduction, Definition of Biodiversity, Levels of Biodiversity, Value of Biodiversity, Biodiversity at Global, National and Local Levels, Conservation of Biodiversity: In-Situ and Ex-Situ

Unit 11: Morphology of Plants: Introduction, Cultivation of Spices, Medicinal Plants

Unit 12: Economic Botany: Introduction, Food, Oils and Fats, Tea and Coffee

Unit 13: Economically Important Plants–I: Introduction, Maize, Sorghum, Pulses, Oilseeds

Unit 14: Economically Important Plants –II: Introduction, Fibres, Sugars, Tuber Crops

Unit 15: Economically Important Plants –III: Introduction, Fruits, Vegetables, Aromatic Plants, Cannabis, Multipurpose Trees

SYLLABUS 2015-16
B.Sc.-II YEAR

Duration : 3Hrs. **BO-304** **Marks (Max. 50, Min. 17)**

Practical Botany

SYLLABUS 2015-16
B.Sc.-III YEAR

Duration : 3Hrs. **ZO-301** **Marks (Max. 100, Min. 35)**

STRUCTURE & FUNCTIONS OF VERTIBRATES

1. Introduction of Vertebrate: Anatomy and morphology of vertebrate, Vertebral column, Gills, Central nervous system Evolutionary history, First vertebrates, from fish to amphibians, Mesozoic vertebrates, After the Mesozoic Classification, Traditional classification, Phylogenetic relationships, Functional morphology of the types included with special emphasis on the adaptations to their mode of life and environment – General characters and classification of Phylum Chordates up to orders - Origin of Chordata

2. Endoskeleton: General plan of neurocranium and dermatocranium, Jaw suspensorium, Vertebrae

3. Digestive system: Modifications in relation to feeding habits, Length, and surface area, internal folds Supplementary diverticulae, Oesophagus, Stomach, its modifications in ruminant mammals, Dentition Dental formula in mammals

4. Respiratory system: Aquatic respiration, Aerial respiration, Accessory respiratory organs in fish, Lungs Air-sacs in birds

5. Circulatory system, Aortic arches, Portal systems, Lymphatic system

6. Nervous system, Evolution of cerebral hemispheres and cerebellum, Chemoreceptor, Neuromast organs of lower vertebrates

7. Urinogenital system: Excretory system, Types and evolution of kidney tubules, Urinary duct and bladder Reproductive system, General plan of gonads 220, Accessory reproductive organs

8. Urochordata: Classification and detailed study (habit, morphology, anatomy, physiology and post embryonic development) of Herdmania

9. Prochordates:General characters and classification - Type study: Amphioxus, Balanoglossus, Ascidians - Affinities and systematic position of Cephalochordata, Hemichordata and Urochordata

10. Agnatha: General characters and affinities - Type study - Petromyzon

11.Pisces: General characters and classification - Origin of fishes - Type study: Scoliodon sorrakowah, Mugil oeur, Epiceratodus - Affinities of Dipnoi - Types of scales and fins - Accessory respiratory organs - Air bladder - Parental care - Migration - Economic importance.

12.Amphibia: General characters and classification - Origin of amphibia - Type study - Rana hexadacryla - Adaptive features of Anura, Urodela and Apoda - Neoteny in Urodela - Parental care in amphibia.

13. Reptilia: General characters and classification - Type study - Calotes versicolor (endoskeleton of Varanus instead of Calotes) - Origin of reptiles and effects of terrestrialisation - Extinct reptiles

14. Snakes of India - Poison apparatus and biting mechanism of poisonous snakes - Skull in reptiles as basis of classification

15. Ayes: and Mammalia: General characters and classification - Type study - Columba livia - Origin of birds - Ratitae - Flight adaptations - Migration. General characters and classification - Type study - RABBIT - Adaptive radiation in mammals - Egg laying mammals

Duration : 3Hrs. **ZO-302** **Marks (Max. 100, Min. 35)**

ECOLOGY & ENVIRONMENTAL BIOLOGY

1 **Introduction of Ecology:** Introduction, Scope - concept - Branthes in Ecology: Autoecology, synecology, integrated ecology, Micro and macro environment. Types of media and subsatum and their influence on animals. Biosphere - Hydrosphere, Lithosphere, Stratosphere. Bicoenosis (community and Biogeocoenosis (ecosystem).

