Rayat Shikshan Sanstha's

Karmaveer Bhaurao Patil College Vashi, Navi Mumbai
Autonomous College

[University of Mumbai]

Syllabus for Approval

Sr. No.	Heading	Particulars
1	Title of Course	F.Y.B.Sc. Chemistry
2	Eligibility for Admission	HSC of all recognized Board
3	Passing marks	40%
4	Ordinances/Regulations (if any)	
5	No. of Semesters	Two
6	Level	U.G.
7	Pattern	Semester
8	Status	New
9	To be implemented from Academic year	2018-2019

AC- / / 2018

Item No-

Rayat Shikshan Sanstha's
KARMAVEER BHAURAO PATIL COLLEGE, VASHI.
NAVI MUMBAI
(AUTONOMOUS COLLEGE)
Sector-15- A, Vashi, Navi Mumbai - 400 703

Syllabus for F.Y.B.Sc. Chemistry

Program: Chemistry

Course: F.Y.B.Sc. Chemistry

(Choice Based Credit, Grading and Semester System with effect from the academic year 2018-2019)

Preamble of the Syllabus:

Bachelor of Science (B.Sc.) in Chemistry is a under graduation course of Department of Chemistry, Karmaveer Bhaurao Patil College Vashi, Navi Mumbai. [Autonomous College]

The Choice Based Credit and Grading System to be implemented through this curriculum, would allow students to develop a strong footing in the fundamentals and specialize in the disciplines of his/her liking and abilities. The students pursuing this course would have to develop understanding of various aspects of the chemistry. The conceptual understanding, development of experimental skills, developing the aptitude for academic and professional skills, acquiring basic concepts and understanding of hyphenated techniques, understanding the fundamental Chemical processes and rationale towards application of chemical knowledge are among such important aspects.

Objectives of the Course:

• To acquaint students with the fundamental Organic, Inorganic, Physical & Analytical Chemistry

• To develop analytical skills and critical thinking through application of theory knowledge into practical course

• To construct and apply knowledge of chemistry, and appreciate the relationship between chemistry and other disciplines

• To enable students to understand chemistry and its Industrial and Social Context

Course Outcome: By the end of the course, a student should develop the ability:

• To understand, coherently and effectively about various genres of chemistry.

• To develop the understanding and interest in the field of chemistry

• To develop basic skills in practical chemistry and its industrial applications.

F. Y. B. Sc. Chemistry

For the subject of chemistry there shall be two papers for 60 lectures each comprising of three units of 20 L each.

Semester-I

1. Paper-I / II Unit-I — Physical and Analytical Chemistry.
2. Paper-I / II Unit-II — Inorganic Chemistry.
3. Paper- I / II Unit-III — Organic Chemistry.

Semester-II

1. Paper-I /II Unit-I — Physical and Analytical Chemistry
2. Paper-I / II Unit-II — Inorganic Chemistry.
3. Paper-I / II Unit-III — Organic Chemistry.

Scheme of Examination for Each Semester:

Continuous Internal Evaluation: 40 Marks (Common Written Test-20 Marks & 20 Marks For- Seminar, Assignment, Projects, Group discussion, Open book test, online test etc.)

Semester End Examination: 60 Marks will be as follows -

I.	**Theory:**		
	Each theory paper shall be of two and half hour duration.		
	All questions are compulsory and will have internal options.		
	Q – I	From Unit – I (having internal options.) 15 M	
	Q – II	From Unit – II (having internal options.) 15 M	
	Q – III	From Unit – III (having internal options.) 15 M	
	Q – IV	Questions from all the THREE Units with equal weightage of marks allotted to each Unit. 15 M	
II.	**Practical**	The External examination per practical course will be conducted as per the following scheme.	
Sr. No.	**Particulars of External Practical Examination**		**Marks%**
1	Laboratory Work		80
2	Journal		10
3	Viva		10
	TOTAL		**100**

