



**VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)**

**DEPARTMENT OF CHEMISTRY
Three/Four- Years UG Programme
Department/Subject Specific Core or Major (DSC)**

**Curriculum, Teaching
and Evaluation
Structure**

for

B. Sc. – I Chemistry

Semester - I & II

(Implemented from academic year 2023-24 onwards)



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**Head
Dept. of Chemistry
Vivekanand College, Kolhapur**

VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)
Department of Chemistry

Program Outcomes (POs):

PO1:Disciplinary Knowledge: Graduates will gain in-depth understanding in their specific major or discipline, mastering the foundational principles and theories, as well as advanced concepts. Execute strong theoretical and practical understanding developed from the specific programme in the area of work.

PO2:Problem-Solving Skills: Graduates will learn to use their knowledge to identify, analyze, and solve problems related to their field of study.

PO3:Analytical Skills: Graduates will gain the ability to collect, analyze, interpret, and apply data in a variety of contexts. They might also learn to use specialized software or equipment.

PO4:Research Skills and Scientific temper: Depending on the field, graduates might learn how to design and conduct experiments or studies, analyze results, and draw conclusions. They might also learn to review and understand academic literature.

PO5:Communication Skills: Many programs emphasize the ability to communicate effectively, both orally and in writing. Graduates may learn to present complex information clearly and succinctly, write detailed reports, and collaborate effectively with others.

PO6:Ethics and Professionalism: Graduates may learn about the ethical and professional standards in their field, and how to apply them in real-world situations.

B.Sc. in Chemistry

Program Specific Outcomes (PSOs):

After successful completion of degree program in Chemistry a student should be able to;

PSO1: Understand fundamental facts and concepts in Chemistry as well as its applications so as to develop interest in the study of chemistry as a discipline.

PSO2: Develop the ability to apply the principles of Chemistry in practical.

PSO3: Acquire skills of different analytical techniques used in chemistry.

PSO4: Develop Skills to evaluate, analyze and interpret the chemical reactions by using various techniques.

PSO5: Acquire knowledge and skills required to hire in any sector related to chemistry as well as to admit for higher education.



VIVEKANANDCOLLEGE,KOLHAPUR

(EMPOWERED AUTONOMOUS)

Department of Chemistry

Teaching and Evaluation Scheme
Three/Four- Years UG Programme
Department/Subject Specific Core or Major (DSC)
First Year Semester- I & II

Sr. No.	Course Abbr.	Course code	Course Name	Teaching Scheme Hours/week		Examination Scheme and Marks				Course Credits
				TH	PR	ESE	CIE	PR	Marks	
Semester-I										
1	DSC-I	DSC03CHE11	Inorganic Chemistry	2	-	40	10	-	50	2
2	DSC-II	DSC03CHE12	Organic Chemistry	2	-	40	10	-	50	2
3	MIN-I	MIN03CHE11	Inorganic Chemistry	2	-	40	10	-	50	2
4	MIN-II	MIN03CHE12	Organic Chemistry	2	-	40	10	-	50	2
5	OEC-I	OEC03CHE11	General Aspects of Inorganic Chemistry	2	-	40	10	-	50	2
6	OEC-II	OEC03CHE12	General Aspects of Organic Chemistry	2	-	40	10	-	50	2
Semester-II										
1	DSC-III	DSC03CHE21	Physical Chemistry	2	-	40	10	-	50	2
2	DSC-IV	DSC03CHE22	Analytical Chemistry	2	-	40	10	-	50	2
3	MIN-III	MIN03CHE21	Physical Chemistry	2	-	40	10	-	50	2
4	MIN-IV	MIN03CHE22	Analytical Chemistry	2	-	40	10	-	50	2
5	OEC-III	OEL03CHE21	General Aspects of Physical Chemistry	2	-	40	10	-	50	2
6	OEC-IV	OEL03CHE22	General Aspects of Analytical Chemistry	2	-	40	10	-	50	2
7	SEC-I	SEC03CHE29	Laboratory Safety Management	2	-	-	-	50	50	2
Annual										
1	DSC-PR-I	DSC03CHE29	DSC Chemistry Lab-1	-	4	-	-	50	50	4
2	MIN-PR-I	MIN03CHE29	MIN Chemistry Lab-1	-	4	-	-	50	50	4
3	OEC-PR-I	OEC03CHE12	OEC Chemistry Lab-1	-	4	-	-	50	50	4
Total				24	16	480	120	200	800	38



B. Sc. Part – I Semester - I CHEMISTRY (Major)
DSC-I: DSC03CHE11: INORGANIC CHEMISTRY

Theory: 30 hrs
Marks-50 (Credits: 02)

CO No. On completion of the course, student will be able to:

- CO1 Learn introductory inorganic chemistry and understand size, shape and electron distribution in shells and sub-shells of an atom.
- CO2 Impart different types of bonds and nature of bonding in inorganic compounds, calculations of different energies associated with ionic bonding.
- CO3 Acquire knowledge of nature of bonding, geometry, stability and magnetic characters of covalent compounds by applying VBT.
- CO4 Understand concepts of acids and bases in chemistry.
- CO5 Adopt and understand the properties and uses of the compounds of p-block elements.

Unit – I: Atomic Structure and Periodicity of Elements

[7]

- 1.1 Introduction, Bohr's theory of hydrogen atom and its limitations
- 1.2 Wave particle duality
- 1.3 Heisenberg uncertainty principle
- 1.4 Quantum numbers and their significance
- 1.5 Shapes of s, p and d atomic orbitals
- 1.6 Electrons filling rules in various orbitals: a) Aufbau's principle b) Hund's rule of maximum multiplicity c) Pauli's exclusion principle.
- 1.7 Electronic configuration of elements. Stability of empty, half-filled and completely filled orbitals.
- 1.8 Periodicity of the elements: General discussion of the following properties of the elements with reference to s block elements: a) electronic configuration b) atomic radii c) ionic radii d) ionization energy e) electron affinity f) electronegativity g) metallic characters h) reactivity i) oxidation state j) melting and boiling points k) chemical properties.

Unit - II: Chemical Bonding and Molecular Structure: Ionic Bonding

[6]

- 2.1 Introduction
- 2.2 Types of Chemical Bonds: a) Ionic Bond b) Covalent Bond c) Co-



ordinate bond d) metallic bond e) Hydrogen Bond f) Van-der Waals force.

- 2.3 Definition and formation of ionic bond. General characteristics of ionic bonding.
- 2.4 Energetic in Ionic bond formation.
- 2.5 Born-Haber cycle for NaCl and its applications.
- 2.6 Fajan's Rule, Applications of Fajan's rule for,
 - i) Polarizing power and polarizability
 - ii) Ionic character in covalent compounds
 - iii) Bond moment, dipole moment and percentage ionic character.

Unit-III: Chemical Bonding and Molecular structure: Valence bond theory (VBT) [5]

- 3.1 Introduction, Heitler - London Theory, Pauling-Slater theory
- 3.2 Valence Bond Theory: Concept of hybridization, different types of hybridization and geometry of following molecules,
 - i) Linear geometry - BeCl_2 (sp hybridization)
 - ii) Planar trigonal geometry - BF_3 (sp^2 hybridization)
 - iii) Tetrahedral geometry - SiCl_4 (sp^3 hybridization)
 - iv) Trigonal bipyramidal geometry - PCl_5 ($sp^3 d$ hybridization)
 - v) Octahedral geometry - SF_6 ($sp^3 d^2$ hybridization)
 - vi) Pentagonal bipyramidal geometry - IF_7 ($sp^3 d^3$ hybridization)
- 3.3 VSEPR Theory with reference to ammonia and water.

Unit-IV: Acids and Bases [5]

- 4.1 Theories of Acids and Bases: Arrhenius concept, Bronsted-Lowry concept, Lewis concept, Lux-Flood concept. (Definition and examples only).
- 4.2 Hard and Soft Acids and Bases (HSAB concept).
 - i) Classification of Acids and Bases as hard soft and borderline.
 - ii) Pearson's HSAB concept.
 - iii) Acid-Base strength and hardness-softness.
 - iv) Application and limitations of HSAB concept.



Unit-V: p-Block Elements (Group 13, 14, 15) [7]

5.1 Position of elements in periodic table.

5.2 Characteristics of group 13th, 14th and 15th elements with special reference to electronic configuration and periodic properties.

5.3 Compounds of group 13th, 14th and 15th elements.

i) Boron-diborane (only structure).

ii) Allotropes of carbon and phosphorus.

iii) Oxyacids of Nitrogen (HNO₂, HNO₃).

Reference Books:

- 1) Lee, J. D. *Concise Inorganic Chemistry* ELBS, 1991.
- 2) Cotton, F. A., Wilkinson, G. & Gaus, P. L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
- 3) Douglas, B. E., McDaniel, D. H. & Alexander, J. J. *Concepts and Models in Inorganic Chemistry*, John Wiley & Sons.
- 4) Huheey, J. E., Keiter, E. A., Keiter, R. L. & Medhi, O. K. *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006.
- 5) Puri, Sharma, Kalia, *Principles of Inorganic Chemistry*
- 6) Suratkar and Thatte, *Theoretical Inorganic Chemistry*
- 7) Day and Sellbin, *Theoretical Inorganic Chemistry*
- 8) R Gopalan & Ramalingum, *Coordination Chemistry*
- 9) Satyaprakash, Tuli and Madan, *Advanced Inorganic Chemistry*
- 10) Huheey, J.E. *Principles of Structure and Reactivity*.
- 12) Huheey, J.E. *Inorganic Chemistry*.
- 13) Gary Meissler and Donald Tarr., *Inorganic Chemistry*.
- 14) D.F. Shriver & P.W. Atkins, *Inorganic Chemistry*.
- 15) E. S. Gilreath. *Fundamental Concepts of Inorganic Chemistry*

**B. Sc. Part-I Semester - I CHEMISTRY
DSC-II: DSC03CHE12: ORGANIC CHEMISTRY**

Theory: 30hrs.