2 **Abiotic Factors:** Water, Properties: Forms of water, soft & hard water. Air: Composition - properties Substratum: Soil: Varieties - soil formation, soil texture, soil groups of India, sod profile, soil water, soil chemistry.

3 **Temperature and Ligh:** Distribution of temperature, changes in time, horizontal, vertical. Thermal stratification. Temperature as a limiting factor Homeotherms, poikilotherms, thermal adaptations - meeting extremes of temperature Dormancy, hibernation, aestivation, torpidity, diapause, composition - light on land and water. Biological effects of light on aquatic and terrestrial organisms. Light as a limiting factor. Reproduction, Metamorphosis, pigmentation, vision, photokinesis phototropism, photoperiodism, migration. Ecological effects on photosynthesis, Pressure, Gravity. Moisture and humidity.

4 **Atmospheric Gases:** Oxygen, Carbondioxide.Limiting factors – Leibig's law of Minimum - Shelfords law of Tolerance. Biogeochemical cycles - Gaseous cycle: Oxygen, carbon, nitrogen cycles. Sedimentary cycle: Sulphur, phosphorus.

5 **Biotic Factors:** Intra specific and interspecific associations, Aggregation colony formation, socal organization, competition, parasitism, autibiosrs commensalisms, mutualism, neutralism nterspecific competition: Competative principle or Gause's principle.

6 **Ecosystem:** Structure and function of ecosystem. - Concepts, components, structure, relationship between habitat and ecological niche - Autotrophic and heterotrophic producer, consumer - trophic level - energy flow in an ecosystem - food chain - food web - pyramids - ecological efficiencies - primary productivity - methods of measurements.

7 **Stages of Decomposition and Benefits:** Ecotypes. Homeostasis of ecosystem. Terrestrial habitat: Biomes - characters tundra, grass land, forest (coniferous, tropical, temperate, deciduous). Deserts - fauna, adaptations of animals inhabiting deserts and caves. 'Types of forests in India.

8 **Fresh water habitat:**Physico-chemical nature of fresh water - biotic communities - lentic-lakes (Oligotrophic and Eutrophic) - ponds - biotic communities of ponds, swamps, lotic - river, streams.

9 **Marine ecology :**Characteristics salinity temperature - pressure, zonation and stratification - chemical properties - biotic communities of pelagic and benthic zone, intertidal zone (rocky shore, sandy shore and muddy shore) sublittoral zone, coral reefs as a specialized oceanic ecosystem

10 **Population Ecology:**Population: definition - Characteristics - Density: measurements of density, natality, mortality, survivorship curve, age distribution age pyramids - population growth forms, concept of carrying capacity.

11 **Population fluctuations**: Seasonal and annual population equilibrium - biotic potential - population dispersal - regulation of population density: density dependent factors, reproduction, predation, emigration, disease, social behaviours, ecotone and edge effect - ecological succession and community evolution, classification of community.

12 **Applied Ecology:**Pollution: Origin - pollution as the limiting factor for man - pollutants - Degradable & Non-degradable air, water, land, noise, thermal radiation, radioactive radiation), green house effect, global warming, acid rain. Air pollution: Source - methods of detection and measurements of air pollution.

13 **Water pollution and Land pollution;**kinds and sources of water pollution - ecology of water pollution - sewage - industrial - thermal - silt-pollution - estuarine - economic - leather tannery - strategy for waste water management and control. Land degradation, radiation, soil erosion, desertification - causes, hazards and control Solid waste - Garbage Management.

