



Estd. 1962
NAAC 'A' Grade

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दुरध्वनी (ईपीएबीएक्स) २६०९००० (अभ्यास मंडळे विभाग— २६०९०९४)

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SU/BOS/Sci & Tech/433

Date: 17/06/2023

To,
The Principal,
All affiliated college,
Shivaji University, Kolhapur.

Subject: Regarding minor change in Syllabus of **B.Sc. Part-I Chemistry Programme as NEP-2020** under Faculty of Science & Technology.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the University have accepted and granted approval to minor change in Structure of **B.Sc. Part-I Chemistry Programme as NEP-2020** under Faculty of Science & Technology which is enclosed herewith.

This minor change in Syllabus of will be implemented from the academic year 2023-24 i.e.

You are therefore, requested to bring this to the notice, all students and teachers concerned.

Thanking you,

Yours faithfully,

Dy. Registrar

Copy to :-

1	The Dean, Faculty of Science & Technology	8	Appointment Section
2	The Chairman, Respective, BOS	9	Centre for Distance Education
3	Exam Section	10	Computer Centre
4	Eligibility Section	11	Affiliation Section (U.G.)
5	O.E. I Section	12	Affiliation Section (P.G.)
6	O.E. II Section	13	P.G.Admission Section
7	O.E. III Section	14	P.G.Seminar Section

Shivaji University

Kolhapur



Accredited By NAAC with 'A++' Grade

Revised Syllabus for Bachelor of Science

Part-I

Chemistry

(NEP-2020)

To be implemented from

June, 2022 onwards

Minor Change in B.Sc. I NEP-2020 Chemistry Sem. I & II Syllabus		
Sem. I Paper-I Inorganic Chemistry (Implemented from- 2023-24)		
	Present	Corrected
Unit IV	Unit-Chemical Bonding and Molecular structure (C) Molecular orbital theory (MOT)	The present unit is replaced by new unit- Acids and Bases
Unit V	No Unit	P-block elements unit is added
Sem. I Paper II Organic Chemistry (Implemented from- 2023-24)		
Unit IV	Unit IV: Cycloalkanes, cycloalkenes and alkadienes	Present unit is replaced by Unit IV: Heterocyclic Compounds
Sem. II, Paper III Physical Chemistry (Implemented from- 2023-24)		
Unit I	---	Additional Topic added- Mathematical Concepts as Unit-I
Unit I	Unit -I Chemical Energetics B) Thermochemistry	Part B is Removed and Unit I is now Unit II- Thermodynamics
Unit II	Chemical equilibrium	This Unit is removed.
Unit III	Kinetic Theory of Gases	This is removed and replaced by Physical Properties of liquids as Unit IV
Unit V	No unit	New Unit Electrochemistry is added.
Sem. II, Paper IV (Implemented from- 2023-24)		
Unit IV	Water Analysis	It is replaced by Unit II- Fundamentals of Industrial Chemistry and IPR
Unit V	Fertilizer Analysis	It is replaced by Unit Soaps and Detergents.

Structure of B. Sc. I Chemistry

Sr. No.	Semester	Title of Paper
1	I	DSC-3A Paper-I, Inorganic Chemistry (2 credits, 30 Hours, 38 Lectures)
2		DSC-4A Paper -II, Organic Chemistry (2 credits, 30 Hours, 37 Lectures)
4	II	DSC-3B Paper -III, Physical Chemistry (2credits, 30 Hours, 38 Lectures)
5		DSC-4B Paper -IV, Analytical Chemistry (2credits, 30 Hours, 37 Lectures)

B. Sc. I (NEP-2020) Semester I DSC-3A Paper I

(Inorganic Chemistry)

(Theory Credits-02, 30 hours, 38 Lectures)

Name of the topic	Expected learning outcomes
1. Atomic structure and Periodicity of Elements	To learn and understand introductory inorganic chemistry. To understand size, shape and electron distribution in shells and sub- shells of an atom.
2. Ionic Bonding	To learn different types of bonds and nature of bonding in inorganic compounds. Calculations of different energies associated with ionic bonding.
3. Chemical Bonding - Valence bond theory (VBT)	Knowledge of nature of bonding, geometry, stability, and magnetic characters of covalent compounds by applying VBT.
4. Acids and Bases	Understanding of role of acids and bases in chemistry. The study is useful in all chemical areas.
5. P-block elements	To learn and understand the properties and uses of the compounds of p-block elements.