Choice Based Credit Grading and Semester System (CBCGS)

F.Y.B. Sc. Chemistry Syllabus

To be implemented from the Academic year 2018-2019

SEMESTER I

Course Code	Unit	Topics	Credits	L / Week
UGCH101	I	Chemical Thermodynamics Chemical Mathematics Introduction to Analytical Chemistry	2	1
	II	Atomic structure, Periodic Table and periodicity Solid State Chemistry		1
	III	Classification and Nomenclature of Organic Compounds Bonding and Structure of organic compounds Fundamentals of organic reaction mechanism		1
UGCH102	I	Chemical Kinetics Liquid state Errors in Quantitative Analysis	2	1
	II	Comparative chemistry of Main Group Elements Catalysis Concept of hybridization		1
	III	Stereochemistry I		1
UGCHP1		Chemistry Practical	2	6

Note: Blue Highlighted Topic / Course has focus on employability/ entrepreneurship/skill development

Semester I

Course Code: UGCH101

Paper I , Unit-I

Chemical Mathematics -Introduction to Analytical Chemistry

Learning objectives:

1. To understand mole concept, concentration calculations and stoichiometric relations.
2. To apply inter – conversions to relate various concentration units.
3. To differentiate between primary and secondary standards. To understand the basic concepts involved in qualitative analysis and solve the numerical problems based on these concepts.
4. To understand the fundamentals involved in various titrimetric analysis
5. To study and understand the tenets of thermodynamics pertaining to First and Second Laws of thermodynamics. Significance and mathematical definition of entropy.
6. To understand limitation of Second Law/ Necessity to introduce work functions A and G.
7. To correlate free energy change and spontaneity of a process.
8. To understand and be able to elucidate the difference between molecular and atomic spectra and understand various types of spectroscopy.
9. To reinforce the basics of Inorganic Chemistry with special reference to atomic structure, periodic table and periodicity of properties.
10. To study the trends of properties of the 'p' block elements. to understand Group 18 elements. Basic structure of matter, predict type of structure. various types of lattices
11. Classification and Nomenclature of Organic Compounds To correctly name an organic compound using IUPAC nomenclature and to accurately represent an organic compound given IUPAC name.
12. To introduce mechanism of organic reactions and to learn to classify reaction types and intermediates. To investigate nucleophilic substitution as well as elimination reactions in detail including a comparative analysis.
13. Bonding and Structure of organic compounds: Fundamentals of organic reaction mechanism:

1.1 Chemical Thermodynamics: (10L)

Thermodynamic terms: System, surrounding, boundaries, open, closed and isolated system, intensive and extensive properties, state functions and path functions, zeroth law of thermodynamics

First law of thermodynamics: concept of heat (q), work (w), internal energy (U), statement of first law, enthalpy, relation between heat capacities, sign conventions, calculations of heat (q), work (w), internal energy (U), and enthalpy (H) (Numericals expected)

Thermochemistry: Heats of reactions, standard states, enthalpy of formation of molecules, enthalpy of combustion and its applications,

1.2 Chemical Mathematics: (6L)

Basic rules of differentiation and partial differentiation, Integration

Expressing concentration of solutions: Normality, molality, molarity, formality, mole fractions, weight ratio, volume ratio, weight to volume ratio, ppm, ppb, millimoles, milliequivalents (Numerical expected), Introduction to Basic Logarithms

Graphical representation of equations: Rules for drawing graph co-ordinates etc., Equation of straight line, slope and intercept, plotting the graph from the data of chemical properties and problems.

1.3 Introduction to Analytical Chemistry (4L)

Importance of analytical chemistry, classification of analytical methods, applications of analytical methods in various fields such as organic, pharmaceutical, metallurgical, electronic industries and environmental analysis.

