Progressive Education Society's

Modern College of Arts, Science and Commerce,

Shivajinagar, Pune 5

(An Autonomous College Affiliated to Savitribai Phule Pune University)

Detailed Syllabus

For B.Sc. (Chemistry)

(2019-20 Course)

(with effect from 2019-20)

CIA: Continuous Internal Evaluation

Semester 1 (First Year)

Course Type	Course Code	Course / Paper Title	Hours / Week	Credit	CIA	End Sem Exam	Total
CCT-1	19ScCheU101	Physical and Inorganic Chemistry-I	3	2	40	60	100
CCT-2	19ScCheU102	Organic and Inorganic Chemistry-I	3	2	40	60	100
CCP-1	19ScCheU103	Chemistry Practical course-I	4	2	40	60	100
Total				**6**	**120**	**180**	**300**
SECT-1	19CsAniU104	Physical Education – I	2	0.5	20	30	50

Semester 2 (First Year)

Course Type	Course Code	Course / Paper Title	Hours / Week	Credit	CIA	End Sem Exam	Total
CCT-3	19ScCheU201	Physical and Inorganic Chemistry-II	3	2	40	60	100
CCT-4	19ScCheU202	Organic and Inorganic Chemistry-II	3	2	40	60	100
CCP-2	19ScCheU203	Chemistry Practical course-II	4	2	40	60	100
Total				**6**	**120**	**180**	**300**
SECT-2	19CsAniU203	Physical Education – II	2	0.5	20	30	50

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First Year of B.Sc. (Animation) (2019 Course)

Course Code: 19ScCheU101

Course Name: Physical and Inorganic Chemistry-I

Teaching Scheme: TH: 3 Hours/Week **Credit: 02**

Examination Scheme: CIA: 40 Marks **End-Sem: 60 Marks**

Course Content

Chapter 1	**Chemical Mathematics (6 Lectures)**
	• Functions and variables: variables as function, variables used in chemistry • Derivative: Rules of differentiation, examples on derivatives of algebraic, logarithmic and exponential functions, partial differentiation, conditions for maxima and minima, problems related to chemistry • Integration: Rules of integration (algebraic, exponential and logarithmic functions), integration-definite and indefinite, problems related to chemistry • Graph: Plotting graphs of linear, exponential and logarithmic functions and their characteristics, sketching of s and p orbitals
Chapter 2	**States of Matter (10 Lectures)**
	• Introduction**:** States of matter and their properties • Gaseous states: Significance of ideal and kinetic gas equation (without derivation), real gases-compressibility factor, Van der Waal's equation of state, isotherms of CO_2, critical constants, correlation between critical constants and Van der Waal's constants, Maxwell-Boltzmann distribution law • Liquid state**:** Properties of liquids, comparison between gaseous and solid state-experimental determination of vapor pressure by isoteniscopic method and viscosity by Ostwald method, liquid crystals and their applications
Chapter 3	**Surface Chemistry (8 Lectures)**
	• Adsorption: Types of adsorption, adsorption isotherms, Freundlich isotherm, Langmuir isotherm, adsorption of gases on solids, adsorption of solutes on solids, applications of adsorption • Catalysis: Phenomena of catalysis, types of catalysis-homogeneous and heterogeneous catalysis, gaseous reactions on solid surfaces • Colloids: Definition and classification, preparation of emulsions,

	gels and sols, properties of suspensions
Chapter 4	**Mole Concept and Stoichiometry (6 Lectures)**
	• Mole concept • Mass-Mole conversions: Mole and gram atomic mass, mole and gram molecular mass, mole concept as applied to ionic compounds, mole in terms of volume, numerical based on above topics • Concentration of solution and methods of expressing concentration of solution: ppm and ppb, % w/w, % w/v, % v/v, strength in grams per liter, mass percent, molarity, molality, mole fraction, normality, specific gravity and weight % • Preparation of standard solutions of acids and bases • Standard solution: Primary standard substances, secondary standard solutions • Normality and its relation with molarity in acids and bases
Chapter 5	**Oxidation and Reduction (5 Lectures)**
	• Introduction and essential terms • Valency and oxidation number • Rules to find out oxidation number • Balancing of redox reactions: Ion exchange method, oxidation number method • Equivalent weight: Equivalent weight of oxidant and reductant • Preparation of normal solutions of oxidant and reductant
Chapter 6	**Experience Based Learning (1 Lecture)**

References Books:

1. Physical Chemistry - P.W. Atkins ELBS, 5th edition.
2. Principles of Physical Chemistry - S. H. Maronand, C. F. Prutton, 4th edition.
3. Physical Chemistry - S. Glasstone.
4. Physical Chemistry - SilbeyAlberty, Bawendi, Wiley India.
5. Quantum Chemistry - I. Levine, 5th edition, Prentice Hall, 1999.
6. Essentials of Physical Chemistry - Bahl, Tuli., S. Chand and Company Ltd.
7. Physical Chemistry of Surfaces - A. W. Adamson, John Wiley and Sons, 5th edition.
8. Mathematical preparation of Physical Chemistry - F. Daniel, Mc Graw Hill
9. Wiley's J.D. Lee Concise Inorganic Chemistry for JEE (Main & Advanced), 4th edition, 2018.