Marks-50 (Credits: 02)

CO No.	On completion of the course, student will be able to:
CO1	Understand the fundamental concepts in Organic Chemistry.
CO2	Learn the spatial arrangement of atoms of organic molecule and their effect



- on properties of organic molecules.
- CO3 Gain knowledge about heterocyclic compounds and its properties.
- CO4 Impart concepts of aromaticity as well as transformation functional groups.

Unit-I: Unit I: Fundamentals of Organic Chemistry [8]

- 1.1 Introduction
- 1.2 Inductive, electromeric, resonance and hyperconjugation effect.
- 1.3 Cleavage of bonds- homolysis, heterolysis
- 1.4 Types of reagents and organic reactions.
- 1.5 Introduction of reactive intermediates, carbocation, carbanion, carbon free radical, carbene, nitrene, arynes with their generation, structure, stability.

Unit-II: Stereochemistry [8]

- 2.1 Concept of stereochemistry
- 2.2 Types of stereoisomerism
- 2.3 Chiral and achiral compounds
- 2.4 Optical isomerism in lactic acid, tartaric acid, 2, 3-dihydroxybutanoic acids
- 2.5 Enantiomerism and diastereomerism, Geometrical isomerism.
- 2.6 Introduction, configuration and geometrical isomerism in aldoxime & ketomixes.
- 2.7 Nomenclature of stereoisomerisms CIP rules, R/S, E and Z (cis & trans).

Unit-III: Heterocyclic Compounds [7]

- 3.1 General Introduction
- 3.2 Classification and Nomenclature of Heterocyclic compounds
- 3.3 Pyrrole: Introduction, Synthesis, physical and chemical properties.
- 3.4 Pyridine: Introduction, Synthesis, physical and chemical properties.

Unit-IV: Chemistry of Aromatic Hydrocarbons [7]

- 4.1 Introduction to homocyclic and polycyclic aromatic hydrocarbons benzene, naphthalene, anthracene
- 4.2 Meaning of important terms; aromatic, non-aromatic, anti-aromatic



4.3 Huckel's rules and its applications.

4.4 Aromatic electrophilic substitution reactions: General mechanism, effect of substitution groups, Mechanism of nitration, sulfonation, halogenation

4.5 Friedel-crafts alkylation & acylation reactions of benzene.

Reference Books:

- 1) Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. *Organic Chemistry*, John Wiley & Sons (2014).
- 2) McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
- 3) Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
- 4) Eliel, E.L. *Stereochemistry of Carbon Compounds*, Tata McGraw Hill education, 2000.
- 5) Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
- 6) Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
- 7) Tiwari, Vishnoi Textbook of Organic Chemistry.
- 8) R. K. Bansal Textbook of Organic Chemistry.
- 9) E. S. Gould Mechanism and structure in organic chemistry.
- 10) Bhal and Bhal Textbook of Organic Chemistry
- 11) Jerry March Advanced Organic Chemistry
- 12) Phatak, Mahagani, Modern Organic Chemistry
- 13) G.R. Chatwal, reaction Mechanism and reagents in Organic Chemistry
- 14) Stereochemistry by P. S. Kalsi (New Age International)
- 15) Organic Chemistry- Clayden, Greeves, Warren.
- 16) Reaction and rearrangement- S. N. Sanyal.
- 17) Organic Reaction Mechanism- V. K. Ahluwalia.
- 18) Advanced Organic Chemistry- Jagdamba Singh.



B. Sc. Part – I Semester - II CHEMISTRY (Major)
DSC-III: DSC03CHE21: PHYSICAL CHEMISTRY
Theory: 30hrs.
Marks-50 (Credits: 02)

CO No.	On completion of the course, student will be able to:	
CO1	Adopt and understand basic concepts and rules of logarithms, graphs, derivative and integrations.	
CO2	Acquire knowledge of basic concepts and applications of thermodynamics.	
CO3	Gain knowledge about basic concepts in kinetics and first order, second order reactions with characteristics.	
CO4	Learn properties of liquid and apply this for the determination by various techniques.	
CO5	Understand basic concepts in electrochemistry, conductors and conductivity cells, measurement of conductance.	
Unit-I:	Basic Mathematical Concepts	[3]
	1.1 Logarithm: Basic rules and calculations.	
	1.2 Graph-Quadrants, drawing of linear graph, Slopes and Intercept.	
	1.3 Derivative and Integration: Basic rules.	
Unit-II:	Thermodynamics	[5]
	2.1 Introduction,	
	2.2 Basic terms used in thermodynamic study	
	2.3 Zeroth law of thermodynamics	
	2.4 First law of thermodynamics: Mathematical equation, sign conventions, statements of first law and its limitations.	
	2.5 Spontaneous and non-spontaneous processes, Second law of thermodynamics.	
	2.6 Heat engine, Carnot's Cycle and efficiency of heat engine.	
	2.7 Numerical Problems	
Unit-III:	Chemical Kinetics	[8]
	3.1 Introduction, rate of reaction, definition, and units of rate constant.	
	3.2 Factors affecting rate of reaction	
	3.3 Order and Molecularity of reaction	
	3.4 First order reaction: Derivation of rate constant. Characteristics of	



the first order reaction

3.5 Pseudo-first order reactions – i) Hydrolysis of methyl acetate in presence of acid, ii) Inversion of cane sugar

3.6 Second order reaction: Derivation of rate constant for equal and unequal concentration of the reactants

3.7 Examples of Second order reaction: i) Reaction between $K_2S_2O_8$ and KI and ii) Saponification of ethyl acetate

3.8 Characteristics of Second order reactions

3.9 Numerical problems

Unit-IV: Physical properties of liquids [6]

4.1 Introduction to states of matter, qualitative description of intermolecular forces in liquids, structure of liquids, classification of physical properties

4.2 Surface tension and its determination using stalagmometer and differential rise method

4.3 Viscosity and its determination using Ostwald's viscometer

4.4 Refractive index (Snell's law) specific and molecular refractivities and its determination using Abbe's refractometer

4.5 Numerical Problems.

Unit-V: Electrochemistry [8]

5.1 Introduction, types of cell, phenomenon of electrolysis, Faradays Laws of electrolysis

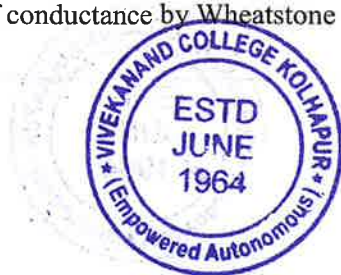
5.2 Types of conductors

5.3 Explanations of Conductance, specific conductance, equivalence and molecular conductance

5.4 Variation of specific conductance, equivalence and molecular conductance with dilution, equivalent conductance at infinite dilution

5.5 Dipping type of conductivity cell, modifications in the technique used before measurement of conductance w.r.to use of alternating current, use of conductivity water, conductivity cell and temperature control

5.6 Measurement of conductance by Wheatstone bridge



5.7 Cell constant and its determination

5.8 Numerical problems.

Reference Books

- 1) Castellan, G.W. *Physical Chemistry* 4th Ed. Narosa (2004).
- 2) Kotz, J.C., Treichel, P.M. & Townsend, J.R. *General Chemistry* Cengage Learning India Pvt. Ltd., New Delhi (2009).
- 3) Mahan, B.H. *University Chemistry* 3rd Ed. Narosa (1998).
- 4) Petrucci, R.H. *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York (1985).
- 5) Puri, Sharma, Pathania, Principles of Physical Chemistry.
- 6) Principles of Physical Chemistry by murrnpruton.
- 7) S.K. Dogra and Dogra. Physical Chemistry
- 8) Engel and Red, Principles of Thermodynamics
- 9) Peter and Atkins. Physical Chemistry
- 10) Glasston and Levis Principle of Physical Chemistry
- 11) Bhal & Tuli, Physical Chemistry

B. Sc. Part – I Semester - II CHEMISTRY (Major) DSC-IV: DSC03CHE22: ANALYTICAL CHEMISTRY

Theory: 30hrs.

Marks-50 (Credits: 02)

CO No.	On completion of the course, student will be able to:
CO1	Learn concepts of analytical chemistry.
CO2	Understand the various aspects of industrial chemistry such as MSDS, preparation of various solutions and IPR.
CO3	Acquire knowledge of chromatographic separation technique such as Paper and Thin layer chromatography.
CO4	Gain theoretical concepts of various volumetric titrations.