Unit II

2.1 Atomic structure: (6L)

***(No derivations** of the mathematical equations required)*

a) Historical perspectives of the atomic structure; Rutherford's Atomic Model, Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Structure of hydrogen atom.

b) Hydrogenic atoms:

1. Simple principles of quantum mechanics;
2. Atomic orbitals
    i) Shells, subshells and orbitals ii) Electron spin iii) Radial shapes of orbitals
3. Many Electron Atoms
    i) Penetration and shielding ii) Effective nuclear charge
4. Aufbau principle, Pauli Exclusion Principle. Hund's Rule

2.2: Periodic Table and periodicity: (8L)

Long form of Periodic Table; Classification for elements as main group, transition and inner transition elements; Periodicity in the following properties: Atomic and ionic size; electron gain enthalpy; ionization enthalpy, effective nuclear charge (Slater's rule);

Electronegativity; Pauling and Mulliken electronegativity (Numerical problems expected, wherever applicable.)

2.3 Solid State Chemistry (6L)

Types of solids, crystal lattice, lattice points, unit cell, space lattice and lattice plane, laws of crystallography: Law of constancy of interfacial angle, law of symmetry and law of rational indices (Numerical expected)

Unit III

3.1 Classification and Nomenclature of Organic Compounds: (6L)

Review of basic rules of IUPAC nomenclature. Nomenclature of mono and bi-functional aliphatic compounds on the basis of priority order of the following classes of compounds: alkanes, alkenes, alkynes, haloalkanes, alcohols, ethers, aldehydes, ketones, carboxylic acids, carboxylic acid derivatives (acid halides, esters, anhydrides, amides), nitro compounds, nitriles and amines; including their cyclic analogues.

3.2 Bonding and Structure of organic compounds: (6L)

Hybridization: sp^3, sp^2, sp hybridization of carbon and nitrogen; sp^3 and sp^2 hybridizations of oxygen in Organic compounds (alcohol, ether, aldehyde, ketone, carboxylic acid, ester, cyanide, amine and amide)

Overlap of atomic orbitals: Overlaps of atomic orbitals to form sigma and pi bonds, shapes of organic molecules.

3.3 Fundamentals of organic reaction mechanism: (8L)

Electronic Effects: Inductive, electrometric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strengths.

Bond fission: Electrophiles and Nucleophiles; Nucleophilicity and basicity;

Types (primary, secondary, tertiary, allyl, benzyl), shape and their relative stability of reactive intermediates: Carbocations, Carbanion and Free radicals, Carbenes and nitrenes.

Introduction to types of organic reactions: Addition, Elimination and Substitution reaction. Rearrangement reactions, Oxidation reaction Reduction reaction, Condensation reactions (With one example of each)

Semester I

Paper II

Unit I

Learning objectives:

1. Study different rate laws
2. Concept of order and molecularity with example
3. Numerical to determine rate constant and order of reaction
4. Determination of order of reaction by different methods
5. Study concept of surface tension with examples determination of surface tension by drop number method and Numerical
6. Basic concept of viscosity determination of viscosity by Ostwald viscometer Numerical Statistical analysis To understand the importance of accuracy, precision, errors and its sources, presentation of experimental data and significant figures. Involved.
7. To understand the statistical methods of representing experimental data. To understand basic logarithmic
8. To understand some characteristic properties of elements Comparative chemistry of Main Group Elements
9. Comparative chemistry of carbides, nitrides, oxides and hydroxides of group I and groupII elements
10. To understand the kinetics of various order reactions and apply these concepts to various categories of catalyzed reactions.
11. Definition, Steps involved in hybridization, Covalence of atoms in molecules, types involving s, p and d orbitals
12. To understand the concept of isomerism, and represent the structures of organic compounds Basic concept of stereochemistry Problems on assigning Stereodiscriptors.