Unit I: Atomic Structure and Periodicity of Elements

(8 hours)

1.1 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 hours)

2.1 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.

2.2 Definition and formation of ionic bond. General characteristics of ionic bonding

2.3 Energetic in Ionic bond formation.

2.4 Born-Haber cycle for NaCl and its applications.

2.5 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 hours)

3.1 VSEPR Theory.

3.2 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^3d hybridization)

v) Octahedral geometry- SF_6 (sp^3d^2 hybridization)

vi) Pentagonal bipyramidal geometry – IF_7 (sp^3d^3 hybridization)

Unit IV: Acids and Bases

(4 hours)

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).

4.2.1 Classification of Acids and Bases as hard soft and borderline.

4.2.2 Pearson's HSAB concept.

4.2.3 Acid –Base strength and hardness-softness.

4.2.4 Application and limitations of HSAB concept.

Unit V: P-Block Elements (Group 13, 14, 15)

(07 hours)

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.

5.3.1 Boron –diborane (only structure).

5.3.2 Allotropes of carbon and phosphorus.

5.3.3 Oxyacids of Nitrogen (HNO_2 , HNO_3).

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) Madan R. L. Chemistry for Degree Students (B. Sc. First year), S. Chand

B.Sc. Part I (NEP-2020) SEMESTER-I

DSE-4A Paper II, Organic Chemistry

(Theory Credits: 02, 30 hours, 37 Lectures)

Name of the topic	Expected learning outcomes
1. Fundamentals of Organic Chemistry	The students are expected to understand the fundamentals and basic principles involved in organic chemistry.
2. Stereochemistry	Understanding the spatial arrangement of atoms of organic molecule and types of stereoisomers.
3. Aromaticity	Knowledge of general properties and fundamental reactions of aromatic compounds.
4. Heterocyclic Compounds	To understand the basic knowledge of heterocyclic compounds. To get knowledge of methods to preparation, physical and chemical properties of some heterocyclic compounds with five and six membered heterocycles containing N as the hetero atom(Pyrrole and Pyridine).

Unit I: Fundamentals of Organic Chemistry

(9 hours)

Introduction, Curved arrow notations, Cleavage of Bonds: Homolysis and Heterolysis. Organic molecular species: Nucleophiles and electrophiles. Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyper conjugation effect, Reactive Intermediates: Generation, Structure, Stability and Reactions of Carbocations, Carbanions, Carbon free radicals, Carbene and Nitrene.

Unit II: Stereochemistry**(9 hours)**

Introduction, Types of Stereoisomerism, Representation of organic molecules using Wedge, Fischer, Sawhorse and Newman formula, Optical Isomerism: Concept of Chirality, Elements of Symmetry, Optical Isomerism in tartaric acid, 2, 3 Dihydroxybutanoic acid, Enantiomerism, Diastereomerism and Meso compounds, Geometrical isomerism in C=C, C=N and alicyclic compounds. Nomenclature of stereoisomers: D and L, Erythro and Threo, R and S, E and Z.

Unit III: Aromaticity**(6 hours)**

Introduction, Characteristics properties of aromatic compounds, Meaning of terms: Aromatic, Non aromatic, Antiaromatic, Pseudoaromatic, Classification of aromatic compounds, Structure of Benzene: Kekule structure, Resonance structure, M.O. picture, Modern theory of Aromaticity, Mechanism of Electrophilic substitution reactions: Nitration, Sulphonation, Halogenation and Friedel - Crafts reaction.