14 **Conservation - Wild life management**: preservation - laws enforced - sanctuaries, national parks. Natural resources management: renewable - forest, fishes and crops, nonrenewable - fossil fuels, metals and minerals.

15 **Environmental Issues:** Environmental degradation - deforestation - urbanization - population explosion and other environmental hazards - depleting natural resources and relationship between poverty and environmental degradation and vice versa - competition, man's thoughtless exploitation of natural resources - Hiroshima and Nagasaki - Bhopal tragedy - Gulf war - oil pollution. Pnnciples of Environmental Impact Assessment and Environmental Monitoring and Auditing. Environmental ethics and laws - Earth summits - Role of Governmental & Non-Governmental agencies for environmental monitoring.

Duration : 3Hrs. **ZO-303** **Marks (Max. 100, Min. 35)**

APPLIED ZOLOGY

Unit 1: Introduction and Scope of Applied Zoology: Commercial Value of Animals**,** Pisciculturea**,** Pharmaceuticals from Animals**,** Biogas and Its Production

Unit 2: Applied Zoology and Associated Industries: Brief account of Sericulture Apiculture and Lac-culture**,** Poultry Industry**,** Dairy Industry

Unit 3: Edible Species of Aquatic Invertebrates: Prawn, Lobsters, Mollusks and Crabs, Shell Fish Farming, Pearl Oyster Culture

Unit 4: Edible Species of Fishes: Fish Culture, Sources of Fish Seeds, Types of Culture Practices, Selection of Species, Indian and Exotic Cultivable Species

Unit 5: Layout of a Typical Fish Pond: Types of Fish Ponds, Management Techniques, Supplementary and Artificial Feeding

Unit 6: Sericulture, Apiculture, Lac-culture, Verrniculture: Diseases Associated with Various Cultures, Advances in Insect Based Industries in India, Meat Leather and Wool Industries and Their Production

Unit 7: Poultry Farming and Commercial Breeds in India: Poultry Diseases, Egg Industry (Eggery) and Present Status, Dairy Farming in India, Breeds of Cattle and Buffalo, Milk Production and its Pasteurization Techniques

Unit 8: Animal Waste Recycling: Biogas and its Production, Types of Biogas Plants, Slaughter House Wastes and Their Utilization, Fish by-Products, Fish Meal

Unit 9: Fish Technology: 'FishForPharma' as a Model for Infectious Diseases, Genetic Improvements in Aquaculture Industry, Transportation of Fish Seed, Induced Reproduction in Fish

Unit 10: Reproductive Health and Human Welfare: Implantation and Placental Physiology in Pregnancy**,** Health and Diseases during Pregnancy**,** Infertility and Reproductive Technology**,** Gender Selection (Sex Selection)

Unit 11: Human Diseases: Epidemiology of Infectious Diseases, Prevention and Control of Diseases, Tuberculosis of Human Diseases, Liver Cirrhosis

Unit 12: Animal Husbandry: Semen Collection of Animal Husbandry, Preservation and Artificial Insemination in Cattle, Synchronization of Estrus in Cattle

Unit 13: Applied Entomology: Termite Society of Insects, Morphological Differences between Different Castes, Reproductive's of Insects, Types of Termites

Unit 14: Bionomics and Control of Crop Pests: Insect Pest Management for Stored Grain, Pectinophora Gossypiella, Corcyra Cephalonica, Trogoderma Granarium, Callosobruchus Chinensis

Unit 15: Insect Control: Classification of Insect Control, Organophosphate Insecticides, Integrated Pest Management for the Home Garden

SYLLABUS 2015-16
B.Sc.-II YEAR

Duration : 3Hrs. **ZO-304** **Marks (Max. 50, Min. 17)**

Practical Zoology

SYLLABUS 2015-16
B.Sc.-III YEAR

Duration : 3Hrs. **MT-301** **Marks (Max. 100, Min. 35)**

ALGEBRA

1. Theory of Equations : Polynomials in one variable and the division algorithm. Relations between the roots and the coefficients. Transformation of equations. Descartes rule of signs. Solution of cubic and biquadratic (quartic) equations.