1.1 Chemical Kinetics: (08L)

Rate of reaction, rate constant, measurement of reaction rates, order and molecularity of reaction, integrated rate equation of first and second order reactions (with equal initial concentration of reactants) (Numerical expected)

Determination of order of reaction by (a) Integration method (b) Graphical method

(c) Ostwald's isolation method (d) Half time method (Numerical expected)

1.2 Liquid State: (06L)

Surface tension: Introduction, methods of determination of surface tension by drop number method (Numerical expected)

Viscosity: Introduction, coefficient of viscosity, relative viscosity, specific viscosity, reduced viscosity, determination of viscosity by Ostwald viscometer (Numericals expected)

1.3 Statistical analysis (06L)

Introduction, Error, accuracy, precision, methods of expressing accuracy, precision, and classification of errors. Mean, median, range, standard deviation, Average deviation, variance significant figures (Numerical problems expected).

Unit-II

2.1 Comparative chemistry of Main Group Elements: (10L)

Metallic and non-metallic nature, oxidation states, electronegativity, anomalous behavior of second period elements, allotropy, catenation, diagonal relationship. Comparative chemistry of carbides, nitrides, oxides and hydroxides of group I and group II elements.

2.2 Catalysis: (5L)

Types, Characteristics, Catalytic poisoning, active centers, Mechanism of enzyme catalysis, organometallics and biocatalyst

2.3 Concept of hybridization : (5L)

Definition, Steps involved in hybridization, Covalency of atoms in molecules, types involving s, p and d orbitals.

Unit III

3. Stereochemistry: (20L)

3.1 Fischer Projection, Newman and Sawhorse Projection formulae (of erythro, threo isomers of tartaric acid and 2,3 dichlorobutane) and their interconversions;

3.2 Geometrical isomerism in alkene and cycloalkanes: cis–trans and syn-anti isomerism E/Z notations with C.I.P rules.

3.3 Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two similar and dissimilar chiral-centres, Distereoisomers, meso structures, racemic mixture and resolution (methods of resolution not expected). Relative and absolute configuration: D/L and R/S designations.

(Problems on assigning Stereodiscriptors)

Choice Based Credit Grading and Semester System (CBCGS)

F.Y.B. Sc. Chemistry Syllabus

To be implemented from the Academic year 2018-2019

SEMESTER II

Course Code	Unit	Topics	Credits	L / Week
UGCH101	I	Gaseous State Chemical Equilibria and Thermodynamic Parameters	2	1
	II	Concept of Qualitative Analysis Acid Base Theories Environmental pollution		1
	III	Formation of alkenes and alkynes by elimination reactions Reactions of alkenes Reactions of alkynes		1
UGCH102	I	Ionic Equilibria Molecular Spectroscopy Total quality management	2	1
	II	Chemical Bond and Reactivity Oxidation Reduction Chemistry		1
	III	Stereochemistry Aromatic Hydrocarbons		1
UGCHP1		Chemistry Practical	2	6

Note: 1. Blue Highlighted Topic / Course has focus on employability/ entrepreneurship/skill development
2. Yellow Highlighted Topic / Course is related to professional ethics, gender, human values, Environment & sustainability

Semester II

Course Code: UGCH201

Paper I, Unit-I

Learning objectives:

1. To study Ideal gas laws, kinetic theory of gases and numerical based on it.
2. Deviation from ideal gas laws various experiments and numerical
3. To understand basic concept of chemical equilibrium Chatelier's principle, factors affecting chemical equilibrium.
4. To study Statement of second law of thermodynamics, concepts of entropy and free energy other related concept and problem based on it.
5. To study concept of volumetric analysis and various terms involved in titrations
6. Basic concept based on volumetric analysis
7. To understand Concept of Qualitative Analysis with examples
8. To study various Acid Base Theories
9. Understand various titration curves with calculations
10. To study basic of Environmental pollution
11. Basic study of Alkenes and alkynes chemistry
12. Understandings of elimination and addition reactions in details with respect to the alkenes and alkynes

1.1 Gaseous State: (06L)

Ideal gas laws, kinetic theory of gases, ideal gases, real gases, compressibility factor, Boyle's temperature (Numericals expected)