Unit-I: Introduction to Analytical Chemistry

[7]

1.1 General Introduction

1.2 Importance of analysis

1.3 Analytical processes (Qualitative and Quantitative)



- 1.4 Methods of analysis (Only classification)
- 1.5 Sampling of solids, liquids and gases
- 1.6 Errors, types of errors (determinate and indeterminate), methods of expressing accuracy (Absolute and relative error)
- 1.7 Significant figures, mean, median, standard deviation
- 1.8 Numerical problems

Unit-II: Fundamentals of Industrial Chemistry and IPR [7]

- 2.1 General introduction, Difference between classical and industrial chemistry, Raw materials for chemical industry, Material safety data sheets (MSDS)
- 2.2 Definition and Explanation of terms –Molecular weight, Equivalent weight, Molarity, Normality, Molality, Molarity of mixed solution, Acidity of base, Basicity of acid, ppt, ppm, ppb solutions, Mole Fraction, Weight fraction, Percentage composition by W/W, W/V, V/V, Problems based on Normality, Molarity, mole fraction, mixed solution, etc.
- 2.3 IPR - Introduction to IPR and its significance in present scenario

Unit-III: Chromatography [8]

- 3.1 Introduction, Basic Principle of Chromatography, Basic terms, Classification of Chromatography
- 3.2 **Paper Chromatography**- Principle, Methodology-types of papers and treatment, sample loading, choice of solvent, development-ascending, descending, circular, location of spots, determination of R_f value, Applications, advantages and disadvantages
- 3.3 **Thin layer chromatography** -Principle, Solvent system, stationary phases, preparation of TLC plate, Detecting reagents, methodology – sample loading, development, detection of spot, R_f value, Applications, advantages and disadvantages.
- 3.4 Comparison of paper chromatography and TLC

Unit-IV: Theory of titrimetric Analysis [8]

- 4.1 Introduction
- 4.2 Acid-base indicators



- 4.3 Theory of indicators w.r.t. Ostwald's ionization theory and quinoid theory
- 4.4 Neutralization curves and choice of indicators for
- Strong acid-strong base
 - Strong acid-weak base
 - Strong base-weak acid
- 4.5 **Complexometric titrations:** Introduction, Types of EDTA titrations, Metallochromic indicators- Eriochrome black-T Indicator, Action of Eriochrome black-T

Reference Books:

- 1) Principles of Physical Chemistry by Puri, Sharma and Pathania, Vishal Publishing company Jalindhar
- 2) Essential of Physical Chemistry by Bahl B.S., Tuli G.D. and Bahl Arun, S.Chand and Company Ltd. New Delhi
- 3) Modern Analytical Chemistry by David Harvey, McGRAW-Hill International Edition, 2000
- 4) Industrial chemistry by B.K. Sharma, G Majorl Publishing Housing, 16th edition 2011
- 5) Advanced Inorganic Chemistry, Vol.No.1, by Gurudeep Raj, Krishna Prakashan Media Ltd, Meerut
- 6) Analytical chemistry by B.K. Sharma, Krishna Prakashan Media Ltd, Meerut, edition 3rd 2011
- 7) Principles of electroplating and electroforming by Blum and Hogaboom
- 8) Chemical Process Industries by Shreve and Brink
- 9) Industrial Chemistry by Loutfy Madkor and Helen Njenga
- 10) Elementary Principles of Chemical Processes by Richard Felder and Ronald Rousseau, John Wiley and Sons

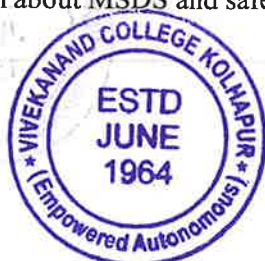
B. Sc. Part – I Semester -II CHEMISTRY

SEC-I: SEC03CHE29: Laboratory Safety Management

Theory: 30hrs.

Marks-50 (Credits: 02)

CO No.	On completion of the course, student will be able to:
CO1	Gain the knowledge of chemical handling and its laboratory management.
CO2	Acquire information about MSDS and safety symbols.



CO3	Adopt skills of Prevention of Accidents and First Aid Measures.
CO4	Understand General Safety & Safe Handling of Chemicals.

Unit-I: Introduction to Laboratory Chemicals & its Management [8]

- Introduction
- General Laboratory Protocols,
- Types of hazardous chemicals: Corrosives, Oxidisers, Flammables, Water Reactives, Pyrophorics, Peroxide forming chemicals; toxics: acute effect, chronic effect, prevention of toxic exposures, LD₅₀, LC50, Threshold limit values
- Routes of Entry: Inhalation, Skin absorption, Gastrointestinal introduction of toxins
- Receipt of chemicals; Labeling of chemicals; Storage of chemicals.

Unit-II: MSDS & Laboratory Safety Pictograms (Symbols) [7]

- Introduction,
- MSDS, CASRN
- Safety symbols of various reactive chemicals.

Unit-III: Prevention of Accidents and First Aid Measures [8]

- Introduction
- First Aid measures for cuts/bleeding, burns, flammable liquid spill, Fire accidents: Fire on the cloth, Eye accidents, Chemical spill on skin, Inhalation of chemical vapours, spilling of unknown and neutral compounds, poisons, inhalation of poisonous gases.
- Universal antidote for any poison
- Materials in First Aid Kit.

Unit-IV: General Safety & Safe Handling of Chemicals [7]

- General Safety and Operational Rules: Electrical Safety, Vacuum operations, Handling glassware, Fume Hood Safety and Ventilation
- Handling and transportation of chemicals, Chemical Spills on surface, Guidelines for handling of acids, alkalis, phenols and reactive chemicals, Compressed Gas Safety, Safe Handling of Cryogenic liquids, Handling of Dry Ice.
- Waste Management & Disposal
- Housekeeping



DSC- PR-I: DSC03CHE29: CHEMISTRY LAB-1

Practical: Four hours week per batch

Marks: 50 (Credits: 02)

Section-I: Inorganic Chemistry

- To prepare standard 0.1 N KMnO_4 solution and to determine the strength of given oxalic acid solutions.
- To determine quantity of Fe (II) ions from the given solutions by titrating it with 0.1N $\text{K}_2\text{Cr}_2\text{O}_7$ solutions by using internal indicator.
- Estimation of amount of Acetic acid from the given vinegar sample by titrimetric method.
- Water analysis: To determine the alkalinity of water sample by using Phenolphthalein and Methyl Orange Indicator
- To estimate amount of Cu (II) ions by iodometric titration by using $\text{Na}_2\text{S}_2\text{O}_3$ solution
- **Spot Tests:** Detection of following cations using spot tests: Cu^{2+} , Co^{2+} , Ni^{2+} , Fe^{3+} , Al^{3+} , Zn^{2+} , Mg^{+2} , Pb^{2+}
- **Paper Chromatography**
Detection of following cations using Paper Chromatography: $\text{Cu}^{2+} + \text{Co}^{2+}$, $\text{Co}^{2+} + \text{Ni}^{2+}$, $\text{Ni}^{2+} + \text{Cu}^{2+}$

Section-II: Organic Chemistry

- Organic Spotting – (6)
- Estimation of Aniline/Phenol
- Estimation of Aspirin from given pharmaceutical tablet.
- Preparation and purification of Oximes of ketones.
- Preparation and purification of 2,4-DNPs of ketones.
- Preparation of 2, 4 dinitro benzene from nitrobenzene.

Section-III: Physical Chemistry

- To study the reaction rate of hydrolysis of methyl acetate in presence of 0.5N HCl.
- To determine viscosity of given liquid A and B.
- Determination of enthalpy of ionization of acetic acid.
- Determination of enthalpy of neutralization of HCl with NaOH



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- Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps using pH-meter.
- To prepare and measure pH of buffer solutions ($\text{CH}_3\text{COOH}+\text{CH}_3\text{COONa}$) by potentiometer.
- To determine equivalent weight of Mg by Eudiometer.

Reference Books:

- 1) Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
- 2) Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
- 3) Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
- 4) Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.
- 5) Khosla, B. D.; Garg, V. C. and Gulati, A. *Senior Practical Physical Chemistry*, S. Chand & Company, New Delhi, 2011.
- 6) Nadkarni, Kothari and Lavande *Practical Book of Physical Chemistry*
- 7) Findley A., *Experimental Physical Chemistry*
- 8) Das, R. C., B, Behra, *Experiments in Physical Chemistry*
- 9) Yadav J. B. *Advance Practical Physical Chemistry*
- 10) Clarke *Handbook of Organic Quantitative Analysis*
- 11) Ahluvalia V. K., *Comprehensive Practical Organic Chemistry*
- 12) Kulkarni, V. S., Dastane, R. *Laboratory Handbook of Organic Qualitative Analysis and Separation*
- 13) Khopkar, S. M., *Basic Concepts in Analytical Chemistry*



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Seat No.		Ques. paper code	
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**VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)**

B.Sc. Part- I (Chemistry) (Semester-I) Examination.....

Course Code and Name: DSC03CHEM11: Inorganic Chemistry

Day:

Time: 2 hours

Date: --/--/----

Marks : 40

Instructions:

- 1) All the questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Draw neat labelled diagrams wherever necessary.
- 4) Use of log table/calculator is allowed.

Q. 1. Select correct alternative(One mark each):

[8]

- i) Xyzabcdefghijklmnop -----
a) ----- b) ----- c) ----- d) -----
- ii) Xyzabcdefghijklmnop -----
a) ----- b) ----- c) ----- d) -----
- iii) Xyzabcdefghijklmnop -----
a) ----- b) ----- c) ----- d) -----
- iv) Xyzabcdefghijklmnop -----
a) ----- b) ----- c) ----- d) -----
- v) Xyzabcdefghijklmnop -----
a) ----- b) ----- c) ----- d) -----
- vi) Xyzabcdefghijklmnop -----
a) ----- b) ----- c) ----- d) -----
- vii) Xyzabcdefghijklmnop -----
a) ----- b) ----- c) ----- d) -----
- viii) Xyzabcdefghijklmnop -----
a) ----- b) ----- c) ----- d) -----

Q.2. Attempt any TWO (Eight marks each):

[16]

- i) Xyzabcdefghijklmnop.
- ii) Xyzabcdefghijklmnop.
- iii) Xyzabcdefghijklmnop.

Q.3. Attempt any FOUR (Four marks each):

[16]

- i) Xyzabcdefghijklmnop.
- ii) Xyzabcdefghijklmnop.
- iii) Xyzabcdefghijklmnop.
- iv) Xyzabcdefghijklmnop.
- v) Xyzabcdefghijklmnop.
- vi) Xyzabcdefghijklmnop.





**VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)**

**DEPARTMENT OF CHEMISTRY
Three/Four- Years UG Programme
Department/Subject Specific Core or Minor (MIN)**

**Curriculum, Teaching
and Evaluation
Structure**

for

B. Sc. – I Chemistry

Semester - I & II

(Implemented from academic year 2023-24 onwards)



VIVEKANAND COLLEGE, KOLHAPUR

(EMPOWERED AUTONOMOUS)

Department of Chemistry

Program Outcomes (POs):

PO1: Disciplinary Knowledge: Graduates will gain in-depth understanding in their specific major or discipline, mastering the foundational principles and theories, as well as advanced concepts. Execute strong theoretical and practical understanding developed from the specific programme in the area of work.