2. Matrix Addition and Multiplication : Diagonal, permutation, triangular, and symmetric matrices. Rectangular matrices and column vectors. Non-singular transformations. Inverse of a Matrix. Rank-nullity theorem. Equivalence of row and column ranks. Elementary matrices and elementary operations. Equivalence and canonical form. Determinants. Eigenvalues, eigenvectors, and the characteristic equation of a matrix. Cayley-Hamilton theorem and its use in finding the inverse of a matrix.

3. Matrix Theory and Linear Algebra : Matrix Theory and Linear Algebra in R". Systems of linear equations, Gauss elimination, and consistency. Subspaces of R", linear dependence, and dimension. Matrices, elementary row operations, row-equivalence, and row space.

4. Linear Equations as Matrix Equations : Systems of linear equations as matrix equations, and the invariance of its solution set under row-equivalence. Row-reduced matrices, row-reduced echelon matrices, row-rank, and using these as tests for linear dependence. The dimension of the solution space of a system of independent homogeneous linear equations.Linear transformations and matrix representation.

5. Modern Algebra : Commutative rings, integral domains, and their elementary properties. Ordered integral domain: The integers and the well-ordering property of positive elements. Finite induction. Divisibility, the division algorithm, primes, GCDs, and the Euclidean algorithm.

6. The Fundamental Theorem of Arithmetic : Congruence modulo n and residue classes. The rings Z,, and their properties. Units in Zn, and Zp for prime p. Subrings and ideals. Characteristic of a ring. Fields.Sets, relations, and mappings. Bijective, injective, and surjective maps. Composition and restriction of maps. Direct and inverse images and their properties. Finite, infinite, countable, uncountable sets, and cardinality.

7. Equivalence Relations and Partitions : Ordering relations. Definition of a group, with examples and simple properties. Groups of transformations. Subgroups. Generation of groups and cyclic groups. Various subgroups of GL2(R). Coset decomposition. Lagrange's theorem and its consequences. Fermat's and Euler's theorems. Permutation groups. Even and odd permutations. The alternating groups An.

8. Isomorphism and Homomorphism : Normal subgroups. Quotient groups.First homomorphism theorem. Cayley's theorem.Trigonometry. De-Moivre's theorem and applications. Direct and inverse, circular and hyperbolic, functions. Logarithm of a complex quantity. Expansion of trigonometric functions.

9. Linear Algebra : Vector spaces over a field, subspaces. Sum and direct sum of subspaces. Linear span. Linear dependence and independence. Basis. Finite dimensional spaces. Existence theorem for bases in the finite dimensional case. Invariance of the number of vectors in a basis, dimension. Existence of complementary subspace of any subspace of a finite-dimensional vector space. Dimensions of sums of subspaces. Quotient space and its dimension.

10. Algebra of Linear Transformations : Matrices and linear transformations, change of basis and similarity. Algebra of linear transformations. The rank-nullity theorem. Change of basis. Dual space. Bidual space and natural isomorphism. Adjoints of linear transformations. Eigenvalues and eigenvectors. Determinants, characteristic and minimal polynomials,

11. Cayley-Hamilton Theorem : Cayley-Hamilton Theorem. Annihilators. Diagonalization and triangularization of operators. Invariant subspaces and decomposition of operators. Canonical forms. Inner product spaces. Cauchy-Schwartz inequality. Orthogonal vectors and orthogonal complements. Orthonormal sets and bases. Bessel's inequality. GramSchmidt orthogonalization method. Hermitian, Self-Adjoint, Unitary, and Orthogonal transformation for complex and real spaces. Bilinear and Quadratic forms. The Spectral Theorem. The structure of orthogonal transformations in real Euclidean spaces. Applications to linear differential equations with constant coefficients.

