

**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 Internal Assessment and Semester End Examinations are as shown below-

A) Internal Assessment: 40 % (40 Marks)

Sr. No.	Particulars	Marks
01	Unit Test (MCQ / Descriptive – Based on Theory and/or Problems - Online/Offline – 1 unit test of 20 marks / 2 unit tests of 10 marks each .	20
02	Assignment / seminar / class test / worksheets	10
03	Active participation in routine class instructional deliveries and Overall conduct as a responsible learner.	10

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

60 Marks per paper Semester End Theory Examination:

1. Duration - These examinations shall be of two hours duration.
2. Theory question paper pattern:
 - a. There shall be 03 questions each of 15 marks on each unit and one question of 15 marks on all units.
 - 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 Internal Assessment and Semester End Examination. The learner shall obtain minimum of 40% marks (i.e. 16 out of 40) in the Internal Assessment and 40% marks in Semester End Examination (i.e. 24 out of 60) 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 Internal Assessment 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
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		
USCH102	I	Basics of Organic Chemistry	10	2	2
	II	Stereochemistry I	10		
	III	Comparative chemistry of Main Group Elements	10		
USCH103		Chemistry Practical	60	4	2
USCH104		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
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		
USCH202	I	Chemistry of Aliphatic Hydrocarbons	6	2	2
	II	Stereochemistry I	2		
		Aromatic Hydrocarbons	8		
	III	Chemical Bond and Reactivity	10		
USCH203		Chemistry Practical	60	4	2
USCH204		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	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 the basics of thermodynamic properties.
- CO2 Prepare solutions of different concentrations from solid and liquid analyte.
- CO3 Analyze the rate and orders of reactions by using different methods.
- CO4 Explain Surface tension and its impact on liquid behavior including capillary action.
- CO5 Differentiate various liquid crystal phases such as Nematic, Smectic and Cholesteric phases.
- CO5 Explore the historical development of atomic models.
- CO6 Explore the trends in elemental properties within specific group or families of elements such as main group elements, transition and inner transition metals.

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 L
	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)	3L

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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Evaluation Pattern:**A) Continuous 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 20 marks / 2 unit tests of 10 marks each .	20
02	Assignment / seminar / class test / worksheets	10
03	Active participation in routine class instructional deliveries and Overall conduct as a responsible learner.	10

40 marks of CIE will be converted into 20 Marks.

B. Semester End Evaluation (Paper Pattern) (60 Marks – 2 hours): 60 Marks**Guidelines for paper pattern for Semester End Evaluation:**

1. As far as possible, one fifth weightage of the total should be given to numerical examples in above paper pattern.
2. All questions will be compulsory and may be divided into sub-questions.
3. Descriptive type of questions, derivation-based questions, problem solving / numerical based questions, etc., will contain internal options.

Question Number one consist of MCQs, fill in the blanks, match the following, true or false, etc., type of questions.

Question Number	Unit	Marks
1	I, II, III	15 (5 Marks each unit)
2	I	15
3	II	15
4	III	15

60 marks of SEE will be converted into 30 Marks.

CIE	SEE	Total Marks
20	30	50

Name of the Course	Organic and Inorganic Chemistry I
Course Code	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 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 Understand the IUPAC nomenclature system of organic compounds.
- CO2 Assign the correct IUPAC name to the organic compounds and write the structure from their IUPAC names.
- CO3 Explain Basic terms in organic chemistry and hybridization of carbon oxygen and nitrogen.
- CO4 Understand the advanced concepts in stereochemistry.
- CO5 Distinguish between chiral and achiral molecules.
- CO6 Draw and interpret Fischer, Newman and Sawhorse projection formulae
- CO7 Differentiate between basic, amphoteric and acidic oxides and hydroxides of Group I and Group II elements.
- CO8 Explore the common oxidation state exhibited by main group element and understand how these oxidation states influence their chemical behavior and compound formation.
- CO9 Explain the chemical reaction involved in formation of photochemical smog.

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	3L
		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.	3L
		Shapes of molecules; Influence of hybridization on bond properties (as applicable to ethane, ethene, and ethyne). 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)	4L

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>	10L
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>	10L

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 (Volume 1), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
4. Finar, I.L. Organic Chemistry (Volume 2: 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, Wiley publication. 12th Ed, 2016
10. Bahland Bahl, Advanced Organic chemistry by S. Chand publication. 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, 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

Evaluation Pattern:**A) Continuous 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 20 marks / 2 unit tests of 10 marks each .	20
02	Assignment / seminar / class test / worksheets	10
03	Active participation in routine class instructional deliveries and Overall conduct as a responsible learner.	10

40 marks of CIE will be converted into 20 Marks

B. Semester End Evaluation (Paper Pattern) (60 Marks – 2 hours): 60 Marks**Guidelines for paper pattern for Semester End Evaluation:**

1. As far as possible, one fifth weightage of the total should be given to numerical examples in above paper pattern.
2. All questions will be compulsory and may be divided into sub-questions.
3. Descriptive type of questions, derivation-based questions, problem solving / numerical based questions, etc., will contain internal options.
4. Question Number one consists of MCQs, fill in the blanks, match the following, true or false, etc., type of questions.

