

University of Mumbai, Mumbai
R.P. Gogate College of Arts & Science
&
R.V. Jogalekar College of Commerce
(Autonomous)
Ratnagiri



Syllabus for

F.Y. B.Sc.

(Chemistry)

Semester I and II

Under Choice Based Credit System
(CBCS)

As Per framework of NEP 2020

With effect from the academic Year- 2023-2024

Revised Scheme of Examination Faculty
of Science
(Under-graduate Programme) Choice
Based Credit System (CBCS) Scheme
of Examination

Bachelor of Science (B.Sc.) Programme

The performance of the learners shall be evaluated into two parts. The learner's performance shall be assessed by Internal Assessment with 40% marks and by conducting the Semester End Examinations with 60% marks. The allocation of marks for the Continuous Internal Evaluation and Semester End Examinations are as shown below-

A) Continuous Internal Evaluation: 40 % (20 Marks)

Sr. No.	Particulars	Marks
01	Unit Test (MCQ / Descriptive – Based on Theory and/or Problems - Online/Offline – 1 unit test of 10 marks	10
02	Assignment / seminar / class test / worksheets	05
03	Active participation in routine class instructional deliveries and Overall conduct as a responsible learner.	05

B) Semester End Examination: 60% (30 Marks)

30 Marks per paper Semester End Theory Examination:

1. Duration - These examinations shall be of one hour duration.
2. Theory question paper pattern:
 - a. There shall be 03 questions each of 10 marks on each unit.
 - b. All questions shall be compulsory with internal choice within the questions.

Standard of Passing

The learner to pass a course shall have to obtain a minimum of 40% marks in aggregate for each course where the course consists of Continuous Internal Evaluation and Semester End Examination. The learner shall obtain minimum of 40% marks (i.e. 8 out of 20) in the Internal Assessment and 40% marks in Semester End Examination (i.e. 12 out of 30) separately, to pass the course and minimum of Letter Grade "P" in the project component, wherever applicable to pass a particular semester. A learner will be said to have passed the course if the learner passes the Continuous Internal Evaluation and Semester End Examination together.

Performance Grading:**Letter Grades and Grade Points**

Semester GPA/ Program CGPA Semester/Program	% of Marks	Alpha-Sign / Letter Grade Result
9.00-10.00	90.0 -100	O (Outstanding)
$8.00 \leq 9.00$	$80.0 \leq 90.0$	A+ (Excellent)
$7.00 \leq 8.00$	$70.0 \leq 80.0$	A (Very Good)
$6.00 \leq 7.00$	$60.0 \leq 70.0$	B+ (Good)
$5.50 \leq 6.00$	$55.0 \leq 60.0$	B (Above Average)
$5.00 \leq 5.50$	$50.0 \leq 55.0$	C (Average)
$4.00 \leq 5.00$	$40.0 \leq 50.0$	P (Pass)
Below 4.00	Below 40	F (Fail)
Ab (Absent)	-	Absent

B.Sc. Programme
Under Choice Based Credit System (CBCS)
Course Structure (Autonomous)
First Year BSc

Semester I	Credits	No of Lectures (1Hr)	Semester II	Credits	No of Lectures (1Hr)
Physical and Inorganic Chemistry I	02	30	Physical and Inorganic Chemistry II	02	30
Organic and Inorganic Chemistry I	02	30	Organic and Inorganic Chemistry II	02	30
Chemistry Practical I	02	60	Chemistry Practical II	02	60
Laboratory Skills in Chemical sciences	02	60	Skills in Chemical Analysis I	02	60

SEMESTER I

Course Code	Unit	Topic	No of Lectures (1Hr)	L/ per week (1Hr)	Credits
23_USCH101	I	Chemical Thermodynamics	7	2	2
		Chemical Calculations	3		
	II	Chemical Kinetics	6		
		Liquid State	4		
	III	Atomic Structure	4		
			Periodic table and Periodicity		
23_USCH102	I	Basics of Organic Chemistry	10	2	2
	II	Stereochemistry I	10		
	III	Comparative chemistry of Main Group Elements	10		
23_USCH103		Chemistry Practical	60	4	2
23_USCHV104		Vocational Skill Course: Laboratory Skills in Chemical sciences	60	4	2

SEMESTER II

Course Code	Unit	Topic	No of Lectures (1Hr)	L/ per week (1Hr)	Credits
23_USCH201	I	Gaseous State	3	2	2
		Electrochemistry-I	3		
		Chemical Equilibria and Thermodynamic Parameters	4		
	II	Ionic Equilibria	6		
		Molecular Spectroscopy	4		
	III	Concept of Qualitative Analysis	6		
		Acid Base Theories	4		
23_USCH202	I	Chemistry of Aliphatic Hydrocarbons	10	2	2
		Stereochemistry I	2		
	III	Aromatic Hydrocarbons	8		
		Chemical Bond and Reactivity	10		
23_USCH203		Chemistry Practical	60	4	2
23_USCHS204		Skill Enhancement Course: Skills in Chemical Analysis I	60	4	2

Name of Programme	B.Sc.
Level	UG
No of Semesters	I and II
Year of Implementation	2023-24
Programme Specific Outcomes (PSO)	<ol style="list-style-type: none"> 1. Acquire the fundamental knowledge of the main branches of chemistry viz. Physical, Inorganic, and Organic 2. Identify and separate components of organic or inorganic origin and will also be able to analyze them by making use of the modern instrumental methods learned. 3. Inculcate the skills useful in chemistry laboratory. 4. Acquire and explore essential skills to succeed in various chemical industries. 5. Appreciate the central role of chemistry in our society and use this as a basis for ethical behavior in issues facing chemists including an understanding of safe handling of chemicals, environmental issues and key issues facing our society in terms of energy, health and medicine.
Relevance of PSO's to the local, regional, national, and global developmental needs (200 words)	<p>The Bachelor of Science in Chemistry programme equips the candidate with knowledge, general competence, and analytical skills on an advanced level, needed in industry, consulting, education, and research and public and private administration.</p> <p>On completion of the programme, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Identify, formulate and analyze scientific problems and reach concrete solutions for societal benefits using various principles of chemical sciences. 2. Introduce the concepts useful for industries viz. Pharmaceutical, dyes, bulk chemical 3. Monitor and assess regional environmental issues and industry process effectively.