12. Advanced Group Theory : Advanced Group Theory. Group automorphisms, inner automorphisms. Automorphism groups and their computations. Conjugacy relation. Normalizer. Counting principle and the class equation of a finite group. Center of a group. Free abelian groups. Structure theorem of finitely generated abelian groups.

13. Ring Theory : Rings and ring homomorphisms. Ideals and quotient rings. Prime and maximal ideals. The quotient field of an integral domain. Euclidean rings. Polynomial rings. Polynomials over Q and Eisenstein's criterion. Polynomial rings over arbitrary commutative rings. UFDs. If A is a UFD, then so is A[x\, x2,..., xn]

Duration : 3Hrs. **MT-302** **Marks (Max. 100, Min. 35)**

COMPLEX ANALYSIS

1. Complex Functions : The complex number system, Polar form of complex numbers, Square roots, Stereographic projection. Möbius transforms, Polynomials, rational functions and power series

2. Analytic Functions : Conformal mappings and analyticity, Analyticity of power series; elementary functions, Conformal mappings by elementary functions

3. Integration : Complex integration, Goursat's theorem, Local properties of analytic functions, A general form of Cauchy's integral theorem, Analyticity on the Riemann sphere

4. Singularities : Singular points, Laurent expansions and the residue theorem, Residue calculus, The argument principle

5. Harmonic functions : Fundamental properties Dirichlet's problem

6. Entire functions : Sequences of analytic functions, Inûnite products, Canonical products, Partial fractions. Hadamard's theorem

7. The Riemann mapping theorem

8. The Gamma function : Complex Numbers and the Complex Plane, Complex Numbers and Their Properties, Complex Plane, Polar Form of Complex Numbers, Powers and Roots, Sets of Points in the Complex Plane, Applications

9. Complex Functions and Mappings : Complex Functions, Complex Functions as Mappings, Linear Mappings, Special Power Functions, The Power Function z^n, The Power Function $z^{1/n}$, Reciprocal Function, Limits and Continuity, Limits, Continuity, Applications

10. **Analytic Functions :** Diûerentiability and Analyticity, Cauchy-Riemann Equations, HarmonicFunctions, Applications,

11. Elementary Functions : Exponential and Logarithmic Functions, Complex Exponential Function, Complex Logarithmic Function, Complex Powers, Trigonometric and Hyperbolic Functions, Complex Trigonometric Functions, Complex Hyperbolic Functions, Inverse Trigonometric and Hyperbolic Functions, Applications

12. Integration in the Complex Plane : Real Integrals, Complex Integrals, Cauchy-Goursat Theorem, Independence of Path, Cauchy's Integral Formulas and Their Consequences, Cauchy's Two Integral Formulas, Some Consequences of the Integral Formulas, Applications

13. Laurent Series : Zeros and Poles, Residues and Residue Theorem, Some Consequences of the Residue Theorem, Evaluation of Real Trigonometric Integrals, Evaluation of Real Improper Integrals, Integration along a Branch Cut, The Argument Principle and Rouch´e's Theorem, Summing Inûnite Series, Applications

14. Conformal Mappings : Conformal Mapping, Linear Fractional Transformations, Schwarz-Christoûel Transformations, Poisson Integral Formulas, Applications, Boundary-Value Problems, Fluid Flow

15. Conformal Mappings : Conformal Mapping, Linear Fractional Transformations, Schwarz-Christoûel Transformations, Poisson Integral Formulas, Applications, Boundary-Value Problems, Fluid Flow

Duration : 3Hrs. **MT-303** **Marks (Max. 100, Min. 35)**

MECHANICS

1 Particle Kinematics: Introduction, Single Particle Kinematics, Motion in configuration space., Conserved Quantities, Systems of Particles., External and internal forces, Constraints, Generalized, Coordinates for Unconstrained Systems, Kinetic energy in generalized coordinates., Phase Space, Dynamical Systems, Phase Space Flows