Unit IV: Heterocyclic Compounds**(6 hours)**

Introduction, Classification and Nomenclature of heterocyclic compounds.

Nitrogen Heterocycles:

- a) Pyrrole:- Introduction, Synthesis, Physical and chemical properties.
- b) Pyridine:- Introduction, Synthesis, Physical and chemical properties.

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 Pvt Ltd, 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) Bahl, A. & Bahl, B. S. Advanced Organic Chemistry, S. Chand, 2010.
- 8) Nasipuri, D. Stereochemistry of Organic compounds: Principles and Applications.
- 9) Madan, R. L. Chemistry for Degree Students (B. Sc. First Year), S. Chand Publication.
- 10) Heterocyclic chemistry, J.A. Joule and K. Mills, 4th ed., Blackwell Publishing 2000
- 11) John A. Joule, Keith Mills.; Heterocyclic Chemistry, 5th Edition, April 2010, ©2010, Wiley Blackwell,
- 12) Gilchrist, T. L. Heterocyclic chemistry; 3rd ed.; Addison Wesley Longman: Edinburgh Gate, 1997.
- 13) Joule, J. A.; Mills, K.; Heterocyclic chemistry; 4th ed.; Blackwell Science: Oxford, 2000.

B. Sc. I (NEP-2020) Semester II

DSC-3B: Paper -III (Physical Chemistry)

(Credits: 02, 30 hours, 38 Lectures)

Name of the Topic	Expected Learning Outcome
1. Basic Mathematical Concepts	Learning and coherent understanding of basic concepts and rules of logarithms, graphs, derivative and integrations.
2. Thermodynamics	Knowledge and coherent understanding of basic concepts in thermodynamics will be gained by the student.
3. Chemical Kinetics	Learning and understanding the knowledge about basic concepts in kinetics and first order, second order reactions with characteristics and suitable examples.
4. Physical properties of liquids	Learning and coherent understanding of surface tension, viscosity and refractive index with suitable examples.
5. Electrochemistry	Learning and coherent understanding of basic concepts in electrochemistry, conductors and conductivity cells, measurement of conductance with suitable examples and numerical problems.

Unit 1: Basic Mathematical Concepts

(3 hours)

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 2: Thermodynamics

(5 hours)

2.1 Introduction, Basic terms used in thermodynamics, Zeroth law of thermodynamics.

2.2 First law of thermodynamics: Mathematical equation, sign conventions, statements of first law and its limitations.

2.3 Spontaneous and non-spontaneous processes, Second law of thermodynamics.

2.4 Heat engine, Carnot's Cycle and efficiency of heat engine.

2.5 Numerical Problems.

Unit 3: Chemical Kinetics

(8 hours)

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.

Unit4: Physical properties of liquids

(6 hours)

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 5: Electrochemistry

(8 hours)

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) Barrow, G.M. Physical Chemistry Tata McGraw-Hill(2007).

2) Castellan G.W. Physical Chemistry 4 th Ed. Narosa(2004).

3) Kotz, J.C. Treichel, P.M.&Townsend,J.R.General Chemistry, Cengage Learning India Pvt Ltd: New Delhi(2009).

4) Mahan ,B.H. University Chemistry, 3rd Ed. Narosa(1998).

5) Petrucci, R.H. General Chemistry, 5th Ed., Macmillan Publishing Co,: New York(1985).

6) Elements of Physical Chemistry S., Glasstone, D.Lewis.(2010)

- 7) Principles of physical Chemistry Marron and Prutton. (2007).
- 8) Elements of Physical Chemistry P.W.Atkins(2017-18)
- 9) Essentials of Physical Chemistry Bahl and Tuli. S. Chand,2010.
- 10) Physical Chemistry Danials and Alberty (2016)
- 11) University General Chemistry C. N. R.Rao(2016)
- 12) Priniples of Physical Chemistry, Puri, Sharma and Pathania 47th Edison, Vishal Publishing Co.
- 13) Physical Chemistry , A. J.Mee
- 14) Advanced Physical Chemistry, GurudeepRaj
- 15) Physical Chemistry , R. A.Alberty
- 16) General Chemistry, 5th Edition, Macmillan Publishing Co. , New York (1985)