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First Year of B.Sc. (Animation) (2019 Course)

Course Code: 19ScCheU102
Course Name: Organic and Inorganic Chemistry-I

Teaching Scheme: TH: 3 Hours/Week **Credit: 02**

Examination Scheme: CIA: 40 Marks **End-Sem: 60 Marks**

Course Content

Chapter 1	**Chemical Bonding, structure and reactivity of Organic Molecules (10 Lectures)**
	• Covalent bond, hybridization - sp, sp^2 and sp^3 hybridization, bond length, bond angle, bond energy, intermolecular and intramolecular forces and their effects • Drawing organic molecules, zig-zag structures, Lewis structure and formal charge • Arrow pushing concept, structural effects - inductive effect, steric effect, resonance effect, hyper-conjugation, tautomerism, applications of structural effects - strength of acids and bases, $pK_a$and pK_b values of common organic acids and bases
Chapter 2	**Chemistry of Hydrocarbons (14 Lectures)**
	• Introduction of petrochemicals • Alkanes - Introduction, nomenclature, physical properties, preparations, reactions of alkanes, analysis of alkanes • Alkenes - Introduction, higher alkenes, nomenclature, physical properties, preparations, reactions of alkenes, analysis of alkenes • Dienes - Structure & properties, conjugated dienes, reactions of dienes, analysis of dienes • Alkynes: Introduction, nomenclature, physical properties, preparation, reactions & analysis of alkynes • Introduction to homocyclic and polycyclic aromatic hydrocarbons (benzene, naphthalene, anthracene), Huckel's rule of aromaticity, reactions of benzene, naphthalene and anthracene - sulphonation, nitration, halogenation, Friedel Craft reactions • Amines: Introduction, nomenclature, physical properties, general methods for preparation, chemical reactions, analysis of amines • Phenols: Introduction, nomenclature, physical properties, general methods for preparation, chemical reactions, analysis of phenols
Chapter3	**Chemistry of S-block elements (11 Lectures)**
	• Recapitulation of periodic table: Quantum numbers, Pauli's exclusion Principle, Aufbau Principle, Hund's rule of maximum multiplicity, electronic configuration

	• *S*-block elements-Group IA (Alkali metals) : Electronic configuration, occurrence, extraction of metals, trends in family: size, oxidation state, ionization potential, standard electrode potential, reactivity, solutions of alkali metal in NH_3, diagonal relationship between Li and Mg, compounds of alkali metals, organometallic compounds, oxygen compounds (monooxide, peroxide, and superoxide), crown ethers, applications (biological, industrial and agricultural) • Group IIA: Alkaline earth metals: Electron configuration, occurrence, extraction • Trends in family: Size, oxidation state, ionization energy, reactivity • Anomalous behavior of Be, Diagonal relationship between Be and Al • Compounds of alkaline earth metals: Oxide and hydroxide, peroxides and superoxides of alkali metals
Chapter4	**Experience Based Learning (1 Lecture)**

Reference Books:

1. Organic Chemistry-Clayden, Oxford Uni. Press.
2. Organic Chemistry-Morrison and Boyd, 6th Edition.
3. A guide book to Mechanism in Organic Chemistry-Peter Syke, 6th Edition.
4. Stereochemistry of Organic Compounds-Eliel Tata Mc Graw Hill, 1989
5. Principles of Physical Chemistry - S.H. Marron & C.F. Pruton, 4th Edition.
6. Concise Inorganic Chemistry-J.D. Lee, 2nd Edition.
7. Concept & model of Inorganic Chemistry-Douglas Mc Doniels, 3rd Edition.
8. New guide to Modern Valance Theory-G.I. Brown, 3rd Edition.
9. Inorganic Chemistry-James Hughey.
10. General Chemistry - Raymand Chang.
11. Wiley's J.D. Lee Concise Inorganic Chemistry for JEE (Main & Advanced), 4thEdition, 2018.