Syllabus for B.Sc. Chemistry from the year 2023-24

Name of the Course	Physical and Inorganic Chemistry I
Course Code	23_USCH101
Class	F.Y.B.Sc. (Chemistry)
Semester	I
No of Credits	02
Nature	Theory
Type	Major / Minor
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	<p>Restructuring of syllabus has been done to ensure a smooth and logical flow of content throughout the curriculum. It also facilitates the logical progression of subjects which allows learners to build their understanding of subject progressively and systematically to grasp contents more effectively.</p> <p>The course equips learners with the basic understanding of chemical thermodynamics, chemical calculations, chemical kinetics, atomic structure, and periodic table and periodicity.</p> <p>In addition to above, the syllabus also focuses on practical. Problem- solving exercises that require learner to apply these theories and basic concepts to real world scenarios.</p> <p>Chemical thermodynamics helps in understanding the energetics of chemical reaction and phase changes. Learner can apply it for process optimization in industries such as petrochemical where efficiency and cost effectiveness are crucial.</p> <p>Chemical kinetics involves study of rates of reaction and factors that influence them. Graduates with proficiency in this field demonstrates strong problem solving skills which are valued in R and D in chemical industry.</p> <p>By Understanding concept relating to concentration learner can able to calculate molality, molarity, normality and use this concepts to prepare solutions of specific concentration</p> <p>Interpreting periodic table requires critical thinking and analytical skills. Learner can able to predict elemental properties, chemical properties etc. from the periodic table.</p>

Nomenclature: Physical and Inorganic Chemistry I

Course Outcomes:

On successful completion of this course learners will be able to:

CO1	Understand fundamental thermodynamic terms, apply the first law of thermodynamics, understand the concepts of heat (q), work (w), internal energy (U), and enthalpy (H). analyze thermodynamic processes, express and Calculate concentration of solutions.
CO2	Understand and analyze reaction kinetics, comprehend surface tension and its measurement, understand and measure viscosity, study liquid crystals and their applications.
CO3	Understand the historical development of atomic structure, apply principles of quantum mechanics to atomic structure, classify elements using the periodic table, analyze periodic trends and properties of elements

Curriculum:

Unit	Title	Learning Points	No of Lectures (in Hrs)
I	Chemical Thermodynamics	Thermodynamic terms: System, surrounding, boundaries, types of system, Intensive and Extensive properties, State functions and path functions, Thermodynamic processes. First law of thermodynamics: Concept of heat (q), work (w), internal energy (U), enthalpy, heat capacity, relation between heat capacities, sign conventions, calculations of heat, work, internal energy and enthalpy(H). (Numerical problems expected where ever necessary)	7
	Chemical Calculations	Methods of expressing concentration of solutions: Normality, Molarity, Formality, Mole fractions, Weight ratio, Volume ratio, Weight to volume ratio, ppm, ppb, millimoles, milliequivalents, Preparation of solutions. (Numerical problems expected wherever necessary)	3

References:

Physical Chemistry

1. Concise Graduate Chemistry – I, II, III and IV, University Textbook of Chemistry, University of Mumbai.
2. Atkins, P.W. and Paula, J. de Atkin's Physical Chemistry 10th Ed. Oxford University Press (2014).
3. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
4. Keith J. Laidler and John H. Meiser, Physical Chemistry, 2nd Ed. (2004)
5. Puri B.R., Sharma L.R. and Pathania M.S. Principles of Physical Chemistry, Vishal Publishing Company, 2008
6. Ball, D.W. Physical Chemistry Thomson Press, India (2007).
7. Mortimer, R.G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).
8. Engel, T. and Reid, P. *Physical Chemistry 3rd Ed.*, Prentice-Hall (2012).
9. Mc Quarrie, D.A. and Simon, J.D. *Molecular Thermodynamics* Viva Books Pvt. Ltd.: New Delhi (2004).
10. Levine, I.N. *Physical Chemistry* 6th Ed., Tata Mc Graw Hill (2010)

Inorganic Chemistry

1. Concise Graduate Chemistry–I, II, III and IV, University Text Book of Chemistry, University of Mumbai.
 2. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
 3. Douglas, B E and Mc Daniel, D.H. Concepts and Models of Inorganic Chemistry, Oxford, 1970
 4. Atkins, P.W. and Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962.
 5. Rodger, G. E. Inorganic and Solid State Chemistry, Cengage Learning India
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Name of the Course	Organic and Inorganic Chemistry I
Course Code	23_USCH102
Class	F.Y.B.Sc. (Chemistry)
Semester	I
No of Credits	02
Nature	Theory
Type	Major / Minor
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	<p>Restructuring of syllabus has been done to ensure a smooth and logical flow of content throughout the curriculum. It also facilitates the logical progression of subjects which allows learners to build their understanding of subject progressively and systematically to grasp contents more effectively.</p> <p>The course equips learners with the understanding of basic organic chemistry, stereochemistry, and comparative chemistry of main group elements</p> <p>In addition to above, the syllabus also focuses on practical</p> <p>Problem-solving exercises that require learner to apply these theories and basic concepts to real world scenarios.</p> <p>Knowledge of IUPAC nomenclature is crucial learner seeking employment in chemistry related fields especially in industry like pharmaceuticals, polymer and fine chemical etc. This helps learner to identify, classify and communicate the chemical compounds they work with.</p> <p>Understanding organic reaction mechanism enables chemist to design optimize synthetic route which is crucial for chemical manufacturing, drug development. Learner with this expertise suitable by research institution</p> <p>Stereochemistry deals with the three dimensional arrangement of atoms in molecule. Which significantly affects the properties and measurements</p> <p>Acquiring Knowledge stereochemistry learner can contribute to drug design, synthesis and optimization in pharmaceutical industry.</p>

Nomenclature: Organic and Inorganic Chemistry II

Course Out comes: On successful completion of this course learners will be able to:

CO1	Classify and name organic compounds based on IUPAC conventions, understand molecular bonding and hybridization in organic structures, and analyze fundamental reaction mechanisms, including reactive intermediates and key electronic effects, for predicting organic reaction pathways.
CO2	Represent and interconvert different stereochemical projections, analyze geometrical and optical isomerism, and assign absolute and relative configurations using C.I.P. rules, enhancing their understanding of molecular chirality and stereochemical relationships.
CO3	Explain the periodic trends in metallic and non-metallic properties, oxidation states, and electronegativity, analyse the anomalous behavior and bonding characteristics of second-period elements, compare the chemistry of oxides and hydroxides of Group I and II elements, and evaluate the environmental impact of key oxides related to the greenhouse effect, photochemical smog, and acid rain.