PO2: Problem-Solving Skills: Graduates will learn to use their knowledge to identify, analyze, and solve problems related to their field of study.

PO3: Analytical Skills: Graduates will gain the ability to collect, analyze, interpret, and apply data in a variety of contexts. They might also learn to use specialized software or equipment.

PO4: Research Skills and Scientific temper: Depending on the field, graduates might learn how to design and conduct experiments or studies, analyze results, and draw conclusions. They might also learn to review and understand academic literature.

PO5: Communication Skills: Many programs emphasize the ability to communicate effectively, both orally and in writing. Graduates may learn to present complex information clearly and succinctly, write detailed reports, and collaborate effectively with others.

PO6: Ethics and Professionalism: Graduates may learn about the ethical and professional standards in their field, and how to apply them in real-world situations.

B. Sc. in Chemistry

Program Specific Outcomes (PSOs):

After successful completion of degree program in Chemistry a student should be able to;

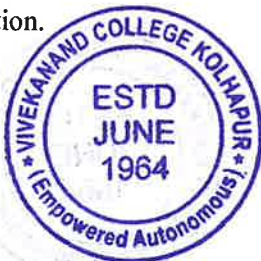
PSO1: Understand fundamental facts and concepts in Chemistry as well as its applications so as to develop interest in the study of chemistry as a discipline.

PSO2: Develop the ability to apply the principles of Chemistry in practical.

PSO3: Acquire skills of different analytical techniques used in chemistry.

PSO4: Develop Skills to evaluate, analyze and interpret the chemical reactions by using various techniques.

PSO5: Acquire knowledge and skills required to hire in any sector related to chemistry as well as to admit for higher education.



VIVEKANAND COLLEGE, KOLHAPUR

(EMPOWERED AUTONOMOUS)

Department of Chemistry

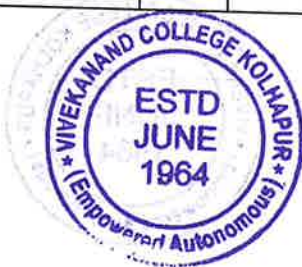
Teaching and Evaluation scheme

Three/Four- Years UG Programme

Department/Subject Specific Core or Minor (MIN)

First Year Semester- I & II

Sr. No.	Course Abbr.	Course code	Course Name	Teaching Scheme Hours/week		Examination Scheme and Marks				Course Credits
				TH	PR	ESE	CIE	PR	Marks	
Semester-I										
1	DSC-I	DSC03CHE11	Inorganic Chemistry	2	-	40	10	-	50	2
2	DSC-II	DSC03CHE12	Organic Chemistry	2	-	40	10	-	50	2
3	MIN-I	MIN03CHE11	Inorganic Chemistry	2	-	40	10	-	50	2
4	MIN-II	MIN03CHE12	Organic Chemistry	2	-	40	10	-	50	2
5	OEC-I	OEC03CHE11	General Aspects of Inorganic Chemistry	2	-	40	10	-	50	2
6	OEC-II	OEC03CHE12	General Aspects of Organic Chemistry	2	-	40	10	-	50	2
Semester-II										
1	DSC-III	DSC03CHE21	Physical Chemistry	2	-	40	10	-	50	2
2	DSC-IV	DSC03CHE22	Analytical Chemistry	2	-	40	10	-	50	2
3	MIN-III	MIN03CHE21	Physical Chemistry	2	-	40	10	-	50	2
4	MIN-IV	MIN03CHE22	Analytical Chemistry	2	-	40	10	-	50	2
5	OEC-III	OEL03CHE21	General Aspects of Physical Chemistry	2	-	40	10	-	50	2
6	OEC-IV	OEL03CHE22	General Aspects of Analytical Chemistry	2	-	40	10	-	50	2
7	SEC-I	SEC03CHE29	Laboratory Safety Management	2	-	-	-	50	50	2
Annual										
1	DSC-PR-I	DSC03CHE29	DSC ChemistryLab-1	-	4	-	-	50	50	4
2	MIN-PR-I	MIN03CHE29	MIN ChemistryLab-1	-	4	-	-	50	50	4
3	OEC-PR-I	OEC03CHE12	OEC ChemistryLab-1	-	4	-	-	50	50	4
Total				24	16	480	120	200	800	38



B. Sc. Part – I Semester - I CHEMISTRY (MINOR)
MIN-I: MIN03CHE11: INORGANIC CHEMISTRY

Theory: 30 hrs.

Marks-50 (Credits: 02)

- CO No. On completion of the course, student will be able to:**
- CO1 Learn introductory inorganic chemistry and understand size, shape and electron distribution in shells and sub-shells of an atom.
 - CO2 Impart different types of bonds and nature of bonding in inorganic compounds, calculations of different energies associated with ionic bonding.
 - CO3 Acquire knowledge of nature of bonding, geometry, stability and magnetic characters of covalent compounds by applying VBT.
 - CO4 Understand concepts of acids and bases in chemistry.
 - CO5 Adopt and understand the properties and uses of the compounds of p-block elements.

Unit –I : Atomic Structure and Periodicity of Elements

[7]

- 1.1 Introduction, Bohr's theory of hydrogen atom and its limitations
- 1.2 Wave particle duality
- 1.3 Heisenberg uncertainty principle
- 1.4 Quantum numbers and their significance
- 1.5 Shapes of s, p and d atomic orbitals
- 1.6 Electrons filling rules in various orbitals: a) Aufbau's principle b) Hund's rule of maximum multiplicity c) Pauli's exclusion principle.
- 1.7 Electronic configuration of elements. Stability of empty, half-filled and completely filled orbitals.
- 1.8 Periodicity of the elements: General discussion of the following properties of the elements with reference to s block elements: a) electronic configuration b) atomic radii c) ionic radii d) ionization energy e) electron affinity f) electronegativity g) metallic characters h) reactivity i) oxidation state j) melting and boiling points k) chemical properties.

Unit-II: Chemical Bonding and Molecular Structure: Ionic Bonding

[6]

- 2.1 Introduction
- 2.2 Types of Chemical Bonds: a) Ionic Bond b) Covalent Bond c) Co-



ordinate bond d) metallic bond e) Hydrogen Bond f) Van-der Waals force.

- 2.3 Definition and formation of ionic bond. General characteristics of ionic bonding.
- 2.4 Energetic in Ionic bond formation.
- 2.5 Born-Haber cycle for NaCl and its applications.
- 2.6 Fajan's Rule, Applications of Fajan's rule for,
 - i) Polarizing power and polarizability
 - ii) Ionic character in covalent compounds
 - iii) Bond moment, dipole moment and percentage ionic character.

Unit-III: Chemical Bonding and Molecular structure: Valence bond theory (VBT) [5]

- 3.1 Introduction, Heitler-London Theory, Pauling-Slater theory
- 3.2 Valence Bond Theory: Concept of hybridization, different types of hybridization and geometry of following molecules,
 - i) Linear geometry - BeCl_2 (sp hybridization)
 - ii) Planer trigonal geometry - BF_3 (sp^2 hybridization)
 - iii) Tetrahedral geometry - SiCl_4 (sp^3 hybridization)
 - iv) Trigonal bipyramidal geometry - PCl_5 ($sp^3 d$ hybridization)
 - v) Octahedral geometry - SF_6 ($sp^3 d^2$ hybridization)
 - vi) Pentagonal bipyramidal geometry - IF_7 ($sp^3 d^3$ hybridization)
- 3.3 VSEPR Theory with reference to ammonia and water.

Unit-IV: Acids and Bases [5]

- 4.1 Theories of Acids and Bases: Arrhenius concept, Bronsted-Lowry concept, Lewis concept, Lux-Flood concept. (Definition and examples only).
- 4.2 Hard and Soft Acids and Bases (HSAB concept).
 - i) Classification of Acids and Bases as hard soft and borderline.
 - ii) Pearson's HSAB concept.
 - iii) Acid-Base strength and hardness-softness.
 - iv) Application and limitations of HSAB concept.



Unit-V: p-Block Elements (Group13, 14, 15) [7]

5.1 Position of elements in periodic table.

5.2 Characteristics of group13th, 14th and 15th elements with special reference to electronic configuration and periodic properties.

5.3 Compounds of group 13th, 14th and 15th elements.

i) Boron-diborane (only structure).

ii) Allotropes of carbon and phosphorus.

iii) Oxyacids of Nitrogen (HNO₂, HNO₃).

Reference Books:

- 1) Lee, J. D. *Concise Inorganic Chemistry* ELBS, 1991.
- 2) Cotton, F. A., Wilkinson, G. & Gaus, P. L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
- 3) Douglas, B. E., McDaniel, D. H. & Alexander, J. J. *Concepts and Models in Inorganic Chemistry*, John Wiley & Sons.
- 4) Huheey, J. E., Keiter, E. A., Keiter, R. L. & Medhi, O. K. *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006.
- 5) Puri, Sharma, Kalia, *Principles of Inorganic Chemistry*
- 6) Suratkar and Thatte, *Theoretical Inorganic Chemistry*
- 7) Day and Sellbin, *Theoretical Inorganic Chemistry*
- 8) R Gopalan & Ramalingum, *Coordination Chemistry*
- 9) Satyaprakash, tuli and madan, *Advanced Inorganic Chemistry*
- 10) Huheey, J.E. *Principles of Structure and Reactivity*.
- 12) Huheey, J.E *Inorganic Chemistry*.
- 13) Gary Meissler and Donald Tarr., *Inorganic Chemistry*.
- 14) D.F.Shriver& P.W. Atkins, *Inorganic Chemistry*.
- 15) E. S. Gilreath. *Fundamental Concepts of Inorganic Chemistry*

B. Sc. Part – I Semester - I CHEMISTRY (MINOR)

MIN-II: MIN03CHE12: ORGANIC CHEMISTRY

Theory: 30hrs.