2 Lagrange's and Hamilton's Equations : Lagrangian Mechanics, Derivation for unconstrained systems, Lagrangian for Constrained Systems, Hamilton's Principle, Examples of functional variation, Conserved Quantities, Hamilton's Equations, Velocity-dependent forces

3. Two Body Central Forces: Reduction to a one dimensional problem, Reduction to a one-body problem, Reduction to one dimension, Integrating the motion, The Kepler problem, Nearly Circular Orbits, The Laplace-Runge-Lenz Vector, The virial theorem, Rutherford Scattering

4. Rigid Body Motion : Configuration space for a rigid body, Orthogonal Transformations, Groups Kinematics in a rotating coordinate system, The moment of inertia tensor, Motion about axed point More General Motion, Dynamics, Euler's Equations, Euler angles, The symmetric top

5 Small Oscillations: Small oscillations about stable equilibrium, Molecular Vibrations, An Alternative Approach, Other interactions, String dynamics, Field theory

6. Hamilton's Equations : Legendre transforms, Variations on phase curves, Canonical transformations Poisson Brackets, Higher Deferential Forms, The natural simplistic 2-form, Generating Functions Hamilton {Jacobi Theory, Action-Angle Variables

7. Perturbation Theory : Integrable systems, Canonical Perturbation Theory, Time Dependent, Perturbation Theory, Adiabatic Invariants, Introduction, For a time-independent Hamiltonian, Slow time, variation in H (q; p; t), Systems with Many Degrees of Freedom, Formal Perturbative Treatment,Rapidly Varying Perturbations, New approach

8. Field Theory: Noether's Theorem

9. Elements of Continuum Mechanics: Deformable body. Idea of a continuum (continuous medium). Surface forces or contact forces. Stress at point in a continuous medium, stress vector, components of stress (normal stress and shear stress) in rectangular Cartesian co-ordinate system; stress matrix. Definition of ideal fluid and viscous fluid.

10 The Properties of Matter in Bulk : What is Statistical Mechanics About, Outline of Book, Fluid Statics, Phase Diagrams, Additional Problem

11. Principles of Statistical Mechanics: Microscopic Description of a Classical System, Macroscopic Description of a Large Equilibrium System,Fundamental Assumption, Statistical Definition of Entropy, Entropy of a Monatomic Ideal Gas .Qualitative Features of Entropy Using Entropy to Find (Define) Temperature and Pressure Additional Problems

12. Thermodynamics: Heat and Work, Heat Engines, Thermodynamic Quantities, Multivariate Calculus, The Thermodynamic Dance, Non-fluid Systems, Thermodynamics Applied to Fluids Thermodynamics Applied to Phase Transitions, Thermodynamics Applied to Chemical Reactions Thermodynamics Applied to Light, Additional Problems

13. Ensembles : The Canonical Ensemble, Meaning of the Term \Ensemble", Classical Monatomic Ideal Gas, Energy Dispersion in the Canonical Ensemble, Temperature as a Control Variable for Energy (Canonical Ensemble), The Equivalence of Canonical and Microcanonical Ensembles, The Grand Canonical Ensemble, The Grand Canonical Ensemble in the Thermodynamic Limit

14. Harmonic Lattice Vibrations: The Problem, Statistical Mechanics of the Problem, Normal Modes for a One-dimensional Chain, Normal Modes in Three Dimensions, Low-temperature Heat Capacity, More Realistic Models, What is a Phonon?, Additional Problems

15. Strongly Interacting Systems and Phase Transitions: Introduction to Magnetic Systems and Models, Free Energy of the One-Dimensional Ising Model, The Mean-Field Approximation,Correlation Functions in the Ising Model, Computer Simulation, Additional Problems