Curriculum:

Unit	Title	Learning Points	No. of lectures (in Hrs)
I	Basics of Organic Chemistry	Classification and Nomenclature of Organic Compounds: Nomenclature of mono and bi functional aliphatic compounds on the basis of priority order of the following classes of compounds: Alkanes, alkenes, alkynes, haloalkanes, alcohols, ethers, aldehydes, ketones, carboxylic acids, carboxylic acid, derivatives (acid halides, esters, anhydrides, amides), nitro compounds, nitrile and amines and their cyclic analogues	3
		Bonding and Structure of organic compounds: Hybridization: sp^3 , sp^2 , sp hybridization of carbon and nitrogen; sp^3 and sp^2 hybridization of oxygen in Organic compounds. Overlap of atomic orbitals: Overlaps of atomic orbitals to form sigma and pi bonds, shapes of organic molecules. Shapes of molecules; Influence of hybridization on bond properties (as applicable to ethane, ethene, and ethyne).	3
		Fundamentals of organic reaction mechanism: Basic terms and concepts: Homolytic and Heterolytic fission with suitable examples. Electrophiles and Nucleophiles. Inductive, electromeric, resonance and mesmeric effects, hyper conjugation and their applications. Types (Primary, secondary, tertiary allyl benzene), shape and their relative stability of the following reactive intermediates i) Carbocation ii) Carbanion iii) Free radical Introduction to type of organic reactions: addition, elimination and substitution reaction (with one example each)	4

II	Stereochemistry I	<p>Projection formulae: Flying Wedge projection, Fischer Projection, Newman and Sawhorse Projection formulae (of erythro, threo isomers of tartaric acid and 2,3-dichlorobutane) and their interconversions; Geometrical isomerism in alkene and cycloalkanes: cis–trans and syn-anti isomerism E/Z notations with C.I.P rules.</p> <p>Optical Isomerism: Optical Activity, Specific Rotation, Chirality/ Asymmetry, Enantiomers, Molecules with two similar and dissimilar chiral-centres, Diastereo isomers, meso structures, racemic mixture and resolution (methods of resolution not expected).</p> <p>Relative and absolute configuration: D/L and R/S designations.</p>	10
III	Comparative chemistry of Main Group Elements	<p>Metallic and non-metallic nature, oxidation states, electronegativity, anomalous behavior of second period elements, allotropy, catenation, diagonal relationship.</p> <p>Comparative chemistry of oxides and hydroxides of group I and group II elements. Some important compounds- NaHCO₃, Na₂CO₃, CaO, CaCO₃; oxides of carbon, oxides of Sulphur and Nitrogen with respect to environmental aspects like greenhouse effect, photochemical smog and acid rain.</p>	10

References:

Organic Chemistry

1. Concise Graduate Chemistry–I, II, III and IV, University Text Book of Chemistry, University of Mumbai.
2. Morrison, R.T .and Boyd, R.N. Organic Chemistry ,Dorling Kindersley (India) Pvt Ltd.(Pearson Education).2012
3. Finar, I.L. Organic Chemistry (Volume1), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
4. Finar, I.L. Organic Chemistry (Volume2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
5. Eliel, E.L. and Wilen, S. H. Stereochemistry of Organic Compounds,Wiley:London,1994
6. Kalsi, P.S. Stereochemistry Conformation and Mechanism, New Age International, 2005.
7. Mc Murry, J.E. Fundamentals of Organic Chemistry,7thEd.Cengage Learning India Edition, 2013
8. Paula Y Bruice, Organic Chemistry,7thEd,Pearsoneducation,Asia.2014
9. Graham Solomon, Fryhle, Dnyder, Organic Chemistry, Wiley publication.12th Ed,2016
10. Bahland Bahl, Advanced Organic chemistry by S. Chandpublication.2010
11. Peter Sykes. Guidebook to the mechanism in Organic chemistry,6th edition
12. D. Nasipuri. Stereochemistry of Organic Compounds, Principles and Applications, Second Edition

Inorganic Chemistry

1. Concise Graduate Chemistry–I, II, III and IV, University Text Book of Chemistry, University of Mumbai.
2. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
3. Douglas, B E and Mc Daniel, D.H. Concepts and Models of Inorganic Chemistry,Oxford,1970
4. Atkins, P.W.and Paula, J. Physical Chemistry,10thEd.,Oxford University Press,2014.Day,M.C.and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications,1962.
5. Rodger, G. E. Inorganic and Solid-State Chemistry, Cengage Learning India

Evaluation Pattern:**A. Continuous Internal Evaluation (40%) : 20 Marks**

Sr. No.	Particulars	Marks
01	Unit Test (MCQ / Descriptive – Based on Theory and/or Problems - Online/Offline – 1 unit test of 10 marks	10
02	Assignment / seminar / class test / worksheets	05
03	Active participation in routine class instructional deliveries and Overall conduct as a responsible learner.	05

B. Semester End Evaluation (Paper Pattern) (60%): 30 Marks**Guidelines for paper pattern for Semester End Evaluation:**

30 Marks per paper Semester End Theory Examination:

1. Duration - These examinations shall be of one hour duration.
2. Theory question paper pattern:
 - a. There shall be 03 questions each of 10 marks on each unit.
 - b. All questions shall be compulsory with internal choice within the questions.

Question Number	Unit	Marks
1	I	10
2	II	10
3	III	10

CIE	SEE	Total Marks
20	30	50

Syllabus for B.Sc. Chemistry from the year 2023-24

Name of the Course	Chemistry Practical I
Course Code	23_USCH103
Class	F.Y.B.Sc. (Chemistry)
Semester	I
No of Credits	02
Nature	Practical
Type	Major
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	<p>Restructuring of syllabus has been done to ensure a smooth and logical flow of content throughout the curriculum. It also facilitates the logical progression of subjects which allows learners to build their understanding of subject progressively and systematically and to grasp contents more effectively. The curriculum also demonstrates how principles apply to real world scenarios.</p> <p>After completion of this course, learners will develop the laboratory skills like safety, handling of chemicals, equipment like digital balance, and preparation of standard solution. These skills are essential in academics as well as in industry.</p> <p>Learners learn safety precautions taken during handling chemicals, Basic experimental techniques and measurement skills including skills of independent investigation of chemistry related problems</p> <p>Organic spotting/ characterization skill is valuable analytical technique used for qualitative and compound identification. By gaining these skills learner can enhance his employability in chemical analysis role or consider entrepreneurial ventures in analytical services.</p>

Practical I

Course Code: USCH103

Course Outcomes:

After successful completion of this course learners are able to

- CO1 Take precautionary measures while handling chemicals.
- CO2 Handle Electronic Balance and other lab equipment carefully.
- CO3 Prepare standard solutions of desired concentration that required in the laboratory
- CO4 Standardize different solutions using suitable primary standard.
- CO5 Estimate percentage composition of mixture gravimetrically.
- CO6 Purify organic compounds using suitable solvent.
- CO7 Draw structure of organic compound using Chems sketch software.