Marks-50 (Credits: 02)

CO No.	On completion of the course, student will be able to:
CO1	Understand the fundamental concepts in Organic Chemistry.
CO2	Learn the spatial arrangement of atoms of organic molecule and their effect



on properties of organic molecules.

CO3

Gain knowledge about heterocyclic compounds and its properties.

CO4

Impart concepts of aromaticity as well as transformation functional groups.

Unit-I: Unit I: Fundamentals of Organic Chemistry [8]

1.1 Introduction

1.2 Inductive, electromeric, resonance and hyperconjugation effect.

1.3 Cleavage of bonds- homolysis, heterolysis

1.4 Types of reagents and organic reactions.

1.5 Introduction of reactive intermediates, carbocation, carbanion, carbon free radical, carbene, nitrene, arynes with their generation, structure, stability.

Unit-II: Stereochemistry [8]

2.1 Concept of stereochemistry

2.2 Types of stereoisomerism

2.3 Chiral and achiral compounds

2.4 Optical isomerism in lactic acid, tartaric acid, 2, 3-dihydroxybutanoic acids

2.5 Enantiomerism and diastereomerism, Geometrical isomerism.

2.6 Introduction, configuration and geometrical isomerism in aldoxime & ketomixes.

2.7 Nomenclature of stereoisomerisms CIP rules, R/S, E and Z (cis & trans).

Unit-III: Heterocyclic Compounds [7]

3.1 General Introduction

3.2 Classification and Nomenclature of Heterocyclic compounds

3.3 Pyrrole: Introduction, Synthesis, physical and chemical properties.

3.4 Pyridine: Introduction, Synthesis, physical and chemical properties.

Unit-IV: Chemistry of Aromatic Hydrocarbons [7]

4.1 Introduction to homocyclic and polycyclic aromatic hydrocarbons
benzene, naphthalene, anthracene

4.2 Meaning of important terms; aromatic, non-aromatic, anti-aromatic



4.3 Huckel's rules and its applications.

4.4 Aromatic electrophilic substitution reactions: General mechanism, effect of substitution groups, Mechanism of nitration, sulfonation, halogenation

4.5 Friedel-crafts alkylation & acylation reactions of benzene.

Reference Books:

- 1) Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. *Organic Chemistry*, John Wiley & Sons (2014).
- 2) McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
- 3) Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
- 4) Eliel, E.L. *Stereochemistry of Carbon Compounds*, Tata McGraw Hill education, 2000.
- 5) Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
- 6) Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
- 7) Tiwari, Vishnoi Textbook of Organic Chemistry.
- 8) R. K. Bansal Textbook of Organic Chemistry.
- 9) E. S. Gould Mechanism and structure in organic chemistry.
- 10) Bhal and Bhal Textbook of Organic Chemistry
- 11) Jerry March Advanced Organic Chemistry
- 12) Phatak, Mahagani, Modern Organic Chemistry
- 13) G.R. Chatwal, reaction Mechanism and reagents in Organic Chemistry
- 14) Stereochemistry by P. S. Kalsi (New Age International)
- 15) Organic Chemistry- Clayden, Greeves, Warren.
- 16) Reaction and rearrangement- S. N. Sanyal.
- 17) Organic Reaction Mechanism- V. K. Ahluwalia.
- 18) Advanced Organic Chemistry- Jagdamba Singh.



B. Sc. Part – I Semester - II CHEMISTRY (MINOR)
MIN-III: MIN03CHE21: PHYSICAL CHEMISTRY

Theory: 30hrs.

Marks-50 (Credits: 02)

- CO No.** **On completion of the course, student will be able to:**
- CO1 Adopt and understand basic concepts and rules of logarithms, graphs, derivative and integrations.
- CO2 Acquire knowledge of basic concepts and applications of thermodynamics.
- CO3 Gain knowledge about basic concepts in kinetics and first order, second order reactions with characteristics.
- CO4 Learn properties of liquid and apply this for the determination by various techniques.
- CO5 Understand basic concepts in electrochemistry, conductors and conductivity cells, measurement of conductance.
- Unit-I:** **Basic Mathematical Concepts** **[3]**
- 1.1 Logarithm: Basic rules and calculations.
- 1.2 Graph-Quadrants, drawing of linear graph, Slopes and Intercept.
- 1.3 Derivative and Integration: Basic rules.
- Unit-II:** **Thermodynamics** **[5]**
- 2.1 Introduction,
- 2.2 Basic terms used in thermodynamic study
- 2.3 Zeroth law of thermodynamics
- 2.4 First law of thermodynamics: Mathematical equation, sign conventions, statements of first law and its limitations.
- 2.5 Spontaneous and non-spontaneous processes, Second law of thermodynamics.
- 2.6 Heatengine, Carnot's Cycle and efficiency of heat engine.
- 2.7 Numerical Problems
- Unit-III:** **Chemical Kinetics** **[8]**
- 3.1 Introduction, rate of reaction, definition, and units of rate constant.
- 3.2 Factors affecting rate of reaction
- 3.3 Order and Molecularity of reaction
- 3.4 First order reaction: Derivation of rate constant. Characteristics of



the first order reaction

- 3.5 Pseudo-first order reactions – i) Hydrolysis of methyl acetate in presence of acid, ii) Inversion of cane sugar
- 3.6 Second order reaction: Derivation of rate constant for equal and unequal concentration of the reactants
- 3.7 Examples of Second order reaction: i) Reaction between $K_2S_2O_8$ and KI and ii) Saponification of ethyl acetate
- 3.8 Characteristics of Second order reactions
- 3.9 Numerical problems

Unit-IV: Physical properties of liquids [6]

- 4.1 Introduction to states of matter, qualitative description of intermolecular forces in liquids, structure of liquids, classification of physical properties
- 4.2 Surface tension and its determination using stalagmometer and differential rise method
- 4.3 Viscosity and its determination using Ostwald's viscometer
- 4.4 Refractive index (Snell's law) specific and molecular refractivities and its determination using Abbe's refractometer
- 4.5 Numerical Problems.

Unit-V: Electrochemistry [8]

- 5.1 Introduction, types of cell, phenomenon of electrolysis, Faradays Laws of electrolysis
- 5.2 Types of conductors
- 5.3 Explanations of Conductance, specific conductance, equivalence and molecular conductance
- 5.4 Variation of specific conductance, equivalence and molecular conductance with dilution, equivalent conductance at infinite dilution
- 5.5 Dipping type of conductivity cell, modifications in the technique used before measurement of conductance w. r. to use of alternating current, use of conductivity water, conductivity cell and temperature control
- 5.6 Measurement of conductance by Wheatstonebridge



5.7 Cell constant and its determination

5.8 Numerical problems.

Reference Books

- 1) Castellan, G.W. *Physical Chemistry* 4th Ed. Narosa (2004).
- 2) Kotz, J.C., Treichel, P.M. & Townsend, J.R. *General Chemistry* Cengage Learning India Pvt. Ltd., New Delhi (2009).
- 3) Mahan, B.H. *University Chemistry* 3rd Ed. Narosa (1998).
- 4) Petrucci, R.H. *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York (1985).
- 5) Puri, Sharma, Pathania. *Principles of Physical Chemistry*.
- 6) *Principles of Physical Chemistry* by murrone prutton.
- 7) S. K. Dogra and Dogra. *Physical Chemistry*
- 8) Engel and Red, *Principles of Thermodynamics*
- 9) Peter and Atkins. *Physical Chemistry*
- 10) Glasston and Levis *Principle of Physical Chemistry*
- 11) Bhal & Tuli, *Physical Chemistry*

B. Sc. Part – I Semester - II CHEMISTRY (MINOR)
MIN-IV: MIN03CHE22: ANALYTICAL CHEMISTRY

Theory: 30hrs.

Marks-50 (Credits: 02)

CO No.	On completion of the course, student will be able to:
CO1	Learn concepts of analytical chemistry.
CO2	Understand the various aspects of industrial chemistry such as MSDS, preparation of various solutions and IPR.
CO3	Acquire knowledge of chromatographic separation technique such as Paper and Thin layer chromatography.
CO4	Gain theoretical concepts of various volumetric titrations.