B. Sc. I Semester II

DSC-4B-Chemistry Paper IV, Analytical Chemistry

(Theory Credits:02, Lectures-30 hours, 37 Lectures)

Name of the topic	Expected learning Outcomes
1. Introduction to analytical Chemistry	Learning various analytical procedures and importance also sampling ,accuracy and precision
2. Fundamentals of Industrial Chemistry and IPR	a. Distinguish between classical and industrial chemistry b. Learning and Understanding basic concepts and concentration terms c. Knowledge of IPR
3. Chromatography	Knowledge of chromatographic separation technique and terms involved in it. Learning paper chromatography and thin layer chromatography
4. Theory of titrimetric Analysis	Knowledge of various type of titrations, neutralization curves, indicators used in various titrations
5. Soaps and Detergents	Knowledge about the chemical nature and cleansing action of soap

1. Introduction to analytical Chemistry (6 hours)

1.1 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 (Numerical problems expected)

2. Fundamentals of Industrial Chemistry and IPR (7 hours)

2.1 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 presence scenario

3. Chromatography (6 hours)

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, Rf value, Applications, advantages and disadvantages

3.4 Comparison of paper chromatography and TLC

4. Theory of titrimetric Analysis

(6 hours)

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

a. Strong acid-strong base

b. Strong acid-weak base

c. Strong base-weak acid

4.5 Complexometric titrations

a. Introduction

b. Types EDTA titrations

c. Metallochromic indicators-Eriochrome black- T

d. Indicator Action of Eriochrome black- T

5. Soaps and Detergents

(6 hours)

5.1 Introduction

5.2 Soaps - Raw materials, Types of soaps, Cleansing action of soap, Manufacture of soap - Boiled or Hot Process, Cold process.

5.3 Detergents - Types of Detergents: Anionic, cationic and amphoteric (with example), Preparation of Teepol and Deriphat

5.4 Preparation of Shampoos

5.5 Comparisons between soaps and detergents.

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, Goel Publishing Housing, 16th edition 2011
- 5) Advanced Inorganic Chemistry, Vol.No.1, by Gurudeep Raj, Krishna Prakashan Media Ltd, Goel Publication, 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. I Practical Course
(2 Credit, 04 hours per week)

Practicals:

(A) Inorganic Chemistry

- 1) To determine quantity of Fe (II) ions from the given solutions by titrating it with 0.1N $K_2Cr_2O_7$ solution by using internal indicator
- 2) To estimate amount of Cu (II) ions by Iodometric titration by using $Na_2S_2O_3$ solution.
- 3) To prepare standard 0.1 N $KMnO_4$ solution and to determine the strength of given oxalic acid solution.
- 4) Estimation of amount of Acetic acid from the given vinegar sample by titrimetric method
- 5) To standardize supplied EDTA solution by titrating with 0.01 M $ZnSO_4$ solution and to estimate amount of calcium from given solution by using Erio- T as an indicator.
- 6) Quality control-To determine percentage purity of the given sample of soda ash (Na_2CO_3) by titrimetric method.
- 7) Chromatography: Separation and identification of cations by Paper Chromatography technique from the following mixtures :
 - a) $Ni^{2+} + Cu^{2+}$
 - b) $Ni^{2+} + Co^{2+}$
- 8) Spot Test: Identify the following metal ions by spot test method.
 $Cu^{2+}, Ni^{2+}, Co^{2+}, Fe^{3+}, Al^{3+}, Pb^{2+}, Zn^{2+}, Hg^{+2}, Mg^{+2}, Mn^{+2}$

B) Organic Chemistry

- 1) Estimations :
 - i) Estimation of Aniline. (by Bromination method)
 - ii) Estimation of Acetamide.
 - iii) Estimation of Aspirin tablet.