Curriculum:

Group	Title	Learning points	No. of Hours
Group A	Skill Experiments	1 Introduction to chemistry lab, safety rules, precautions. 2. Introduction to lab apparatus and handling. 3. Preparation of molar and normal solutions. (Any 4) i) NaOH, ii) KOH iii) Succinic acid, iii) Oxalic acid iv) $K_2Cr_2O_7$ v) Iodine vi) $Na_2S_2O_3$ 4. To prepare 0.1N Succinic acid and standardize the NaOH solution of different concentrations. 5. To draw chemical structure of organic molecule using chemdraw/ chemsketch.	20
Group B	Physical and Inorganic Experiments	1) To determine enthalpy of dissolution of salt (KNO_3) 2) Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature (Any two solutions) 3) To determine the rate constant for the hydrolysis of ester using HCl as Catalyst. 4) To determine the percent purity of sample of $BaSO_4$ containing NH_4Cl 5) To determine the percent purity of ZnO containing $ZnCO_3$.	20
Group C	Inorganic and Organic Experiments	1) Purification of organic compounds by recrystallization selecting suitable solvent (minimum 2 organic compounds to be given) (Learners are expected to report a) Solvent for recrystallization b) Percentage Yield and the melting points of the purified compound.	20

		3. Basic principles of Organic compound characterization (minimum 4 Solid organic compounds) (Learners should perform Preliminary Tests, Solubility Test, obtain melting point and recrystallize the compound with given solvent)	
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References:

Physical Chemistry

- 1) Laboratory Experiments in Chemistry I and II, University Practical Book of Chemistry, University of Mumbai.
- 2) Athawale, V. D. and Mathur, P. *Experimental Physical Chemistry* New Age International: New Delhi (2001).
- 3) Khosla, B.D.; Garg, V.C. and Gulati, A. Senior Practical Physical Chemistry, R .Chand and Co.: New Delhi (2011).
- 4) Garland, C.W.; Nibler, J.W. and Shoemaker, D.P. *Experiments in Physical Chemistry 8th Ed.*; Mc Graw-Hill: New York (2003).
- 5) Halpern, A.M. and Mc Bane, G.C. *Experimental Physical Chemistry 3rd Ed.*; W.H .Freeman and Co: New York (2003).

Inorganic Chemistry

- 1) Laboratory Experiments in Chemistry I and II, University Practical Book of Chemistry, University of Mumbai.
- 2) Mendham, J.A. I. Vogel's *Quantitative Chemical Analysis 6th Ed.* Pearson, 2009.

Organic Chemistry

- 1) Laboratory Experiments in Chemistry I and II, University Practical Book of Chemistry, University of Mumbai.
- 2) Mann, F.G. and Saunders, B.C. *Practical Organic Chemistry*, Pearson Education (2009).
- 3) Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry*, 5thEd. Pearson (2012).
- 4) Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. and Smith, P.W.G., *Text book of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.

Evaluation Pattern: Practical Total Marks: 50

A) Internal Assessment: 40 % (20 Marks)

Sr. No.	Particulars	Marks
01	Performance during practical session Skill, Accuracy, precision of measurement, Record of observation, calculations, graph, result and conclusion. Timely submission of journal	15
02	Overall performance (attendance, punctuality, interaction during Practical session throughout semester	05
Total		20

B) Semester End Examination: 60% (30 Marks)

Sr. No.	Group	Title	Method	Marks
1.	B	Physical and Inorganic experiments	Experiment performance as per the practical slip	25
		Viva Voce and journal		05
OR				
2.	C	Inorganic and Organic experiments	Experiment performance as per the practical slip	25
		Viva Voce and journal		05
Total				30

CIE / Internal	SEE	Total
20	30	50

Syllabus for B.Sc. Chemistry from the year 2023-24

Name of the Course	Laboratory Skills in Chemical sciences
Course Code	23_USCHV104
Class	F.Y.B.Sc. (Chemistry)
Semester	I
No of Credits	02
Nature	Practical (VSC)
Type	Vocational Skill Course
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	<p>Restructuring of syllabus has been done to ensure a smooth and logical flow of content throughout the curriculum. It also facilitates the logical progression of subjects which allows learners to build their understanding of subject progressively and systematically and to grasp contents more effectively. The curriculum is so designed that it offers hands-on approach to learn the subject.</p> <p>VSC in chemistry demands for a skilled workforce in various industries such as pharmaceuticals, fine chemicals, food processing, by providing trained individual .VSC in chemistry equips students with practical and specialized skills required by industry. By Acquiring such skills a learner will be more suitable for industry</p>

Practical II

Course Code: USCH104

Course Outcomes:

After successful completion of this course learners are able to

- CO1 Take precautionary measures while handling chemicals
- CO2 Handle Electronic Balance and other lab equipment carefully.
- CO3 Prepare standard solutions of desired concentration that required in the laboratory
- CO4 Standardize different solutions using suitable primary standard
- CO5 Characterize organic compounds.
- CO6 Draw structure of organic compound using Chems sketch software

Curriculum:

Group	Title	Learning points	No. of Hours
Group A	Skill Experiments	1 Introduction to chemistry lab, safety rules, precautions. 2. Introduction to lab apparatus and handling. 3. Preparation of molar and normal solutions.(Any 4) i) NaOH,ii) KOH iii) Succinic acid, iii) Oxalic acid iv) $K_2Cr_2O_7$ v) Iodine vi) $Na_2S_2O_3$ 4. To prepare 0.1N Succinic acid and standardize the NaOH solution of different concentrations. 5. To draw chemical structure of organic molecule using chemdraw/ chemsketch..	20
Group B	Physical and Inorganic Experiments	1) Commercial analysis of mineral acids. 2) Commercial analysis of organic acids. 3) Titration using double indicator: analysis of solution of Na_2CO_3 and $NaHCO_3$. 4) Determination of optical activity of compounds using polarimeter. 5) To determine the percent purity of ZnO containing $ZnCO_3$.	20
Group C	Inorganic - Organic Experiments	Purification of organic compounds by recrystallization selecting suitable solvent (minimum 2organic compounds to be given) Learners are expected to report a) Solvent for recrystallization. b) Percentage Yield and the melting points of the purified compound.) Basic principles of Organic compound characterization (minimum 4 Solid organic compounds) (Learners should perform Preliminary Tests, Solubility	20

		Test, obtain melting point and recrystallize the compound with given solvent)	
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References:

- 1) Laboratory Experiments in Chemistry I and II, University Practical Book of Chemistry, University of Mumbai.
 - 2) Athawale, V.D. and Mathur, P. *Experimental Physical Chemistry* New Age International: New Delhi (2001).
 - 3) Khosla, B. D.; Garg, V. C. and Gulati, A. *Senior Practical Physical Chemistry*, R. Chand and Co.: New Delhi (2011).
 - 4) Laboratory Experiments in Chemistry I and II, University Practical Book of Chemistry, University of Mumbai.
 - 5) Vogel, A. I., Tatchell, A. R. Furnis, B. S., Hanna ford, A.J.and Smith, P.W. G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
 - 6) Mendham, J., A. I. Vogel's *Quantitative Chemical Analysis* 6th Ed., Pearson, 2009.
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Evaluation Pattern: Practical Total Marks: 50