Unit-I: Introduction to Analytical Chemistry

- 1.1 General Introduction
- 1.2 Importance of analysis
- 1.3 Analytical processes (Qualitative and Quantitative)
- 1.4 Methods of analysis (Only classification)

[7]



- 1.5 Sampling of solids, liquids and gases
- 1.6 Errors, types of errors (determinate and indeterminate), methods of expressing accuracy (Absolute and relative error)
- 1.7 Significant figures, mean, median, standard deviation
- 1.8 Numerical problems

Unit-II: Fundamentals of Industrial Chemistry and IPR [7]

- 2.1 General introduction, Difference between classical and industrial chemistry, Raw materials for chemical industry, Material safety data sheets (MSDS)
- 2.2 Definition and Explanation of terms –Molecular weight, Equivalent weight, Molarity, Normality, Molality, Molarity of mixed solution, Acidity of base, Basicity of acid, ppt, ppm, ppb solutions, Mole Fraction, Weight fraction, Percentage composition by W/W, W/V, V/V, Problems based on Normality, Molarity, mole fraction, mixed solution, etc.
- 2.3 IPR-Introduction to IPR and its significance in present scenario

Unit-III: Chromatography [8]

- 3.1 Introduction, Basic Principle of Chromatography, Basic terms, Classification of Chromatography
- 3.2 **Paper Chromatography**- Principle, Methodology-types of papers and treatment, sample loading, choice of solvent, development-ascending, descending, circular, location of spots, determination of R_f value, Applications, advantages and disadvantages
- 3.3 **Thin layer chromatography** -Principle, Solvent system, stationary phases, preparation of TLC plate, Detecting reagents, methodology – sample loading, development, detection of spot, R_f value, Applications, advantages and disadvantages.
- 3.4 Comparison of paper chromatography and TLC

Unit-IV: Theory of titrimetric Analysis [8]

- 4.1 Introduction
- 4.2 Acid-base indicators
- 4.3 Theory of indicators w. r. t. Ostwald's ionization theory and



quinoid theory

4.4 Neutralization curves and choice of indicators for

- i) Strong acid-strong base
- ii) Strong acid-weak base
- iii) Strong base-weak acid

4.5 **Complexometric titrations:** Introduction, Types of EDTA titrations, Metallochromic indicators- Eriochrome black-T Indicator, Action of Eriochrome black-T

Reference Books:

- 1) Principles of Physical Chemistry by Puri, Sharma and Pathania, Vishal Publishing company Jalindhar
- 2) Essential of Physical Chemistry by Bahl B.S., Tuli G.D. and Bahl Arun, S. Chand and Company Ltd. New Delhi
- 3) Modern Analytical Chemistry by David Harvey, McGRAW-Hill International Edition, 2000
- 4) Industrial chemistry by B.K. Sharma, GMajorl Publishing Housing, 16th edition 2011
- 5) Advanced Inorganic Chemistry, Vol. No.1, by Gurudeep Raj, Krishna Prakashan Media Ltd, Meerut
- 6) Analytical chemistry by B.K. Sharma, Krishna Prakashan Media Ltd, Meerut, edition 3rd 2011
- 7) Principles of electroplating and electroforming by Blumand Hogaboom
- 8) Chemical Process Industries by Shreve and Brink
- 9) Industrial Chemistry by Loutfy Madkor and Helen Njenga
- 10) Elementary Principles of Chemical Processes by Richard Felder and Ronald Rousseau, John Wiley and Sons



MIN- PR-I: MIN03CHE29: CHEMISTRY LAB-1

Practical: Four hours week per batch

Marks: 50 (Credits02)

Section-I: Inorganic Chemistry

- To prepare standard 0.1 N KMnO_4 solution and to determine the strength of given oxalic acid solutions.
- To determine quantity of Fe (II) ions from the given solutions by titrating it with 0.1N $\text{K}_2\text{Cr}_2\text{O}_7$ solutions by using internal indicator.
- Estimation of amount of Acetic acid from the given vinegar sample by titrimetric method.
- Water analysis: To determine the alkalinity of water sample by using Phenolphthalein and Methyl Orange Indicator
- To estimate amount of Cu (II) ions by iodometric titration by using $\text{Na}_2\text{S}_2\text{O}_3$ solution
- **Spot Tests:** Detection of following cations using spot tests: Cu^{2+} , Co^{2+} , Ni^{2+} , Fe^{3+} , Al^{3+} , Zn^{2+} , Mg^{+2} , Pb^{2+}
- **Paper Chromatography**
Detection of following cations using Paper Chromatography: $\text{Cu}^{2+} + \text{Co}^{2+}$, $\text{Co}^{2+} + \text{Ni}^{2+}$, $\text{Ni}^{2+} + \text{Cu}^{2+}$

Section-II: Organic Chemistry

- Organic Spotting – (6)
- Estimation of Aniline/Phenol
- Estimation of Aspirin from given pharmaceutical tablet.
- Preparation and purification of Oximes of ketones.
- Preparation and purification of 2,4-DNPs of ketones.
- Preparation of 2, 4 dinitro benzene from nitrobenzene.

Section-III: Physical Chemistry

- To study the reaction rate of hydrolysis of methyl acetate in presence of 0.5N HCl.
- To determine viscosity of given liquid A and B.
- Determination of enthalpy of ionization of acetic acid.



Vivekanand College, Kolhapur (Empowered Autonomous)

- Determination of enthalpy of neutralization of HCl with NaOH
- Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps using pH-meter.
- To prepare and measure pH of buffer solutions ($\text{CH}_3\text{COOH} + \text{CH}_3\text{COONa}$) by potentiometer.
- To determine equivalent weight of Mg by Eudiometer.

Reference Books:

- 1) Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
- 2) Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
- 3) Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
- 4) Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.
- 5) Khosla, B. D.; Garg, V. C. and Gulati, A. *Senior Practical Physical Chemistry*, S. Chand & Company, New Delhi, 2011.
- 6) Nadkarni, Kothari and Lavande *Practical Book of Physical Chemistry*
- 7) Findley A., *Experimental Physical Chemistry*
- 8) Das, R. C., B, Behra, *Experiments in Physical Chemistry*
- 9) Yadav J. B. *Advance Practical Physical Chemistry*
- 10) Clarke *Handbook of Organic Quantitative Analysis*
- 11) Ahluvalia V. K., *Comprehensive Practical Organic Chemistry*
- 12) Kulkarni, V. S., Dastane, R. *Laboratory Handbook of Organic Qualitative Analysis and Separation*
- 13) Khopkar, S. M., *Basic Concepts in Analytical Chemistry*



Seat No.		Ques. paper code	
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**VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)**

B.Sc. Part- I (Chemistry) (Semester-I) Examination.....

Course Code and Name: MIN03CHE11: Inorganic Chemistry

Day:

Time: 2 hours

Date: --/--/----

Marks : 40

Instructions:

- 1) All the questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Draw neat labelled diagrams wherever necessary.
- 4) Use of log table/calculator is allowed.

Q. 1. Select correct alternative (One mark each):

[8]

- i) Xyzabcdefghijklmnop -----
a) ----- b) ----- c) ----- d) -----
- ii) Xyzabcdefghijklmnop -----
a) ----- b) ----- c) ----- d) -----
- iii) Xyzabcdefghijklmnop -----
a) ----- b) ----- c) ----- d) -----
- iv) Xyzabcdefghijklmnop -----
a) ----- b) ----- c) ----- d) -----
- v) Xyzabcdefghijklmnop -----
a) ----- b) ----- c) ----- d) -----
- vi) Xyzabcdefghijklmnop -----
a) ----- b) ----- c) ----- d) -----
- vii) Xyzabcdefghijklmnop -----
a) ----- b) ----- c) ----- d) -----
- viii) Xyzabcdefghijklmnop -----
a) ----- b) ----- c) ----- d) -----

Q.2. Attempt any TWO (Eight marks each):

[16]

- i) Xyzabcdefghijklmnop.
- ii) Xyzabcdefghijklmnop.
- iii) Xyzabcdefghijklmnop.

Q.3. Attempt any FOUR (Four marks each):

[16]

- i) Xyzabcdefghijklmnop.
- ii) Xyzabcdefghijklmnop.
- iii) Xyzabcdefghijklmnop.
- iv) Xyzabcdefghijklmnop.
- v) Xyzabcdefghijklmnop.
- vi) Xyzabcdefghijklmnop.



SD/Dr

Head
Dept. of Chemistry
Vivekanand College, Kolhapur



**VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)**

**DEPARTMENT OF CHEMISTRY
Three/Four- Years UG Programme
Open Elective**

**Curriculum, Teaching
and Evaluation
Structure**

for

B. Sc. – I Chemistry

Semester - I & II

(Implemented from academic year 2023-24 onwards)




Head
Dept. of Chemistry
Vivekanand College, Kolhapur

**VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)
Department of Chemistry**

Program Outcomes (POs):

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PO6:Ethics and Professionalism: Graduates may learn about the ethical and professional standards in their field, and how to apply them in real-world situations.

B. Sc. In Chemistry

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PSO2: To develop the ability to apply the principles of Chemistry in practical.

PSO3: Acquire skills of different analytical techniques used in chemistry.

PSO4: Develop Skills to evaluate, analyze and interpret the chemical reactions by using various techniques.

PSO5: Acquire knowledge and skills required to hire in any sector related to chemistry as well as to admit for higher education.



**VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)**

Department of Chemistry

Teaching and Evaluation Scheme

Three/Four- Years UG Programme

Open Elective

First Year Semester – I & II

Sr. No.	Course Abbr.	Course code	Course Name	Teaching Scheme Hours/week		Examination Scheme and Marks				Course Credits
				TH	PR	ESE	CIE	PR	Marks	
Semester-I										
1	DSC-I	DSC03CHE11	Inorganic Chemistry	2	-	40	10	-	50	2
2	DSC-II	DSC03CHE12	Organic Chemistry	2	-	40	10	-	50	2
3	MIN-I	MIN03CHE11	Inorganic Chemistry	2	-	40	10	-	50	2
4	MIN-II	MIN03CHE12	Organic Chemistry	2	-	40	10	-	50	2
5	OEC-I	OEC03CHE11	General Aspects of Inorganic Chemistry	2	-	40	10	-	50	2
6	OEC-II	OEC03CHE12	General Aspects of Organic Chemistry	2	-	40	10	-	50	2
Semester-II										
1	DSC-III	DSC03CHE21	Physical Chemistry	2	-	40	10	-	50	2
2	DSC-IV	DSC03CHE22	Analytical Chemistry	2	-	40	10	-	50	2
3	MIN-III	MIN03CHE21	Physical Chemistry	2	-	40	10	-	50	2
4	MIN-IV	MIN03CHE22	Analytical Chemistry	2	-	40	10	-	50	2
5	OEC-III	OEL03CHE21	General Aspects of Physical Chemistry	2	-	40	10	-	50	2
6	OEC-IV	OEL03CHE22	General Aspects of Analytical Chemistry	2	-	40	10	-	50	2
7	SEC-I	SEC03CHE29	Laboratory Safety Management	2	-	-	-	50	50	2
Annual										
1	MIN-PR-I	MIN03CHE29	MIN Chemistry Lab-1	-	4	-	-	50	50	4
2	MIN-PR-I	MIN03CHE29	MIN Chemistry Lab-1	-	4	-	-	50	50	4
3	OEC-PR-I	OEC03CHE12	OEC Chemistry Lab-1	-	4	-	-	50	50	4
Total				24	16	480	120	200	800	38



B. Sc. Part – I Semester - I CHEMISTRY (Open Elective)
OEC-I: OEC03CHE11: GENERAL ASPECTS OF INORGANIC CHEMISTRY

Theory: 30hrs.
Marks-50 (Credits: 02)

CO No.	On completion of the course, student will be able to:
CO1	Learn introductory Inorganic chemistry and understand size, shape and electron distribution in shells and sub-shells of an atom.
CO2	Understand of role of acids and bases in chemistry.
CO3	Illustrate the basic parameters of water, different water softening processes and ill effects of hard water.
CO4	Describe the principle, types and mechanism of corrosion and its control methods.