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First Year of B.Sc. (Animation) (2019 Course)

Course Code: 19ScCheU103

Course Name: Physical and Inorganic Chemistry Practical

Teaching Scheme: TH: 3 Hours/Week **Credit: 02**

Examination Scheme: CIA: 40 Marks **End-Sem: 60 Marks**

Course Content

Physical Chemistry Experiments: (Any 6 Expt.)	
1.	Introduction to the apparatus in chemistry laboratory and to sketch the polar plots of 's' and 'p' orbitals.
2.	Todeterminethe gasconstant 'R' indifferentunitsbyeudiometric method.
3.	To plot the graph of following functions using excel. a) Exponential function b) logarithmic function c) linear function
4.	Todetermine ΔH and ΔS for the following chemical reactions. $Zn_{(s)} + CuSO_4 \rightarrow Cu_{(s)} + ZnSO_{4(aq)}$
5.	To determine the pH of given solutions by using pH metry.
6.	Preparations of stable emulsions using a suitable emulsifying agent.
7.	To test the validity of 'Freundlich and Langmuir adsorption isotherms' by charcoal adsorption method.
8.	To determine relative viscosity of given organic liquids by viscometer.
Inorganic Chemistry Experiments: (3 Expt.)	
9.	Theory of Inorganic Qualitative Analysis.(Up to group detection and acidic radicals)
10.	Three Inorganic qualitative analyses without phosphate and borate removal.
	i. Mixture-1 (water soluble)
	ii. Mixture-2 (water insoluble)
	iii. Mixture-3 (water insoluble)
11.	**Laboratory Safety - I (Additional)**

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First Year of B.Sc. (Animation) (2019 Course)

Course Code: 19ScCheU201

Course Name: Physical and Inorganic Chemistry-II

Teaching Scheme: TH: 3 Hours/Week **Credit: 02**

Examination Scheme: CIA: 40 Marks **End-Sem: 60 Marks**

Course Content

Chapter 1	**Atomic Structure (12 Lectures)**
	• Introduction • Atomic spectrum of hydrogen • Bohr model of hydrogen atom, derivation of atomic radius and energy, energy level diagram of hydrogen atom • Failure of classical mechanics-black body radiation, photoelectric effect, electron diffraction, atomic spectra, quantization of energy, de Broglie's hypothesis, Heisenberg's uncertainty principle (without proof) • Wave equation, time independent Schrödinger equation, hydrogen atom (expressions only) wave functions for 's' and 'p' atomic orbitals
Chapter 2	**Chemical Thermodynamics (12 Lectures)**
	• Introduction • First law of thermodynamics and its limitations • Carnot cycle and efficiency • Entropy and second law of thermodynamics, • Entropyasastatefunction • Entropychangein isolated system, reversible and irreversible process • Entropy change in ideal gases-isothermal,isobaric,isochoricprocesses • Entropychangeinphysicaltransitions • Entropy changeinchemicalreactions • Statistical definition of entropy, absolute entropy, third law of thermodynamics
Chapter 3	**Chemical Bonding and Structures (6 Lectures)**
	• Types of bond: Ionic, covalent, coordinateand metallic bonds • Octet rule and limitations

	• Valence bond theory • Concept of atomic orbital overlap and bond formation • Formation of Sigma (σ) and Pi (π) bonds • Distinguish between Sigma (σ) and Pi (π) bonds • Bonding in molecule using pure ‘s’ and ‘p’ orbitals (s-s, p-pand s-p)
Chapter 4	**Concept of Hybridization (2 Lectures)**
	• Need of hybridization • Definition of hybridization • sp, sp^2, sp^3hybridisation and recapitulation • Hybridisation using d-orbitals with examples: dsp^2, dsp^3, and sp^3d, sp^3d^2, d^2sp^3, sp^3d^3
Chapter 5	**VSEPR (3 Lectures)**
	• Assumptions of VSEPR theory • Bonding and shapes of irregular molecules ClF_3, BrF_3, Cl_2O, BrF_5, $TeCl_4$, XeO_3, $XeOF_4$, $BeCl_2$, BX_3, NO_3^- • Limitations of VSEPR theory
Chapter 6	**Experience Based Learning (1 Lecture)**

References Books:

1. Physical Chemistry - P.W. Atkins ELBS, 5th edition.
2. Principles of Physical Chemistry - S. H. Maronand, C. F. Prutton, 4th edition.
3. Physical Chemistry - S. Glasstone.
4. Physical Chemistry - SilbeyAlberty, Bawendi, Wiley India.
5. Quantum Chemistry - I. Levine, 5th edition, Prentice Hall, 1999.
6. Essentials of Physical Chemistry - Bahl, Tuli., S. Chand and Company Ltd.
7. Physical Chemistry of Surfaces - A. W. Adamson, John Wiley and Sons, 5th edition.
8. Mathematical preparation of Physical Chemistry - F. Daniel, Mc Graw Hill
9. Wiley's J.D. Lee Concise Inorganic Chemistry for JEE (Main & Advanced), 4th edition, 2018.