A) Internal Assessment: 40 % (20 Marks)

Sr. No.	Particulars	Marks
01	Performance during practical session Skill, Accuracy, precision of measurement, Record of observation, calculations, graph, result and conclusion. Timely submission of journal	15
02	Overall performance (attendance, punctuality, interaction during Practical session throughout semester	05
Total		20

A) Semester End Examination: 60% (30 Marks)

Sr. No.	Group	Title	Method	Marks
1.	B	Physical and Inorganic experiments	Experiment performance as per the practical slip	25
		Viva Voce and journal		05
OR				
2.	C	Inorganic and Organic experiments	Experiment performance as per the practical slip	25
		Viva Voce and journal		05
Total				30

CIE / Internal	SEE	Total
20	30	50

Syllabus for B.Sc. Chemistry from the year 2023-24

Name of the Course	Physical Inorganic Chemistry II
Course Code	23_USCH201
Class	F.Y.B.Sc. (Chemistry)
Semester	II
No of Credits	02
Nature	Theory
Type	Major
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	<p>Restructuring of syllabus has been done to ensure a smooth and logical flow of content throughout the curriculum. It also facilitates the logical progression of subjects which allows learners to build their understanding of subject progressively and systematically to grasp contents more effectively.</p> <p>The course equips learners with the basic understanding of gaseous state, electrochemistry, chemical and ionic equilibria, molecular spectroscopy,, concepts of qualitative analysis</p> <p>In addition to above, the syllabus also focuses on practical</p> <p>Problem-solving exercises that require learner to apply these theories and basic concepts to real world scenarios.</p> <p>Chemical thermodynamics helps in understanding the energetics of chemical reaction and phase changes. Learner can apply it for process optimization in industries such as petrochemical where efficiency and cost effectiveness are crucial.</p> <p>Measurement of conductivity enhances various skills, including laboratory technique, data analysis. And instrumental operation. The study of conductivity measurement is essential for those seeking employment in industries that deals with electrolyte such as the production of batteries, fuel cells.</p>

Nomenclature: Physical and Inorganic Chemistry II

Course Outcomes:

After successful completion of this course learners are able to

CO1	Understand the kinetic theory of gases and gas laws, analyze electrolytic conductance, apply the Second law of thermodynamics, and study chemical equilibrium and equilibrium constants.
CO2	Understand ionization and pH concepts, analyze buffer solutions and their Properties, and understand electromagnetic radiation and its interaction with matter, apply Beer-Lambert's law in spectroscopy.
CO3	Analyze gaseous evaluates in Qualitative analysis, understand precipitation equilibria and factors affecting precipitation, study theories of Acids and Bases

Curriculum:

Unit	Title	Learning Points	No. of Lectures (in hrs.)
I	Gaseous State	Kinetic theory of gases, Maxwell-Boltzmann's distribution of velocities (Qualitative discussion), Ideal gas laws, Deviation from ideal gas laws, Ideal and real gases, Reasons for deviation from ideal gas laws, Compressibility factor, Boyle's temperature, van der Waals equation of state. (Numerical problems expected wherever necessary)	3
	Electrochemistry-I	Conductance, specific conductance, equivalent conductance, molar conductance, Variation of molar conductance with concentration of strong and weak electrolyte. (Numerical problems expected wherever necessary)	3
	Chemical Equilibria and Thermodynamic Parameters	Second law of thermodynamics, concept of entropy, Physical significance of entropy, Concept of free energy, Helmholtz and Gibbs free energy, Variation of free energy with temperature and pressure, Spontaneity and Physical significance of free energy Reversible and irreversible reactions, equilibrium constants (K_c and K_p), relationship between K_c and K_p . (Numerical problems expected wherever necessary)	4
II	Ionic Equilibria	Degree of ionization, factors affecting degree of ionization, Ionization constant and ionic product of water, Ionization of weak acids and bases, Dissociation constants of mono-, di- and tri-protic acids.	6

	Molecular Spectroscopy	pH scale, Buffer solutions, types of buffers, Derivation of Henderson equation for acidic and basic buffers, Buffer action, buffer capacity (Numerical problems expected, wherever necessary) Electromagnetic radiation, electromagnetic spectrum, Planck's equation, Interaction of electromagnetic radiation with matter; Absorption, Emission, Scattering, Electronic, Vibrational and Rotational transitions, Beer-Lamberts law. Deviation from Beer-Lamberts law. (Numerical problems expected, wherever necessary)	4
III	Concept of Qualitative Analysis	Testing of Gaseous Evolutes, Role of Papers impregnated with Reagents in qualitative analysis (with reference to papers impregnated with starch iodide, potassium dichromate, Lead acetate, and dimethyl glyoxime and oxine reagents). Precipitation equilibria, Formation of precipitates like AgCl, AgBr, AgI and BaSO ₄ effect of common ions, uncommon ions, oxidation states, buffer action, complexing agents on precipitation of ionic compounds. (Balanced chemical equations)	6
	Acid Base Theories	Arrhenius, Lowry- Bronsted, Lewis, Solvent-Solute concept of acids and bases, Usanovich concept, Hard and Soft acids and bases, Applications of HSAB.	4

References:

Unit-I: Physical Chemistry

- 1) Concise Graduate Chemistry – I, II, III and IV, University Text Book of Chemistry, University of Mumbai.
- 2) Atkins, P. W. and Paula J. de Atkin's Physical Chemistry 10th Ed., Oxford University Press (2014).
- 3) Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
- 4) Keith J. Laidler and John H. Meiser, Physical Chemistry, 2nd Ed. (2004)
- 5) Puri B.R., Sharma L.R. and Pathania M.S. Principles of Physical Chemistry, Vishal Publishing Company, 2008
- 6) Ball, D. W. Physical Chemistry Thomson Press, India (2007).
- 7) Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).
- 8) Engel, T. and Reid, P. *Physical Chemistry 3rd Ed.*, Prentice-Hall (2012).
- 9) Mc Quarrie, D. A and Simon, J.D. *Molecular Thermodynamics* Viva Books Pvt. Ltd.: New Delhi (2004).
- 10) Levine I. N. *Physical Chemistry* 6th Ed., TataMcGraw Hill (2010)

Unit II: Inorganic Chemistry

1. Concise Graduate Chemistry–I, II, III and IV, University Text Book of Chemistry, University of Mumbai.
 2. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
 3. Douglas, B. E. and Mc Daniel, D. H. Concepts and Models of Inorganic Chemistry, Oxford, 1970
 4. Atkins, P. W. and Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962.
 5. Rodger, G. E. Inorganic and Solid State Chemistry, Cengage Learning India
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Evaluation Pattern:**C. Continuous Internal Evaluation (40%) : 20 Marks**

Sr. No.	Particulars	Marks
01	Unit Test (MCQ / Descriptive – Based on Theory and/or Problems - Online/Offline – 1 unit test of 10 marks	10
02	Assignment / seminar / class test / worksheets	05
03	Active participation in routine class instructional deliveries and Overall conduct as a responsible learner.	05

D. Semester End Evaluation (Paper Pattern) (60%): 30 Marks**Guidelines for paper pattern for Semester End Evaluation:**

30 Marks per paper Semester End Theory Examination:

3. Duration - These examinations shall be of one hour duration.

4. Theory question paper pattern:

a. There shall be 03 questions each of 10 marks on each unit.

b. All questions shall be compulsory with internal choice within the questions.