.Question Number	Unit	Marks
1	I, II, III	15 (5 Marks each unit)
2	I	15
3	II	15
4	III	15

60 marks of SEE will be converted into 30 Marks.

CIE/ Internal	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	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
2.	C	Inorganic and Organic experiments	Experiment performance as per the practical slip	25
		Viva Voce and journal		10
Total				60

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

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	USCH104
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.

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
2.	C	Inorganic and Organic experiments	Experiment performance as per the practical slip	25
		Viva Voce and Journal		10
Total				60

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

CIE	SEE Exam	Total
20	30	50

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

Name of the Course	Physical Inorganic Chemistry II
Course Code	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 Explain Distribution of velocities with the help Maxwell's and Boltzmann's law.
- CO2 Differentiate between ideal and non-ideal solutions.
- CO3 Understand basic terms of electrochemistry like conductance, equivalent conductance.
- CO4 Discuss Variation of molar conductance with concentration of strong and weak electrolyte.
- CO5 Explain Second law of thermodynamics.
- CO6 Relate equilibrium constants (K_c and K_p).
- CO7 Derive Henderson equation for acidic and basic buffer.
- CO8 Discuss Beer-Lamberts law.
- CO9 Study Role of Papers impregnated with Reagents in qualitative analysis.
- CO10 Apply Arrhenius theory to acid and base.

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)	3L
	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)	3L
	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)	4L
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.	6L

	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)	4L
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)	6L
	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.	4L

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

Unit Test (MCQ / Descriptive – Based on Theory and/or Problems - Online/Offline – 1 unit test of 20 marks / 2 unit tests of 10 marks each .	20
Assignment / seminar / class test / worksheets	15
Attendance and active participation in classroom	05

40 marks of CIE will be converted into 20 Marks.

B. Semester End Evaluation (Paper Pattern) (60 Marks – 2 hours): 60 Marks**Guidelines for paper pattern for Semester End Evaluation:**

4. As far as possible, one fifth weightage of the total should be given to numerical examples in above paper pattern.
5. All questions will be compulsory and may be divided into sub-questions.
6. Descriptive type of questions, derivation-based questions, problem solving / numerical based questions, etc., will contain internal options.

Question Number one consist of MCQs, fill in the blanks, match the following, true or false, etc., type of questions.

Question Number	Unit	Marks
1	I, II, III	15 (5 Marks each unit)
2	I	15
3	II	15
4	III	15

60 marks of SEE will be converted into 30 Marks.

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	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</p> <p>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 Summarize the different methods for the synthesis of alkanes, alkenes, dienes and alkynes
- CO2 Predict the product of organic reactions involving alkanes, alkenes and alkynes as substrates.
- CO3 Design synthesis of simple saturated and unsaturated hydrocarbons.
- CO4 Write the mechanism using fundamental concepts of writing mechanism.
- CO5 Identify aromatic system using Huckel's rule.
- CO6 Differentiate between Chemical bond and ionic bond.
- CO7 Apply VSEPR theory to molecules.
- CO8 Determine the number of bonding and nonbonding electron pairs around the atom by applying VSEPR theory.
- CO9 Explain the redox reactions.

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.	10L
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.	2L 8L

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 A B _n type molecules with and without lone pair of electrons is electronic principles, applications and limitations of VSEPR theory.	10L
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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:**A) Continuous Evaluation (40%) : 20 Marks**

Unit Test (MCQ / Descriptive – Based on Theory and/or Problems - Online/Offline – 1 unit test of 20 marks / 2 unit tests of 10 marks each .	20
Assignment (Min three)	15
Attendance and active participation in classroom	05

40 marks of CIE will be converted into 20 Marks.

B. Semester End Evaluation (Paper Pattern) (60 Marks – 2 hours): 60 Marks**Guidelines for paper pattern for Semester End Evaluation:**

7. As far as possible, one fifth weightage of the total should be given to numerical examples in above paper pattern.
8. All questions will be compulsory and may be divided into sub-questions.
9. Descriptive type of questions, derivation-based questions, problem solving / numerical based questions, etc., will contain internal options.

16 Question Number one consists of MCQs, fill in the blanks, match the following, true or false, etc., type of questions.

Question Number	Unit	Marks
1	I, II, III	15 (5 Marks each unit)
2	I	15
3	II	15
4	III	15

60 marks of SEE will be converted into 30 Marks.

CIE/ Internal	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	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 (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

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
2.	C	Inorganic and Organic experiments	Experiment performance as per the practical slip	25
		Viva Voce and journal		10
Total				60

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

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	USCH204
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 Hrs.
	Description of Experiments	
II	Group A	25 Hrs.
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 Hrs.
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
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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. Gore)

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