Deviation from ideal gas laws, reasons for deviation from ideal gas laws, Van der Waals equation of state, Joule-Thomson effect: qualitative discussion and experimentation, inversion temperature. (Numericals expected)

1.2 Chemical Equilibria and Thermodynamic Parameters: (08L)

Reversible and irreversible reactions, law of mass action, dynamic equilibria, equilibrium constant, (K_c and K_p), relationship between K_c and K_p, Le Chatelier's principle, factors affecting chemical equilibrium (Numerical expected)

Statement of second law of thermodynamics, concepts of entropy and free energy, spontaneity and physical significance of free energy, thermodynamic derivation of equilibrium constant (Numericals expected)

1.3 Introduction to Volumetric Analysis (06L)

Introduction, terms involved in titration, Theory of Indicators, Primary and secondary standard solutions, Apparatus used and their calibration: burettes, micro burettes, volumetric pipettes, graduated pipettes, volumetric flask, methods of calibration

Unit II

2.1 Concept of Qualitative Analysis: (5L)

Precipitation equilibria, effect of common ions, uncommon ions, oxidation states, buffer action, complexing agents on precipitation of ionic compounds. (Balanced chemical equations and numerical problems expected.)

2.2 Acid Base Theories: (10L)

Arrhenius, Lowry- Bronsted, Lewis, Lux-Flood, Usanovich concept, Solvent – Solute concept of acids and bases, Hard and Soft acids and bases. Applications of HSAB. Applications of acid base chemistry in: i) Understanding organic reactions like Friedel Craft's (acylation/alkylation) Reaction
ii) Volumetric analysis with special reference to construction of titration curve involving strong acid and strong base.

2.3 Environmental pollution: (5L)

Introduction, Types of pollution, sources of air pollution, greenhouse effect, water pollution, important steps in water treatment, coagulation, sedimentation, filtration and disinfection.

Unit III

3.0 Chemistry of Alkenes and alkynes: (20L)

3.1 Formation of alkenes and alkynes by elimination reactions: Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.

3.2 Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition)

Mechanism of oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1, 2-and 1, 4-addition reactions in conjugated dienes

3.3 Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

Semester II

Paper II

Unit I

Learning objectives:

1. To study basic concept of ionic equilibrium and Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water, ionization of weak acids.
2. To understand chemistry of Buffers.
3. To understand and be able to elucidate the difference between molecular and atomic spectra and understand various types of spectroscopy.
4. Understand Total quality management, concept of quality, quality control, quality assurance, total quality management, ISO series, Good Laboratory Practices.
5. To study concept of Chemical Bond and Reactivity with different theories.
6. Study of Oxidation Reduction Chemistry with different example.
7. Study of redox titration with single and multi-electron systems.
8. To understand stereochemistry of Cycloalkanes and Conformational Analysis.
9. To understand basic concept of Aromaticity.
10. To study different reactions of benzene.

1.1 Ionic Equilibria: (7L)

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water, ionization of weak acids and bases, pH scale, common ion effect, dissociation constants of mono-, di- and triprotic acid (exact treatment for monoprotic acid)

Buffers: Introduction, types of buffers, derivation of Henderson equation for acidic and basic buffers, buffer action, buffer capacity (Numericals expected)

1.2 Molecular Spectroscopy: (08L)

Electromagnetic radiation, electromagnetic spectrum, Planck's equation, interaction of electromagnetic radiation with matter: Absorption, emission, scattering, fluorescence, electronic, vibrational and rotational transitions, Beer-Lambert's law, U.V. and visible spectroscopy, absorption spectroscopy, terms involved radiant power, absorbance, transmittance, percentage transmittance, wavelength of maximum absorbance (Numericals expected)

1.3 Total quality management (05)

Total quality management, concept of quality, quality control, quality assurance, total quality management, ISO series, Good Laboratory Practices (GLP).