Question Number	Unit	Marks
1	I	10
2	II	10
3	III	10

CIE	SEE	Total Marks
20	30	50

Syllabus for B.Sc. Chemistry from the year 2023-24

Name of the Course	Organic and Inorganic Chemistry II
Course Code	23_USCH202
Class	F.Y.B.Sc. (Chemistry)
Semester	II
No of Credits	02
Nature	Theory
Type	Major / Minor
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	<p>Restructuring of syllabus has been done to ensure a smooth and logical flow of content throughout the curriculum. It also facilitates the logical progression of subjects which allows learners to build their understanding of subjects progressively and systematically to grasp contents more effectively.</p> <p>The course equips learners with the understanding of chemistry of aliphatic hydrocarbon, stereochemistry II, Aromatic hydrocarbon, chemical bond reactivity, oxidation-reduction chemistry</p> <p>In addition to above, the syllabus also focuses on practical Problem-solving exercises that require learner to apply these theories and basic concepts to real world scenarios.</p> <p>The course includes core courses such as Organic chemistry, and Inorganic Chemistry. Knowledge of aliphatic hydrocarbon is essential for learner pursuing career in industries like Petrochemical, oil and Gas, Plastics. Learner with this expertise may find more job opportunity in Petrochemical, polymer etc. Stereochemistry deals with the three dimensional arrangement of atoms in molecule. Which significantly affects the properties and measurements</p> <p>Acquiring Knowledge stereochemistry learner can contribute to drug design, synthesis and optimization in pharmaceutical industry</p>

Nomenclature: Organic and Inorganic Chemistry.

Course Outcome

After successful completion of this course learners are able to

CO1	Explain the formation and reactivity of alkanes, alkenes, and alkynes, analyse the mechanisms of elimination and addition reactions, predict regioselectivity in electrophilic and nucleophilic additions, and apply concepts like Markovnikov's rule, Saytzeff and Hofmann eliminations, and reaction mechanisms such as hydroboration-oxidation, ozonolysis, and the Diels-Alder reaction.
CO2	Analyse the conformational stability of alkanes using energy diagrams, apply Hückel's rule to determine aromaticity in arenes, carbocations, carbanions, and heterocyclic compounds, and explain the mechanisms of electrophilic aromatic substitution reactions, including the effects of substituents on regioselectivity.
CO3	Differentiate between ionic and covalent bonding based on fundamental principles, analyse molecular shapes using Lewis structures and VSEPR theory, apply Fajan's Rule to predict bond character, and evaluate the applications and limitations of VSEPR theory in determining molecular geometry.

Curriculum:

Unit	Title	Learning Points	No of Lectures (In hrs.)
I	Chemistry of Aliphatic Hydrocarbons	Carbon-Carbon sigma bonds Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig reaction, free radical substitutions: Halogenation-relative reactivity and selectivity Carbon-Carbon pi – bonds Formation of alkenes and alkynes by elimination reactions: Mechanism of E1, E2, E1cb reaction. Saytzeff and Hofmann eliminations Reactions of alkenes: Electrophilic additions with mechanisms (Markownikoff/ Anti Markownikoff addition), Mechanism of hydroboration - oxidation, ozonolysis, reduction (catalytic and chemical), syn- and anti-dihydroxylation (oxidation), 1, 2- and 1, 4-addition reactions in conjugated dienes, Diels-Alder reaction. Reaction of alkynes: Acidity, Electrophilic and Nucleophilic additions with mechanisms. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.	10
II	Stereochemistry II Aromatic Hydrocarbons	Conformational analysis of alkanes: (ethane, propane and n-butane). Relative stability with energy diagram. Aromaticity: Hückel's rule, anti-aromaticity, aromatic character of arenes, cyclic carbocations/ carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Crafts alkylation/ acylation with their mechanism, Directing effects of the groups.	2 8

III	Chemical Bond and Reactivity	Types of chemical bond, comparison between ionic and covalent bonds, polarizability (Fajan's Rule), shapes of molecules, Lewis dot structure, Sidgwick Powell Theory, basic VSEPR theory for AB_n type molecules with and without lone pair of electrons is electronic principles, applications and limitations of VSEPR theory.	10
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References:

Unit I: Organic Chemistry

1. Concise Graduate Chemistry–I, II, III and IV, University Text Book of Chemistry, University of Mumbai.
2. Morrison, R.T. and Boyd, R.N. Organic Chemistry, Dorling Kindersley (India) Pvt Ltd. (Pearson Education).2012
3. Finar, I.L. Organic Chemistry (Volume1), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
4. Finar, I.L. Organic Chemistry (Volume2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Eliel, E. L. and Wilen, S. H. Stereochemistry of Organic Compounds, Wiley:London,1994
6. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.
7. Mc Murry, J.E. Fundamentals of Organic Chemistry,7th Ed. Cengage Learning India Edition, 2013
8. Paula Y Bruice, Organic Chemistry,7th Ed, Pearson education,Asia.2014
9. Graham Solomon, Fryhle, Snyder, Organic Chemistry, Wileypublication.12thEd,2016
10. Bahland Bahl, Advanced Organic chemistry by S. Chandpublication.2010
11. Peter Sykes. Guidebook to the mechanism in Organic chemistry,6thedition
12. D. Nasipuri. Stereochemistry of Organic Compounds, Principles and Applications, Second Edition

Unit II: Inorganic Chemistry

1. Concise Graduate Chemistry–I, II, III and IV, University Text Book of Chemistry, University of Mumbai.
2. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
3. Douglas, B. E. and Mc Daniel, D. H. Concepts and Models of Inorganic Chemistry,Oxford,1970
4. Atkins,P.W.andPaula,J.PhysicalChemistry,10thEd.,OxfordUniversityPress,2014.Day,M.C.and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications,1962.
5. Rodger, G. E. Inorganic and Solid State Chemistry, Cengage Learning India

Evaluation Pattern:**E. Continuous Internal Evaluation (40%) : 20 Marks**

Sr. No.	Particulars	Marks
01	Unit Test (MCQ / Descriptive – Based on Theory and/or Problems - Online/Offline – 1 unit test of 10 marks	10
02	Assignment / seminar / class test / worksheets	05
03	Active participation in routine class instructional deliveries and Overall conduct as a responsible learner.	05

F. Semester End Evaluation (Paper Pattern) (60%): 30 Marks**Guidelines for paper pattern for Semester End Evaluation:**

30 Marks per paper Semester End Theory Examination:

5. Duration - These examinations shall be of one hour duration.

6. Theory question paper pattern:

a. There shall be 03 questions each of 10 marks on each unit.

b. All questions shall be compulsory with internal choice within the questions.