2) Organic Qualitative Analysis: Detection of physical constant, type, elements, functional group, and Confirmatory test. Identification of Organic Compounds (at least eight) (four containing at least one extra element- N, S, Cl)

a) Acids: Oxalic acid, Benzoic acid, Cinnamic acid

b) Phenols: Beta-Naphthol, p-Nitrophenol

c) Base: Aniline, p-Nitroaniline

d) Neutral: Acetone, Acetanilide, Chloroform, m-Dinitrobenzene, Thiourea, Bromobenzene

3) Purification of organic compounds by crystallization (from water and alcohol) and distillation.

C) Physical Chemistry:

1) Determination of viscosity of given liquids A and B (Density data of liquids, viscosity of water to be given) [Any two liquids from Acetone, Carbon tetra chloride, Chloroform, Ethyl alcohol, Benzyl alcohol, Ethylene glycol and n- propyl alcohol]

2) To study the velocity constant of hydrolysis of methyl acetate in presence HCl/H₂SO₄.

3) To study the reaction between Potassium persulphate and Potassium iodide kinetically (equal concentration).

4) Determination of heat of ionization of weak acid by using polythene bottle.

5) Determination of Surface tension of the given liquids by Stalagmometer.

6) Determination of equivalent weight of Mg by eudiometer.

7) Determination of Cell constant of given conductivity cell using KCl solution. (N/10 and N/50 KCl) (Solutions should be prepared by the students).

8) Preparation and standardization of HCl/H₂SO₄ solution from the bulk.

References:

1) Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.

- 2) Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009
- 3) Vogel's Text Book of Quantitative Chemical Analysis. (Longmann) ELBS Edition.
- 4) Vogel's Text Book of Qualitative Chemical Analysis. (Longmann) ELBS Edition.
- 5) Hand book of Organic Qualitative Analysis: Clarke.
- 6) Comprehensive Practical Organic Chemistry – Qualitative Analysis by V. K. Ahluwalia, Sunita Dhingra. University Press. Distributor – Orient Longman Ltd.
- 7) Comprehensive Practical Organic Chemistry preparation and Quantitative Analysis: V. K. Ahluwalia, Renu Aggarwal. University Press. Distributor – Orient Longman Ltd.
- 8) A Laboratory Hand - Book of Organic Qualitative Analysis and Separation: V. S. Kulkarni. Dastane Ramchandra & Co. Pune
- 9) Practical book of Physical Chemistry: Nadkarni, Kothari & Lawande.
- 10) Experimental Physical Chemistry: A. Findlay.
- 11) Systematic Experimental Physical Chemistry: S. W. Rajbhoj, Chondhekar. (Anjali Publication.)
- 12) Experiments in Physical Chemistry: R. C. Das and B. Behra. (Tata McGrawHill)
- 13) Advanced Practical Physical Chemistry: J. B. Yadav (Goel Publishing House.)
- 14) Practical Physical Chemistry: B. D. Khosala. (R. Chand & Sons)
- 15) Experiments in Chemistry: D. V. Jahagirdar.
- 16) A Text Book of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis: A.I. Vogel (Third Ed.) (ELBS)

B.Sc. I Syllabus (NEP-2020)

To be implemented from June 2023 onwards Semester I & II

Nature of Question paper

Total Marks 40

Q.1 Choose the correct alternative and rewrite the sentence again. 8 Marks

- a)
- b)
- c)
- d)
- e)
- f)
- g)
- h)

Q.2. Attempt any TWO of the following (Out of Three)

16 Marks

- a)
- b)
- c)

Q.3. Answer any FOUR of the following (Out of SIX)

16 Marks

- a)
- b)
- c)
- d)
- e)
- f)

B.Sc. I Syllabus (NEP-2020)
To be implemented from June 2023 onwards
Nature of Practical Examination

Total Marks 50

Q.1 Physical Section Experiment	15 Marks
Q. 2 Organic Section Experiment	15 Marks
Q. 3 Inorganic Section Experiments	15 Marks
Q. 4 Journal	05 Marks