Unit II

2.1: Chemical Bond and Reactivity: (10L)

Types of chemical bond, comparison between ionic and covalent bonds, polarizability (Fajan's Rule), shapes of molecules, Lewis dot structure, Sidgwick Powell Theory, basic VSEPR theory for ABn type molecules with and without lone pair of electrons, isoelectronic principles, applications and limitations of VSEPR theory.

2.2: Oxidation Reduction Chemistry: (10L)

a) Reduction potentials
b) Redox potentials: half reactions; balancing redox equations.
c) Redox stability in water: pH dependence of redox potentials.
d) Applications of redox chemistry
i) Extraction of elements: (example: isolation of copper by auto reduction)
ii) Redox reagents in Volumetric analysis: a) Iodimetric and Iodometric b) $KMnO_4$
iii) Titration curves: a) single electron systems (example Ce(IV) against Fe(II)); and b) Multi electron systems as in $KMnO_4$ against Fe(II))

Unit III

3.1 Stereochemistry: (10L)

Cycloalkanes and Conformational Analysis:

Conformation analysis of alkanes (ethane, propane and n-butane); Relative stability with energy diagrams.

Types of cycloalkanes and their relative stability, Baeyer strain theory,

Conformation analysis of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy.

3.2 Aromatic Hydrocarbons: (10L)

Aromaticity: Hückel's rule, anti-aromaticity, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples.

Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft alkylation and acylation with their mechanism.

Reference Books for Semester I and Semester II:

Unit I: (Physical Chemistry)

1. Atkins P.W. and Paula J.de, Atkin's Physical Chemistry, 10th Ed., Oxford University 12 Press (2014).
2. Ball D.W., Physical Chemistry, Thomson Press, India (2007).

3. Castellan G.W., Physical Chemistry, 4th Ed., Narosa (2004).
4. Mortimer R.G., Physical Chemistry, 3rd Ed., Elsevier: NOIDA, UP (2009).
5. Engel T. and Reid P., Physical Chemistry, 3rd Ed., Pearson (2013).
6. Peter A. and Paula J. de., Physical Chemistry, 10th Ed., Oxford University Press (2014).
7. McQuarrie D.A. and Simon J.D., Molecular Thermodynamics, Viva Books Pvt. Ltd.,New Delhi (2004).
8. Levine I.N., Physical Chemistry, 6th Ed., Tata Mc Graw Hill (2010).
9. Metz C.R., 2000 Solved Problems in Chemistry, Schaum Series (2006).
10. Mortimer R.G., Physical Chemistry, 3rd Ed., Elsevier: NOIDA, UP (2009).
11. Banwell C.N., Fundamentals of Molecular Spectroscopy, 4th Ed., Tata McGraw Hill (1994). 12. K.L. Kapoor, A Textbook of Physical Chemistry, Macmillan (2000).

Unit I: (Analytical Chemistry)

1. Instrumental methods of chemical analysis by H. Kaur, Pragati Prakashan.
2. Principles of instrumental Analysis, 5th Edition, by D. A. Scoog, F. J. Holler, T. A. Nieman, Harcourt Asia Publisher.
3. Introduction to Instrumental Analysis by R. D. Braun. McGraw Hill Publisher.
4. Quantitative chemical analysis 6th edition by Vogel, Pearson Education Limited, 2007.
5. Electrochemical Methods of fundamentals and applications by Allen J. Bard and Larry R
6. Faulkner, John Wiley and Sons, 1980.
7. Modern Analytical Chemistry by David Harvey, Mc Graw Hill higher education Publisher.
8. Quality in the analytical laboratory by Elizabeth Pichard Wiley India.
9. Quality control and Total quality management by P. L. Jain. Tata Mc Graw Hill 2006.

10. Unit II:

1. 1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. 2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970

3. 3. Atkins, P.W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014.
4. 4. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962.
5. 5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.

Unit III:

1. Morrison, R. T. and Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt Ltd. (Pearson Education).2012
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
4. Eliel, E. L. and Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994. 5. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.
5. Mc. Murry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.