Unit-I: Periodicity of Elements [8]

- 1.1 Introduction
- 1.2 Shapes of s, p and d atomic orbitals
- 1.3 Electrons filling rules in various orbitals: a) Aufbau's principle b) Hund's rule of maximum multiplicity c) Pauli's exclusion principle.
- 1.4 Electronic configuration of elements, Stability of empty, half-filled and completely filled orbitals.
- 1.5 Periodicity of the elements: General discussion of the following properties of the elements with reference to s block elements: a) electronic configuration b) atomic radii c) ionic radii d) ionization energy e) electron affinity f) electronegativity g) metallic characters h) reactivity i) oxidation state j) melting and boiling points k) chemical properties.

Unit-II: Acids and Bases [4]

- 2.1 Introduction to theories of Acids and Bases
- 2.2 Arrhenius concept
- 2.3 Bronsted- Lowry concept
- 2.4 Lewis concept
- 2.5 Lux-Flood concept



Unit-III: Water [9]

- 3.1 Introduction
- 3.2 Sources of water
- 3.3 Water quality parameters (definition, causes and estimation) like colour, odour, pH, acidity, alkalinity, hardness, chlorides, total solids, dissolved oxygen, Chemical oxygen demand.
- 3.4 Ill effects of hard water in domestic and industrial purposes
- 3.5 Treatment of water by lime soda method, sterilization (chlorination), Zeolite process, ion exchange process, reverse osmosis.

Unit-IV: Corrosion and its Control [9]

- 4.1 Introduction
- 4.2 Types of corrosion, atmospheric corrosion, corrosion due to oxygen and other gases, Electrochemical corrosion
- 4.3 Mechanism of electrochemical corrosion (hydrogen evolution and oxygen absorption)
- 4.4 Factors influencing corrosion
- 4.5 Corrosion control methods - proper design and material selection, cathodic protection, metallic coating like hot dipping (galvanizing and tinning), metal cladding, spraying and electroplating

Reference Books:

- 1) Lee, J. D. Concise Inorganic Chemistry ELBS, 1991.
- 2) Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.
- 3) Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.
- 4) Huheey, J.E., Keiter, E.A. Keiter, R.L. & Medhi, O.K. Inorganic Chemistry:
- 5) Principles of Structure and Reactivity, Pearson Education India, 2006.
- 6) Puri, Sharma, Kalia. Principles of Inorganic Chemistry
- 7) Jain & Jain, 'A textbook of Engineering Chemistry', Dhanpat rai & Co.
- 8) S. S. Dara, 'A textbook of Engineering Chemistry', S. Chand & Co., Delhi.
- 9) Environmental Chemistry, H. Kaur



B. Sc. Part – I Semester - I CHEMISTRY (Open Elective)
OEC-II: OEC03CHE12: GENERAL ASPECTS OF ORGANIC CHEMISTRY

Theory: 30hrs.

Marks-50 (Credits: 02)

CO No.	On completion of the course, student will be able to:
CO1	Understand the fundamental concepts in Organic Chemistry.
CO2	Learn Chemistry of Aliphatic and Aromatic compounds.
CO3	Acquire the knowledge of basic concept of Green chemistry.
CO4	Gain the knowledge about soap and its manufacturing.

Unit-I: Unit I: Fundamentals of Organic Chemistry [8]

- 1.1 Introduction
- 1.2 Inductive, electromeric, resonance and hyperconjugation effect.
- 1.3 Cleavage of bonds- homolysis, heterolysis
- 1.4 Types of reagents and organic reactions.
- 1.5 Introduction of reactive intermediates, carbocation, carbanion, carbon free radical, carbene, nitrene, arynes with their generation, structure, stability.

Unit-II: Chemistry of Aliphatic and Aromatic compounds [8]

- 2.1 Introduction to Aliphatic Compounds - Preparation methods, and Chemical properties.
- 2.2 Aromatic compounds – Classification - Antiaromatic, Nonaromatic, pseudoaromatic etc.
- 2.3 Structure of benzene - MOT and VBT (case- Benzene)
- 2.4 Electrophilic Substitution Reactions – Nitration, Sulphonation and Halogenation

Unit-III: Green Chemistry [7]

- 3.1 Introduction
- 3.2 Twelve Principles of Green Chemistry
- 3.3 Advantages and Applications
- 3.4 Use of Zeolites, Microwave and Ultrasound waves in organic chemical reactions.



3.5 Applications in various fields

Unit-IV: Soaps

[7]

- 4.1 Introduction – Definition, Saponification reaction
- 4.2 Structure of soap molecule, Action of soap/detergent
- 4.3 Classification of soap
- 4.4 Manufacture of soap- Raw materials required for Soap,
- 4.5 Hot or boiled Methods for manufacture of soap
- 4.6 Difference between Soap and detergent
- 4.7 Applications of soap

Reference Books:

- 1) Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. *Organic Chemistry*, John Wiley & Sons (2014).
- 2) McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
- 3) Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
- 4) Eliel, E.L. *Stereochemistry of Carbon Compounds*, Tata McGraw Hill education, 2000.
- 5) Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
- 6) Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
- 7) Tiwari, Vishnoi Textbook of Organic Chemistry.
- 8) R. K. Bansal Textbook of Organic Chemistry.
- 9) E. S. Gould Mechanism and structure in organic chemistry.
- 10) Bhal and Bhal Textbook of Organic Chemistry
- 11) Jerry March Advanced Organic Chemistry
- 12) Phatak, Mahagani, Modern Organic Chemistry
- 13) G.R. Chatwal, reaction Mechanism and reagents in Organic Chemistry
- 14) Stereochemistry by P. S. Kalsi (New Age International)
- 15) Organic Chemistry- Clayden, Greeves, Warren.
- 16) Reaction and rearrangement- S. N. Sanyal.
- 17) Organic Reaction Mechanism- V. K. Ahluwalia.
- 18) Advanced Organic Chemistry- Jagdamba Singh.



B. Sc. Part – I Semester - II CHEMISTRY (Open Elective)
OEC-III: OEC03CHE21: GENERAL ASPECTS OF PHYSICAL CHEMISTRY

Theory: 30hrs

Marks-50 (Credits: 02)

CO No.	On completion of the course, student will be able to:
CO1	Learnandcoherently understand the basic concepts of solution, types of solution and distribution law.
CO2	Acquire knowledge of basic concepts and applications of thermodynamics.
CO3	Gain knowledgeaboutbasic conceptsin Nuclear Chemistry.
CO4	Learnandcoherently understand the concepts of surface tension,viscosityandrefractiveindex.

Unit-I: Solution

[7]

- 1.1 Introduction (solution, solute, solvent, immiscible liquids, miscible liquids etc.)
- 1.2 Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions,
- 1.3 Colligative properties-relative lowering of vapour pressure,
- 1.4 Raoult's law, elevation of B.P.
- 1.5 Nernst distribution law & its limitations
- 1.6 Modification of distribution law with respect to change in molecular state of solute (i.e. association and dissociation of solute in one of the solvent.)
- 1.7 Applications of distribution law i. Process of extraction (derivation expected) ii. Determination of solubility of solute in particular solvent. iii. In distribution indicators. iv. Determination of molecular weight of solute in different solvents.

Unit-II: Thermodynamics

[8]

- 2.1 Introduction,
- 2.2 Basic terms used in thermodynamic study
- 2.3 Zeroth law of thermodynamics
- 2.4 First law of thermodynamics: Statements of first law and its



limitations.

2.5 Internal energy and enthalpy, heat capacity and specific heat, measurement of ΔU and ΔH , enthalpy of: bond dissociation, combustion, formation, atomization, sublimation, phase transition, ionization, solution and dilution.

2.6 Spontaneous and non-spontaneous processes, Second law of thermodynamics, Introduction of entropy as a state function,

2.7 Third law of thermodynamics – statement and introduction

Unit-III Nuclear Chemistry

[8]

3.1 Introduction

3.2 Types of nuclear radiation, properties of α , β and γ rays.

3.3 Rate of radioactive decay, Decay constant, Half life, average life,

3.4 Nuclear stability, mass defect and binding energy. N/Z ratio

3.5 Application of radioisotopes: a) As tracers: i) In studying reaction mechanism, ii) In medicine, iii) In agriculture, iv) In industry, b) As radiotherapy, c) In mutation of crops. d) Carbon dating

Unit-IV: Physical properties of liquids

[7]

4.1 Introduction to states of matter, qualitative description of intermolecular forces in liquids, structure of liquids, classification of physical properties

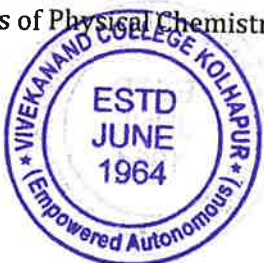
4.2 Surface tension and its determination using stalagmometer and differential rise method

4.3 Viscosity and its determination using Ostwald's viscometer

4.4 Refractive index (Snell's law) specific and molecular refractivities and its determination using Abbe's refractometer

Reference Books

- 1) Castellan, G.W. *Physical Chemistry* 4th Ed. Narosa (2004).
- 2) Kotz, J.C., Treichel, P.M. & Townsend, J.R. *General Chemistry* Cengage Learning India Pvt. Ltd., New Delhi (2009).
- 3) Mahan, B.H. *University Chemistry* 3rd Ed. Narosa (1998).
- 4) Petrucci, R.H. *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York (1985).
- 5) Puri, Sharma, Pathania. *Principles of Physical Chemistry*.