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First Year of B.Sc. (Animation) (2019 Course)

Course Code: 19ScCheU202

Course Name: Organic and Inorganic Chemistry-I

Teaching Scheme: TH: 3 Hours/Week **Credit: 02**

Examination Scheme: CIA: 40 Marks **End-Sem: 60 Marks**

Course Content

Chapter 1	**Chemistry of functional groups (10 Lectures)**
	• Alkyl halides: Introduction, nomenclature, physical properties, general methods for preparation, chemical reactions, analysis of alkyl halides • Alcohols: Introduction, nomenclature, physical properties, general methods for preparation, chemical reactions, analysis of alcohols • Ethers: Introduction, nomenclature, physical properties, general methods for preparation, chemical reactions, analysis of ethers • Aldehydes and ketones: Introduction, nomenclature, physical properties, general methods for preparation, chemical reactions, analysis of aldehydes and ketones • Carboxylic acids: Introduction, nomenclature, physical properties, general methods for preparation, chemical reactions, analysis of carboxylic acids
Chapter 2	**Stereochemistry (14 Lectures)**
	• Concept of isomerism, types of isomers, representation of organic molecules (projection formulae) • Conformational isomerism in alkanes (ethane, propane and n-butane) with energy profile diagrams • Geometrical isomerism-Definition, conditions for geometrical isomers, physical and chemical properties, E/Z nomenclature of geometrical isomers • Optical isomers-Isomer number and tetrahedral carbon atom, chirality, optical isomerism with one asymmetric carbon atom, specific rotation, enantiomerism, R/S nomenclature • Baeyer's strain theory, chair and boat conformations of cyclohexane, ring flipping, locking of conformation with example
Chapter 3	**Chemistry of P block elements (11 Lectures)**
	• Position of elements in periodic table • Electronic configuration of elements • Trends in properties: Atomic size, ionization potential, electronegativity, electron affinity, oxidation state, reactivity • Anomalous behavior of first member of each group • Structure and properties of: Borates, aluminum trichloride, allotrops of

	carbon (diamond, graphite, fullerene and graphene), classification of silicates, preparation, physical and chemical properties of NH_3 and sulphuric acid, oxide of phosphorous and sulfur, interhalogen compounds, oxyacids, strength of oxoacids • Industrial compounds of p block elements (NH_3, H_2SO_4, HNO_3)
Chapter 4	**Experience Based Learning (1 Lecture)**

Reference Books:

1. Organic Chemistry-Clayden, Oxford Uni. Press.
2. Organic Chemistry-Morrison and Boyd, 6th Edition.
3. A guide book to Mechanism in Organic Chemistry-Peter Syke, 6th Edition.
4. Stereochemistry of Organic Compounds-Eliel Tata Mc Graw Hill, 1989
5. Principles of Physical Chemistry - S.H. Marron & C.F. Pruton, 4th Edition.
6. Concise Inorganic Chemistry-J.D. Lee, 2nd Edition.
7. Concept & model of Inorganic Chemistry-Douglas Mc Doniels, 3rd Edition.
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First Year of B.Sc. (Animation) (2019 Course)

Course Code: 19ScCheU203

Course Name: Organic and Inorganic Chemistry Practical

Teaching Scheme: TH: 3 Hours/Week **Credit: 02**

Examination Scheme: CIA: 40 Marks **End-Sem: 60 Marks**

Course Content

Organic Chemistry Experiments: (7 Expt.)	
1.	**Purification Techniques (3 Expt.)** i) To purify given organic compound by recrystallization technique and to record the TLC, M.P. of crude and purified products. (**2 compounds**) ii) To purify given organic compound by distillation technique and to record the TLC, B.P. of crude and purified products. (**2 compounds**) iii) To purify given organic compound by sublimation technique and to record the TLC, B.P. of crude and purified products. (**2 compounds**)
2.	**Organic Estimations (Any 2 out of 3 Expt.)** i) Estimation of Vitamin C from Cetin tablet. ii) Estimation of Aspirin from APC tablet. iii) Estimation of Glucose from Glucon-D by $KBrO_3$.
3.	**Organic Qualitative Analysis (2 Expt.)** To determine type and physical constants of given '**three different organic compounds'** Nature of the compounds for each practical: i) Water soluble/Water miscible (**1 Compd.**) ii) Water insoluble/Water immiscible **(2 Compd.**)
Inorganic Chemistry Experiments (2 Expt.)	
4.	To standardize $KMnO_4$ soln. & hence find strength of the given solution.
5.	Estimation of total hardness of water by EDTA method.
6.	**Laboratory Safety - II (Additional)**