CHEMISTRY PRACTICALS
SEMESTER I
Course Code: UGCHP1
PRACTICAL CHEMISTRY

Learning objectives:

1) To learn to perform experiments that has specific aims with correct techniques.
2) To develop skills of observation, recording and analyzing data.
3) To learn to present the experimental work in a systematic manner

Unit I: Physical Chemistry

1. To prepare 0.1 N succinic acid and standardize the NaOH of two different concentrations
2. To determine the rate constant for the hydrolysis of ester using HCl as catalyst
3. To determine enthalpy of dissolution of salt (like KNO_3)
4. Introduction to Laboratory Safety.

Unit II: Inorganic Chemistry.

1. Commercial analysis of (any two) a) Mineral acid b) Organic acid c) Salt of weak acid and strong base, by using volumetric method.
2. Titration using double indicator: analysis of solution of Na_2CO_3 and $NaHCO_3$.
3. Gravimetric analysis - To determine the percent purity of sample of BaSO4 containing NH_4Cl
4. **Unit III: Organic Chemistry**
1. Purification of any two organic compounds by recrystallization selecting suitable solvent. (Provide 1g.). Learners are expected to report a) Solvent for recrystallization. b) Mass and the melting points of purified compound. Learners should calibrate thermometer before determining melting point.
2. Chromatography (Any one) a) Separation of a mixture of two sugars by ascending paper chromatography b) Separation of a mixture of o-and p-nitro phenols by thin layer chromatography (TLC) (Demonstration)

SEMESTER II

Course Code: UGCHP2

Unit I: Physical Chemistry

1) To determine the rate constant for the saponification reaction between ethyl acetate and NaOH
2) To determine dissociation constant of weak acid (Ka) using Henderson's equation and the method of incomplete titration pH metrically.
3) To verify Beer-Lambert's law, using $KMnO_4$ solution by colorimetric method.

4) To standardize commercial sample of HCl using borax and to write material safety data of the chemicals involved.

Unit II: Inorganic Chemistry

1. Qualitative analysis: (at least 4 mixtures to be analyzed) Semi-micro inorganic qualitative analysis of a sample containing two cations and two anions. Cations (from amongst): Pb^{2+}, Ba^{2+}, Ca^{2+}, Sr^{2+}, Cu^{2+}, Cd2+, Fe^{2+}, Ni^{2+}, Mn^{2+}, Mg^{2+}, Al^{3+}, Cr^{3+}, K^{+}, NH^{4+} Anions (From amongst): CO_3 2- , S^{2-} , SO_3^{2-} , NO^{2-} , NO^{3-}, Cl- , Br- , I- , SO_4^{2-} , PO_4^{3-} (Scheme of analysis should avoid use of sulphide ion in any form for precipitation / separation of cations.)
2. Redox Titration: To determine the percentage of Coper (II) present in a given sample by titration against a standard aqueous solution of sodium thiosulfate (iodometry titration)

Unit III: Organic Chemistry

Characterization of organic compound containing C, H, (O), N, S, X elements. (minimum 6 compounds)

Reference Books

Unit I: Physical Chemistry

1. Khosla B.D., Garg V.C. and Gulati A., Senior Practical Physical Chemistry, R. Chand and Co., New Delhi (2011).
2. Garland C. W., Nibler J.W. and Shoemaker D.P., Experiments in Physical Chemistry, 8th Ed., McGraw-Hill, New York (2003).
3. Halpern A.M. and McBane G.C., Experimental Physical Chemistry, 3rd Ed., W.H. Freeman and Co., New York (2003).
4. Athawale V.D. and Mathur P., Experimental Physical Chemistry, New Age International, New Delhi (2001).

Unit II: Inorganic Chemistry

Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6 th Ed., Pearson, 2009.

Unit III: Organic Chemistry

1. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chem
4. Organic chemistry by Solomon and Fryhles.
5. Organic chemistry by Morrison and Boyd