- 6) Principles of Physical Chemistry by murrnpruton.
- 7) S.K. Dogra and Dogra. Physical Chemistry
- 8) Engel and Red, Principles of Thermodynamics
- 9) Peter and Attkins. Physical Chemistry
- 10) Glasston and Levis Principle of Physical Chemistry
- 11) Bhal&Tuli, Physical Chemistry

B. Sc. Part – I Semester - II CHEMISTRY (Open Elective)
OEC-IV: OEC03CHE22: GENERAL ASPECTS OF APPLIED
CHEMISTRY

Theory: 30hrs.

Marks-50 (Credits: 02)

CO No.	On completion of the course, student will be able to:
CO1	Learn concepts of analytical chemistry.
CO2	Understand the various aspects of industrial chemistry such as MSDS, preparation of various solutions and IPR.
CO3	Create awareness and sense of responsibilities towards environment.
CO4	Acquire knowledge of basic chemistry of fuels.

Unit-I:	Introduction to Analytical Chemistry	[7]
	1.1 General Introduction	
	1.2 Importance of analysis	
	1.3 Analytical processes (Qualitative and Quantitative)	
	1.4 Methods of analysis (Only classification)	
	1.5 Sampling of solids, liquids and gases	
	1.6 Errors, types of errors (determinate and indeterminate), methods of expressing accuracy (Absolute and relative error)	
	1.7 Significant figures, mean, median, standard deviation	
	1.8 Numerical problems	

Unit-II:	Fundamentals of Industrial Chemistry and IPR	[7]
	2.1 General introduction, Difference between classical and industrial chemistry, Raw materials for chemical industry, Material safety data sheets (MSDS)	
	2.2 Definition and Explanation of terms – Molecular weight, Equivalent	



weight, Molarity, Normality, Molality, Molarity of mixed solution, Acidity of base, Basicity of acid, ppt, ppm, ppb solutions, Mole Fraction, Weight fraction, Percentage composition by W/W, W/V, V/V, Problems based on Normality, Molarity, mole fraction, mixed solution, etc.

2.3 IPR – Introduction to IPR and its significance in present scenario

Unit-III: Environmental Chemistry

[8]

- 3.1 Concept and Scope of environmental chemistry
- 3.2 Environmental segments- Atmosphere, Hydrosphere, Lithosphere, Biosphere
- 3.3 The Natural cycles of the environment: General introduction of Hydrological cycle, Oxygen cycle, Nitrogen cycle, Phosphate cycle, Sulfur cycle.
- 3.4 Detail explanation of Oxygen cycle.
- 3.5 Composition of the atmosphere: Major component, Minor Component and trace component.
- 3.6 Toxic trace elements in the natural water and waste water: Elements, Sources and effects.
- 3.7 Air Pollutants - Primary pollutants sources,
- 3.8 Chemistry of Acid rain

Unit-IV: Fuel

[8]

- 4.1 Definition of fuel, classification of fuel a) on the basis of physical state b) on the basis of source.
- 4.2 Characteristics of good fuel,
- 4.3 Calorific value & its determination by Bomb Calorimeter.
- 4.4 Coal-Proximate analysis of coal and its importance
- 4.5 Fuel quality rating- octane number and cetane number
- 4.6 Gaseous fuel: Composition, calorific value and application of CNG, LPG and biogas.
- 4.7 Renewable energy sources: Types and general introduction of Solar energy, tidal energy, biomass energy, wind energy, fuel cells.
- 4.8 Advantages of gaseous fuel over solid fuels.



Reference Books:

- 1) Environmental chemistry by A. K. De
- 2) Modern Analytical Chemistry by David Harvey, McGRAW-Hill International Edition, 2000
- 3) Industrial chemistry by B.K. Sharma, GMajor Publishing Housing, 16th edition 2011
- 4) Analytical chemistry by B.K. Sharma, Krishna Prakashan Media Ltd, Meerut, edition 3rd 2011
- 5) Principles of electroplating and electroforming by Blum and Hogaboom



OEC- PR-I: OEC03CHE29: CHEMISTRY LAB-1

Practical: Four hours week per batch

Marks: 50 (Credits 02)

Section - I: Inorganic Chemistry

- To prepare standard 0.1 N KMnO_4 solution and to determine the strength of given oxalic acid solutions.
- To determine quantity of Fe (II) ions from the given solutions by titrating it with 0.1N $\text{K}_2\text{Cr}_2\text{O}_7$ solutions by using internal indicator.
- Estimation of amount of Acetic acid from the given vinegar sample by titrimetric method.
- Water analysis: To determine the alkalinity of water sample by using Phenolphthalein and Methyl Orange Indicator
- To estimate amount of Cu (II) ions by iodometric titration by using $\text{Na}_2\text{S}_2\text{O}_3$ solution
- **Spot Tests:** Detection of following cations using spot tests: Cu^{2+} , Co^{2+} , Ni^{2+} , Fe^{3+} , Al^{3+} , Zn^{2+} , Mg^{+2} , Pb^{2+}
- **Paper Chromatography**
Detection of following cations using Paper Chromatography: $\text{Cu}^{2+} + \text{Co}^{2+}$, $\text{Co}^{2+} + \text{Ni}^{2+}$, $\text{Ni}^{2+} + \text{Cu}^{2+}$

Section-II: Organic Chemistry

- Organic Spotting – (6)
- Estimation of Aniline/Phenol
- Estimation of Aspirin from given pharmaceutical tablet.
- Preparation and purification of Oximes of ketones.
- Preparation and purification of 2,4-DNPs of ketones.
- Preparation of 2, 4 dinitro benzene from nitrobenzene.

Section-III: Physical Chemistry

- To study the reaction rate of hydrolysis of methyl acetate in presence of 0.5N HCl.
- To determine viscosity of given liquid A and B.
- Determination of enthalpy of ionization of acetic acid.
- Determination of enthalpy of neutralization of HCl with NaOH



Vivekanand College, Kolhapur (Empowered Autonomous)

- Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps using pH-meter.
- To prepare and measure pH of buffer solutions ($\text{CH}_3\text{COOH}+\text{CH}_3\text{COONa}$) by potentiometer.
- To determine equivalent weight of Mg by Eudiometer.

Reference Books

- 1) Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
- 2) Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
- 3) Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
- 4) Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.
- 5) Khosla, B. D.; Garg, V. C. and Gulati, A. *Senior Practical Physical Chemistry*, S. Chand & Company, New Delhi, 2011.
- 6) Nadkarni, Kothari and Lavande *Practical Book of Physical Chemistry*
- 7) Findley A., *Experimental Physical Chemistry*
- 8) Das, R. C., B, Behra, *Experimens in Physical Chemistry*
- 9) Yadav J. B. *Advance Practical Physical Chemistry*
- 10) Clarke *Handbook of Organic Quantitative Analysis*
- 11) Ahluvalia V. K., *Comprehensive Practical Organic Chemistry*
- 12) Kulkarni, V. S., Dastane, R. *Laboratory Handbook of Organic Qualitative Analysis and Separation*
- 13) Khopkar, S. M., *Basic Concepts in Analytical Chemistry*



Seat No.		Ques. paper code	
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**VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)**

B.Sc. Part- I (Electronics) (Semester-I) Examination.....
 Course Code and Name: OEC03CHE11: General Aspects of Inorganic Chemistry
 Day: _____ Time: 2 hours
 Date: --/--/---- Marks : 40

Instructions:

- 1) All the questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Draw neat labelled diagrams wherever necessary.
- 4) Use of log table/calculator is allowed.

Q. 1. Select correct alternative (One mark each):

[8]

- | | | | |
|---------------------------|----------|----------|----------|
| i) Xyzabcdefghijklmnop | ----- | | |
| a) ----- | b) ----- | c) ----- | d) ----- |
| ii) Xyzabcdefghijklmnop | ----- | | |
| a) ----- | b) ----- | c) ----- | d) ----- |
| iii) Xyzabcdefghijklmnop | ----- | | |
| a) ----- | b) ----- | c) ----- | d) ----- |
| iv) Xyzabcdefghijklmnop | ----- | | |
| a) ----- | b) ----- | c) ----- | d) ----- |
| v) Xyzabcdefghijklmnop | ----- | | |
| a) ----- | b) ----- | c) ----- | d) ----- |
| vi) Xyzabcdefghijklmnop | ----- | | |
| a) ----- | b) ----- | c) ----- | d) ----- |
| vii) Xyzabcdefghijklmnop | ----- | | |
| a) ----- | b) ----- | c) ----- | d) ----- |
| viii) Xyzabcdefghijklmnop | ----- | | |
| a) ----- | b) ----- | c) ----- | d) ----- |

[16]

Q.2. Attempt any TWO (Eight marks each):

- i) Xyzabcdefghijklmnop.
- ii) Xyzabcdefghijklmnop.
- iii) Xyzabcdefghijklmnop.

[16]

Q.3. Attempt any FOUR (Four marks each):

- i) Xyzabcdefghijklmnop.
- ii) Xyzabcdefghijklmnop.
- iii) Xyzabcdefghijklmnop.
- iv) Xyzabcdefghijklmnop.
- v) Xyzabcdefghijklmnop.
- vi) Xyzabcdefghijklmnop.



S. D. K.

Head
 Dept. of Chemistry
 Vivekanand College Kolhapur