Question Number	Unit	Marks
1	I	10
2	II	10
3	III	10

CIE	SEE	Total Marks
20	30	50

Syllabus for B.Sc. Chemistry from the year 2023-24

Name of the Course	Chemistry Practical II
Course Code	23_USCH203
Class	F.Y.B.Sc. (Chemistry)
Semester	II
No of Credits	02
Nature	Practical
Type	Major / Minor
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	<p>Restructuring of syllabus has been done to ensure a smooth and logical flow of content throughout the curriculum. It also facilitates the logical progression of subjects which allows learners to build their understanding of subject progressively and systematically and to grasp contents more effectively. The curriculum also demonstrates how principles apply to real world scenarios.</p> <p>Learners will able to operate laboratory equipment like Conductometer, colorimeter, pH meter. Basic experimental techniques and measurement skills make learner suitable for investigation of chemistry related problems</p> <p>Organic spotting/ characterization skill is valuable analytical technique used for qualitative and compound identification. By gaining these skills learner can enhance his employability in chemical analysis role or consider entrepreneurial ventures in analytical services.</p>

Practical:

Course Outcomes: After Completion of the course Lerner will able to

- CO1 Operate laboratory equipment such as pH meter, Conductometr, colorimeter and other lab equipment carefully.
 CO2 Determine dissociation constant weak acid pH metrically.
 CO3 Validate Beer Lambert's law using KMnO_4 solution.
 CO4 Standardize different solutions using suitable primary standard
 CO5 Characterize organic compound
 CO6 Purify organic compounds using suitable solvent.
 CO7 Estimate amount of copper iodometrically.

Group	Title	Learning points	No. of Hours
Group A	Physical	1) To determine the amount of strong acid in the given solution by titrating against strong base conductometrically 2) To determine the dissociation constant of weak acid (K_a) using Henderson's equation and the method of incomplete titration pH metrically. 3) To verify Beer-Lamberts law using KMnO_4 solution by colorimetric method. 4) To standardize commercial sample of HCl using borax and to write material safety data of the chemicals involved.	20
Group B	Inorganic Experiments	5) Semi-micro Qualitative analysis:(5 mixtures to be analyzed) Semi-micro inorganic qualitative analysis of a sample containing two cations and two anions(from amongst): <i>Cations (from amongst):</i> Pb^{2+} , Ba^{2+} , Ca^{2+} , Sr^{2+} , Cu^{2+} , Cd^{2+} , Fe^{2+} , Ni^{2+} , Mn^{2+} , Mg^{2+} , Al^{3+} , Cr^{3+} , K^+ , NH_4^+ <i>Anions (from amongst):</i> CO_3^{2-} , S^{2-} , SO_3^{2-} , NO_2^- , NO_3^- , Cl^- , Br^- , I^- , SO_4^{2-} , PO_4^{3-} (Scheme of analysis should avoid use of sulphide ion in any form for precipitation/ separation of cations.) 6) Redox Titration : To determine the percentage of copper(II) present in a given sample by titration against a standard aqueous solution of sodium thiosulfate (iodometry titration)	20
Group C	Organic Experiments	Characterization of organic compounds containing C,H,(O) N,S,X elements (6 solid/liquid organic compounds)(Preliminary test, solubility/miscibility test, detection of elements, detection of functional groups and determination of physical constant)	20

Minimum 80 percent of practical must be completed in each term

References:

Unit I: Physical Chemistry

- 1) Laboratory Experiment in Chemistry I and II, University Practical Book of Chemistry, University of Mumbai.
- 2) Athawale, V. D. and Mathur, P. *Experimental Physical Chemistry* New Age International: New Delhi (2001).
- 3) Khosla, B. D.; Garg, V.C. and Gulati, A. *Senior Practical Physical Chemistry*, R. Chand and Co.: New Delhi (2011).
- 4) Garland, C. W.; Nibler J. W. and Shoemaker, D.P. *Experiments in Physical Chemistry 8th Ed.*; McGraw-Hill: New York (2003).
- 5) Halpern, A. M. and Mc Bane, G.C. *Experimental Physical Chemistry 3rd Ed.*; W.H. Freeman and Co.: New York (2003).

Unit II: Inorganic Chemistry

- 1) Laboratory Experiments in Chemistry I and II, University Practical Book of Chemistry, University of Mumbai.
- 2) Mendham, J., A.I. Vogel's *Quantitative Chemical Analysis 6th Ed*, Pearson, 2009.

Unit III: Organic Chemistry

- 1) Laboratory Experiments in Chemistry I and II, University Practical Book of Chemistry, University of Mumbai.
- 2) Mann, F.G. and Saunders, B.C. *Practical Organic Chemistry*, Pearson Education (2009).
- 3) Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.* Pearson (2012).
- 4) Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. and Smith, P.W.G., *Text book of Practical Organic Chemistry*, Prentice-Hall, 5th edition,

Evaluation Pattern: Practical Total Marks: 50

A) Internal Assessment: 40 % (20 Marks)

Sr. No.	Particulars	Marks
01	Performance during practical session Skill, Accuracy, precision of measurement, Record of observation, calculations, graph, result and conclusion. Timely submission of journal	15
02	Overall performance (attendance, punctuality, interaction during Practical session throughout semester	05
Total		20

A) Semester End Examination: 60% (30 Marks)

Sr. No.	Group	Title	Method	Marks
1.	B	Physical and Inorganic experiments	Experiment performance as per the practical slip	25
		Viva Voce and journal		05
OR				
2.	C	Inorganic and Organic experiments	Experiment performance as per the practical slip	25
		Viva Voce and journal		05
Total				30

CIE / Internal	SEE	Total
20	30	50

Syllabus for B.Sc. Chemistry from the year 2023-24

Name of the Course	B.Sc.
Course Code	23_USCHS204
Class	F.Y.B.Sc. (Chemistry)
Semester	II
No of Credits	02
Nature	Practical
Type	Skill Enhancement Course (SEC)
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	Skill Enhancement Course (SEC) introduces classical analytical procedures and chemistry for analyzing various types of the sample matrix quantitatively. The main focus is on Titrimetric methods like Acid Base titrations, Complexometric titrations, and redox and precipitation titration. Basic experimental techniques and measurement skills make learner suitable for investigation of chemistry related problems This could be anything from analyzing the composition of a new drug to detection of impurity in a food samples. By gaining these skills learner can enhance his employability in chemical analysis role or consider entrepreneurial ventures in analytical services.

Skill Enhancement Course (SEC)

Course Code: USCH204: Skill in Chemical Analysis I

No. of Credits: 02

Course Outcomes: After Completion of the course Lerner will able to

- CO1 Understand classical methods of chemical analysis
- CO2 Explain primary and secondary standards used in titrimetry
- CO3 Discuss different types of titration
- CO4 Acquire basic laboratory skills
- CO5 Estimate Vitamin C in tablet by titration method.
- CO6 Detect adulterants in food sample.

Curriculum:

Unit	Description	Hours
I	Introduction to Classical method of analysis : Titrimetric Methods Basic terms involved in Titrimetric methods of analysis. Comparing volumetry and Titrimetry, Conditions suitable for titrimetry Tools of Titrimetry: Graduated glassware and Calibration Standard solutions (Primary and Secondary standards in Titrimetry) and Calculations in Titrimetry. Types of titrimetry – Neutralisation (Acidimetry, alkalimetry), Redox, (Iodometry, Iodimetry,) Precipitation and Complexometric titrations and indicators used in these titrations Neutralisation Titrations Concept of pH and its importance in Neutralisation Titrations End point and Equivalence point of Neutralisation titrations Determination of End point by using indicators causing colour change	10
	Description of Experiments	
II	Group A	25
1	Estimation of ibuprofen by titration method	
2	Estimation of Aspirin tablet by titration method	
3	Estimation of alkali content/ acid absorbing capacity in antacid by titration method	
4	Assay of Vitamin C in Tablet by titration method	
5	Assay of Tincture Iodine	
6	Determination of % of Sodium Chloride present in a Saline sample	

III	Group B	25
1	Assay of Ascorbic acid in citrus juice	
2	Estimation of Calcium in Milk powder complexometrically	
3	Estimation of Magnesium in Talcum Powder Complexometrically	
4	Determination of % Sodium Carbonate in Washing Soda	
5	Estimation of acetic acid in Vinegar Titrimetrically.	
6	Detection of adulterants in food sample A) Milk : Sugar, starch, Formalin, Urea, Detergent B) Coffee : Starch/ Cereal, Chicory c) Jaggery : Washing Soda, Chalk Powder, Metanil yellow colour	

References:

- 1) Vogel's Textbook of Quantitative Chemical Analysis, Fifth Edition, G H Jeffery and J Bassett.
- 2) Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. and Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
- 3) Mendham, J. A. I. Vogel's *Quantitative Chemical Analysis* 6th Ed. Pearson, 2009.
- 4) Indian Pharmacopoeia Vol. I and II, 2007

Evaluation Pattern: Practical Total Marks: 50

B) Internal Assessment: 40 % (20 Marks)

Sr. No.	Particulars	Marks
01	Performance during practical session Skill, Accuracy, precision of measurement, Record of observation, calculations, graph, result and conclusion. Timely submission of journal	15
02	Overall performance (attendance, punctuality, interaction during Practical session throughout semester	05
Total		20

C) Semester End Examination: 60% (30 Marks)

Sr. No.	Description	Marks (0 marks)
1	MCQ test Unit I	15
1	One experiment from Group A	20
2	One experiment from Group B	20
3	Viva	05
Total Marks		60

Marks in SEE practical examination will be converted into 30 marks.

CIE	SEE Exam	Total
20	30	50

Date: 04/11/2023

Chairperson BoS

(Dr. M. G. Gons)

*R.P. Gogate College of Arts and Science and R. V. Jogalekar College of Commerce
(Autonomous), Ratnagiri 41 | Page*

Evaluation Pattern: Practical Total Marks: 50

B) Internal Assessment: 40 % (20 Marks)

Sr. No.	Particulars	Marks
01	Performance during practical session Skill, Accuracy, precision of measurement, Record of observation, calculations, graph, result and conclusion. Timely submission of journal	15
02	Overall performance (attendance, punctuality, interaction during Practical session throughout semester	05
Total		20


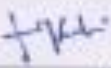

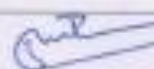
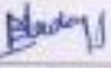

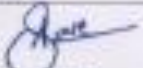
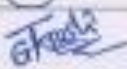
B) Semester End Examination: 60% (30 Marks)

Sr. No.	Group	Title	Method	Marks
1.	B	Physical and Inorganic experiments	Experiment performance as per the practical slip	25
		Viva Voce and journal		05
OR				
2.	C	Inorganic and Organic experiments	Experiment performance as per the practical slip	25
		Viva Voce and journal		05
Total				30

CIE / Internal	SEE	Total
20	30	50

Ratnagiri Education Society's
R. P. Gogate College of Arts and Science and R. V. Jogalekar College of Commerce
(Autonomous), Ratnagiri

Meeting of BoS in Chemistry

Date	14 th October 2023		
Time	12.00PM		
Venue	Meeting Room		
Mode	Hybrid		
Attendance			
Sr. No.	Name and type of the Member	Present mode Online / Offline	Signature
1	Name: Dr. Milind Ganesh Gore (Chairman) Head of the Department	offline	
2	Name: Dr. Ghanashyam B. Sathe (VC nominee) HOD Chemistry Dapoli Urban Bank Senior Science College, Dapoli	Online	
3	Name: Prof. Savita Ladage (Subject Expert) Dean. HBCSE, TIFR Mumbai	Absent	Absent
4	Name: Dr. Ganpat K. Naik (Subject Expert) HOD Chemistry, Parvatihai Chougule College Madgaon, Goa.	Online	
5	Name: Mr. Sandeep Suresh Gongale (Industry representative) GM (HR) Finolex Industries Pvt. Ltd, Ranpar	Online	
6	Name: Dr. Vikas Kulkarni, GM, Lupin (Alumini representative) Pharmaceuticals, Mumbai	Online	
7	Name: Dr. Mrs. Aparna M. Kulkarni Department faculty member (1)	offline	
8	Name: Mr. Maruti B. Kamble Department faculty member (2)	offline	
9	Name: Dr. Swaminath L. Bhattar Department faculty member (3)	Absent	Absent
10	Name: Dr. Umesh B. Sankpal Department faculty member (4)	offline	
11	Name: Dr. Meghana E. Mhadaye Department faculty member (5)	offline	
12	Name: Mrs. Pratiksha Barsakar Department faculty member (6)	offline	
13	Name: Mr. Ankit A Surve Department faculty member (7)	offline	
14	Name: Trupti Gajanan Joshi Department faculty member (8)	offline	
15	Name: Miss Rina B. Shinde Department faculty member (9)	offline	